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Acknowledgements
Our thanks go to all of the obstetrics professionals who devoted their time and their experience to the collection of information related to maternal deaths and without whom this report could not have been published.

Especially,
• to all the assessors, both anesthesiologists-critical-care specialists and gynecologists-obstetricians, who contributed directly to the field investigations;
• to the experts who analyzed the cases and contributed to the drafting of the report;
• to InVS and Inserm, which provided funding for this work.

Translation:
Jo Ann Cahn
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFE</td>
<td>Amniotic fluid embolisms</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired immunodeficiency syndrome</td>
</tr>
<tr>
<td>AVK</td>
<td>Antivitamin K</td>
</tr>
<tr>
<td>BEH</td>
<td>Weekly Epidemiologic Bulletin (Bulletin épidémiologique hebdomaire)</td>
</tr>
<tr>
<td>BMI</td>
<td>Body-mass index</td>
</tr>
<tr>
<td>BP</td>
<td>Blood pressure</td>
</tr>
<tr>
<td>CEMACH</td>
<td>Confidential enquiry into maternal and child health</td>
</tr>
<tr>
<td>CepiDc</td>
<td>National Center for Death Statistics and Epidemiologic Study of Causes of Death (Centre d'épidémiologie des cause médicales de décès)</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence interval</td>
</tr>
<tr>
<td>Cnam-TS</td>
<td>National health insurance fund for salaried workers (Caisse nationale d’assurance maladie des travailleurs salariés)</td>
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<td>CNEMM</td>
<td>National Expert Committee on Maternal Mortality (Comité national d’experts sur la mortalité maternelle)</td>
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<tr>
<td>CNGOF</td>
<td>National French College of Gynecologists and Obstetricians (Collège National des Gynécologues et Obstétriciens Français)</td>
</tr>
<tr>
<td>CT</td>
<td>Computed tomography</td>
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<tr>
<td>CVT</td>
<td>Cerebral venous thrombosis</td>
</tr>
<tr>
<td>DBP</td>
<td>Diastolic blood pressure</td>
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<tr>
<td>DGS</td>
<td>Directorate-General of Health (Direction générale de la santé)</td>
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<tr>
<td>DHOS</td>
<td>Directorate-General of Hospitals and Health Care Organization (Direction de l’hospitalisation et de l’organisation des soins)</td>
</tr>
<tr>
<td>DIC</td>
<td>Disseminated intravascular coagulation</td>
</tr>
<tr>
<td>DOM</td>
<td>Overseas districts (Départements d’outre-mer)</td>
</tr>
<tr>
<td>ECM</td>
<td>External cardiac massage</td>
</tr>
<tr>
<td>ENCMMM</td>
<td>National confidential survey on maternal mortality (Enquête nationale confidentielle sur les morts maternelles)</td>
</tr>
<tr>
<td>GAS</td>
<td>Group A streptococcus</td>
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<tr>
<td>HAS</td>
<td>French Authority for Health (Haute autorité de santé)</td>
</tr>
<tr>
<td>HELLP</td>
<td>Syndrome including hemolytic anemia, elevated liver proteins, and low platelets</td>
</tr>
<tr>
<td>ICD</td>
<td>International Classification of Diseases</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive care unit</td>
</tr>
<tr>
<td>IdF</td>
<td>Île-de-France</td>
</tr>
<tr>
<td>INSEE</td>
<td>National Institute for Statistics and Economic Studies (Institut national des statistiques et des études économiques)</td>
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<td>Inserm</td>
<td>National Institute for Health and Medical Research (Institut national de la santé et de la recherche médicale)</td>
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<tr>
<td>INVS</td>
<td>French Institute of Public Health Surveillance (Institut de veille sanitaire)</td>
</tr>
<tr>
<td>IU</td>
<td>International units</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>IVP</td>
<td>Intravenous push</td>
</tr>
<tr>
<td>LMWH</td>
<td>Low molecular weight heparin</td>
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<tr>
<td>MBP</td>
<td>Mean blood pressure</td>
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<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>PAH</td>
<td>Pulmonary artery hypertension</td>
</tr>
<tr>
<td>PE</td>
<td>Pulmonary embolisms</td>
</tr>
<tr>
<td>SBP</td>
<td>Systolic blood pressure</td>
</tr>
<tr>
<td>SFAR</td>
<td>French Society of Anesthesiology and Resuscitation (Société française d’anesthésie et de réanimation)</td>
</tr>
<tr>
<td>SFPM</td>
<td>French Society of Perinatal Medicine (Société française de médecine périnatale)</td>
</tr>
<tr>
<td>SFNN</td>
<td>French Neonatology Society (Société française de néonatologie)</td>
</tr>
<tr>
<td>TTP</td>
<td>Thrombotic thrombocytopenic purpura</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>VTE</td>
<td>Venous thromboembolism</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</tbody>
</table>
Avoidable Maternal Deaths

Pr. Gilles Crépin, gynecologist-obstetrician, member of the National Academy of Medicine, France

France can justifiably be proud of two particularly enviable indicators: an increasing number of births (834,000 in 2008) and a total period fertility1 greater than 2. It thus has the highest birthrate and fertility rate in Europe.

Nonetheless these reassuring data must not hide the much worse statistics about maternal mortality and morbidity and perinatal mortality. WHO has documented maternal mortality ratios for more than 15 years now, and its figures place France around the mean for Europe2. The ratio in France is thus below the best and very far from the Swedish ratio, which is half as high.

Although we could argue about the credibility of some of these estimates and thus reduce the importance of these differences, the report 3 of the National Expert Committee on Maternal Mortality contained in the Bulletin épidémiologique hebdomadaire n° 2-34 offers relevant illumination about the current French reality on the particularly sensitive subject.

Experts conducted this enquiry with flawless rigor. It covers a period both recent (it is the first enquiry of this type during this decade) and sufficiently long (2001 through 2006). The report summarizes a large number of various indicators and makes demanding recommendations.

Of all the data presented, three items deserve special attention:

• the global maternal mortality ratio has indeed regressed since 2001, but it is still 9.6/100,000 births. In the opinion of the experts who examined their principal causes, the most alarming fact is that nearly half (more precisely, 46%) of the deaths were avoidable, or presumed to be, and were most often associated with inappropriate treatment measures. These 40 maternal deaths a year are stupefying. They demonstrate the need for strong measures where these situations are most urgent;

• the disparity between Île-de-France, the overseas districts, and metropolitan continental France, like the differences between the French-born and the foreign-born populations, are very significant. They require detailed investigation;

• one third of the deaths were not assessed by the experts because of the absence of official provisions to ensure exhaustiveness, although it is both essential and fundamental. Similarly, only 20% of the deaths were followed by autopsies, a low rate compared with that in English-speaking countries. Such lacunae in the information collection system on a national level suggest that the number of avoidable deaths may be higher.

The authors and the experts who contributed in so exemplary a manner to this important reference work deserve both our thanks and our congratulations. This hard-hitting document of real-life dramas demands a response from the public authorities, policy-makers at all levels of responsibility, and all the healthcare professionals involved in childbirth. It must also push us forward toward the objective of collecting all deaths, even those involved in criminal or civil litigation. It must lead to radical obligatory measures and to the rigorous application of guidelines, either those already existing or new ones.

Only in this way can we move from hope to reality, drastically reduce the current figures, and still better eradicate completely the unbearable existence of avoidable maternal deaths.

2.1 Establishment and assignments

The Ministry of Health issued a decree creating the National Expert Committee on Maternal Mortality (CNEMM) on 2 May 1995. Committee members were first nominated on 18 September 1995. More appointments were made in September 1998 and 2001.

In 2006, the French Institute of Public Health Surveillance (InVS) took over the responsibility for activities initially managed by the DGS (Direction Générale de la Santé), and a Memorandum of Understanding was signed between InVS and INSERM Unit 149 for the continued performance of the National Confidential Enquiry into Maternal Deaths (ENCMM). The committee was thus able to continue its expert assessment of maternal deaths.

Beyond the ex officio members, which include the DGS, the Directorate-General of Hospitals and Health Care Organization (DHOS), the National Council of Midwives, and the principal national health insurance fund (CnamTS, for salaried workers), the committee included 12 recognized and respected public figures, from both public and private institutions: five obstetrician-gynecologists, three anesthesiologist-critical-care specialists (hereafter anesthesiologists), three epidemiologists, and a midwife.

The committee's tasks were defined as follows: the confidential analysis of maternal deaths, the proposal of measures to prevent maternal mortality, and the submission of a report to the Minister, at the end of each term, on the causes of and trends in maternal mortality.

2.2 CNEMM procedures

The procedure begins by the identification of potential cases at the National Center for Death Statistics and Epidemiologic Study of Causes of Death (CepiDc), a part of INSERM, based on death certificates. When a woman dies during pregnancy or the puerperal period, CepiDc writes to the physician who certified the death to inform them of the existence of the confidential enquiry into maternal deaths and to invite their participation. If they cannot furnish the necessary additional information, they are asked for the name and address of the physician or physicians who should be contacted.

This information is transmitted to the INSERM research unit that studies the epidemiology of perinatal, women's and children's health (unit 149, renamed unit 953 in January 2009), which notifies two assessors, one an obstetrician, the other an anesthesiologist. They are responsible for completing a standardized file, in contact with the medical team or teams involved.

The assessors are chosen from an official list composed by professional organizations: the National French College of Gynecologists and Obstetricians (CNGOF) and the French Society of Anesthesiology and Resuscitation (SFAR). At assignment, the assessors are not aware of the cause of death stated on the death certificate. To identify the case, they know the patient's date of birth and date of death, and they have contact information for the physicians with whom they need to communicate.

The assessors play a primary role because they complete a standard file as precisely and completely as possible. This file was developed by the committee to be filled in from the information collected from the healthcare professionals and from the medical files (chart entries, laboratory results, surgical and autopsy reports). All other useful information must be attached to the file, after being strictly anonymized. There is only one file per case, jointly completed by the two assessors.

The assessors' activity is essential at this stage, to collect all of the items essential for the Committee's work, because once the file has been anonymized and returned to INSERM, unit 149/953, it is no longer possible to return to the source to request additional information. Not only the patient's name, but the hospital's, the physicians', and, for the Committee's — but not the statistical — analysis, even the region are removed.

The completely anonymous files are then analyzed by the full Committee. All committee members receive a complete copy of all files. Two members are more specifically responsible for presenting the case at the meeting to introduce the discussion. The expert assessment is performed collectively. Its aims are: first, to determine the cause of death (either an initial or principal cause) and therefore to judge whether it was a directly or indirectly obstetric cause; second, to assess whether the patient received optimal care or not; and third, to state under what conditions the death might possibly have been avoided. The conclusions are reached consensually, after discussion.
The confidential enquiries performed by the assessors began in January 1997. The first report to the minister was submitted in May 2001, analyzing the period 1996-1999. A second report was submitted in December 2006 covering the deaths assessed from 1999 through 2001. Implementation of a procedure to correct the time gap that had developed over time allowed this report to cover 2 three-year periods, 2001-2003 and 2004-2006.
In France, maternal mortality was a widely overlooked topic at the end of the 1980s, despite several hospital studies and one national synthesis. It thereafter became the subject of epidemiologic research as part of the extension of a European concerted action on health-care facilities and avoidable deaths. This concerted action showed that the proportion of maternal deaths in France was clearly higher than that observed in other EU countries at the time. In view of the importance of avoidable deaths in the evaluation of health-care services and facilities, a system of confidential enquiries into maternal death, like that conducted in England and Wales since the early 1950s, appeared necessary.

Since 1996, regular epidemiologic surveillance of maternal deaths has been conducted at a national level from two data sources that, while linked, use different methods of collection and analysis: the data from death certificates (CepiDc) and from the ENCMM. The latter specify the cause of death and assess its avoidability, but cover only approximately 70% of maternal deaths. These were combined for the first time in this report, to obtain a more exhaustive and thus more accurate vision. The second innovation concerns the inclusion of maternal deaths in the French overseas districts (DOM), which have been covered by CepiDc since 2000 and were thus able to be assessed in the same manner as those in metropolitan France.

### Definitions

According to the International Classification of Diseases (ICD), a maternal death is "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes." They are divided into two groups: deaths from a direct obstetric cause, that is, "resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above," and deaths from an indirect obstetric cause, that is, "resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy."

The maternal mortality rate is the ratio of the number of maternal deaths observed in one year to the number of live births the same year.

### 3.1 New Estimates of Maternal Mortality

The aim of the ENCMM is to bring together all of the cases from which general lessons can be drawn, to help improve the organization of care, clinical practice rules, and even regulations. The epidemiologic data from these enquiries provide information important for guiding public health policy. Mortality remains an essential indicator of maternal health and will remain so as long as there is neither a generally accepted standard definition of severe maternal morbidity nor an adequate surveillance system for it.

#### 3.1.1 Data sources

Since 1996, regular epidemiologic surveillance of maternal mortality at the national level has been conducted from two different sources, related but collected and analyzed by different methods:

- • data based on death certificates completed by physicians and analyzed at the CepiDc;
- • data from a very detailed questionnaire designed to allow the National Expert Committee to analyze each case and determine the avoidability of the death.

These two resources provide complementary information, which will be presented either separately or combined, according to the requirements of the analysis. Moreover, live births, necessary to calculate rates, come from civil status records (birth certificates drawn up systematically throughout the country and processed by the National Institute for Statistics and Economic Studies (Institut national des statistiques et des études économiques, INSEE) (www.insee.fr).

#### 3.1.1.1 Inclusion of possible maternal deaths

Since 2000, CepiDc has handled not only death certificates from metropolitan France, but also those from the DOM. This is the first time that maternal deaths in the DOM have been analyzed as part of the ENCMM.

Possible maternal deaths to be analyzed included all deaths: 1) coded by CepiDc with items from section ‘O’ of the International Classification of Diseases, 10th revision (ICD-10), pregnancy, delivery and the puerperium, or from code Y 76, obstetric and gynecological devices associated with adverse events during diagnostic procedures or treatment, and regardless of whether this code concerned the initial, immediate or additional cause of death; or 2) for which the box “death during pregnancy or less than a year afterwards” on the death certificate death was checked.
3.1.1.2 Information collected

The women’s social and demographic characteristics and general information about the death (parts I and II of the questionnaire, in appendix 2a) were extracted from the death certificate. All the medical information about the obstetric or medical history, the course of the pregnancy, the mode of delivery, and the events that followed came from the enquiry conducted by the assessors, structured by a detailed questionnaire, as did the information about the specific disorder causing the death (hemorrhage, thrombo- or amniotic fluid embolism, or complications of hypertension, infections, anesthesia or resuscitation). The experts’ conclusions about avoidability and optimal care are also collected (see the detailed enquiry methodology in the 2006 report and BEH n. 50, Dec. 2006).

3.1.1.3 Special procedure for deaths from 2004 to 2006

To catch up with the accumulated delay of recent years, a special procedure was applied to the deaths in 2004 through 2006. After CepiDc reported them, we conducted a simplified investigation, contacting the certifying physician directly. Assessors were not used. This procedure accelerated data collection, but obtained fewer details about management of delivery, thereby limiting the experts’ ability to evaluate the quality of care. Accordingly, several results will be presented separately for 2001-2003 and 2004-2006.

3.1.2 Analysis

Besides the official ratio of maternal mortality calculated by CepiDc, we estimated a corrected ratio, based on the simple addition of the deaths identified by the ENCMM and the cases identified from death certificates when we obtained no response for the detailed enquiry.

The official data underestimate the number of maternal deaths relative to the corrected data by approximately 17% (that is, by 42 deaths in 2001-2003 and 36 in 2004-2006). This underestimation is stable from one year to another, but varies randomly by age group and region because of the small number of cases. All the results in part 3.1 are presented according to the corrected data (except for Figure 1); they are therefore not directly comparable to the results in preceding reports. The uncorrected results are available on request from INSERM unit 953.

Avoidability was studied from the medical and obstetric information collected in the detailed ENCM maternality wards (an obstetrician and an anesthesiologist) for presentation. All the experts had information about all the files; the files were presented in a committee session with a written memorandum opinion by two members responsible for its presentation; each case was debated in plenary session, and the committee reached consensual determinations about the etiology of the initial cause of death and, if it was obstetric, on its avoidability, and finally on the quality of care.

The Committee did not use any list of criteria of good management, defined a priori by disease or event, because patients’ histories are often complex and most often several interconnected complications combine to lead to death. The Committee reached a consensus judgment by considering the most recent findings from the literature and the clinical practice guidelines published before the death and by applying its members’ professional expertise.

Deaths are classified as direct or indirect obstetric (that is, maternal death) or non-obstetric or not defined. Avoidability is defined as “certain, probable, unavoidable, or not established”. When the experts determine that a death was avoidable, they list their justifications for this finding. Avoidability is not assessed for deaths determined to be non-obstetric. Care is assessed as optimal, not optimal, or unknown. These judgments are based on data from the literature and the expertise of the committee members.

3.1.3 Results: Frequency and trends from 2001 to 2006

From 60 to 100 maternal deaths were counted each year (Table 1). Since 1990, the number has fluctuated continuously from year to another, randomly, because of the rarity of this event. But the general trend of the ratio shows a significant decrease (p<0.01). Ratios greater than 10 per 100 000 were recorded in 1992, 1996, and 2002, without any known explanation. Inversely, 2005 saw the lowest official ratio ever recorded in France, 5.8/100 000 live births.

During the last period, 2001-2006, the official annual maternal mortality ratio continue to decrease, however there is not a statistically significant trend (Figure 1).

To limit the disruptions linked to annual fluctuations, the ENCM presents the results in three-year periods. Figure 2 shows the general trend and underlines the slight rate increase for France when the DOM are included in 2001.

Maternal deaths represent a very small proportion of the total deaths for women in this age group — less than 0.5%. This proportion has fallen since 1999, while the total number of deaths of women of reproductive age has remained stable.
TABLE 1

Annual number of maternal deaths and maternal mortality ratio per 100 000 live births, using death certificate data alone

<table>
<thead>
<tr>
<th>Years</th>
<th>Maternal deaths CepiDc</th>
<th>Live births</th>
<th>Official ratio&lt;sup&gt;b&lt;/sup&gt; [95% CI]</th>
<th>Maternal deaths and corrected ratio Numbers</th>
<th>Ratio [95% CI]</th>
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<tbody>
<tr>
<td>1990</td>
<td>79</td>
<td>762 407</td>
<td>10.4 [8.1; 12.6]</td>
<td>Not available</td>
<td></td>
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<tr>
<td>1991</td>
<td>90</td>
<td>759 056</td>
<td>11.9 [9.4; 14.3]</td>
<td>Not available</td>
<td></td>
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<tr>
<td>1992</td>
<td>96</td>
<td>743 658</td>
<td>12.9 [10.3; 15.5]</td>
<td>Not available</td>
<td></td>
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<td>1993</td>
<td>66</td>
<td>711 500</td>
<td>9.3 [7.0; 11.5]</td>
<td>Not available</td>
<td></td>
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<tr>
<td>1994</td>
<td>83</td>
<td>710 993</td>
<td>11.7 [9.2; 14.2]</td>
<td>Not available</td>
<td></td>
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<tr>
<td>1995</td>
<td>70</td>
<td>729 609</td>
<td>9.6 [7.3; 11.8]</td>
<td>Not available</td>
<td></td>
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<td>1996</td>
<td>97</td>
<td>734 338</td>
<td>13.2 [10.6; 15.8]</td>
<td>Not available</td>
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<td>1997</td>
<td>70</td>
<td>726 768</td>
<td>9.6 [7.4; 11.9]</td>
<td>Not available</td>
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<td>1998</td>
<td>75</td>
<td>738 080</td>
<td>10.2 [7.9; 12.5]</td>
<td>Not available</td>
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<td>1999</td>
<td>55</td>
<td>744 791</td>
<td>7.4 [5.4; 9.3]</td>
<td>Not available</td>
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<td>50</td>
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<td>6.5 [4.7; 8.2]</td>
<td>Not available</td>
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<td>2001</td>
<td>61</td>
<td>804 052</td>
<td>7.6 [7.2; 9.3]</td>
<td>75 [9.3; 7.2; 11.4]</td>
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<tr>
<td>2002</td>
<td>81</td>
<td>793 606</td>
<td>10.2 [9.9; 12.3]</td>
<td>98 [12.5; 9.9; 14.8]</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>66</td>
<td>793 893</td>
<td>8.3 [7.5; 9.7]</td>
<td>77 [9.7; 7.5; 11.9]</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>61</td>
<td>800 240</td>
<td>7.6 [7.1; 9.3]</td>
<td>74 [9.3; 7.1; 11.3]</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>47</td>
<td>807 787</td>
<td>5.8 [6.2; 8.2]</td>
<td>66 [8.2; 6.2; 10.1]</td>
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<tr>
<td>2006</td>
<td>68</td>
<td>830 288</td>
<td>8.2 [6.7; 8.7]</td>
<td>73 [8.8; 6.8; 10.8]</td>
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<tr>
<td>2007</td>
<td>60</td>
<td>819 605</td>
<td>7.3 [5.6; 9.4]</td>
<td></td>
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</tbody>
</table>

Sources: INSEE, Inserm CepiDc and U953
<sup>a</sup>Ratio per 100 000 live births
<sup>b</sup>Deaths in the DOM are included from 2001.
<sup>c</sup>Provisional data

FIGURE 1

Trends in the official maternal mortality ratio in France since 1989, in 3-year periods, ratio per 100 000 live births
3.1.4 Study of social and demographic factors

3.1.4.1 Age

The mean age of the women who died was 33.4 years, substantially higher than the mean age at birth (30 years). The distribution of maternal deaths has moved increasingly toward the higher ages: 42% of the deaths (but only 19% of births) involved women aged 35 years or older (compared with 33% during the 1990-1994 period), a change corresponding in part to the trends in the distribution of births according to maternal age (Figure 3). We had already shown a substantial association between maternal mortality and maternal age in the previous study (Table 2 and Figure 4). Contrary to common belief, the risk of maternal mortality is not higher at very young ages; rather, it increases regularly with age and reaches its highest ratio beyond 45 years, as does overall mortality among women. The risk of maternal death is 3 times higher at 35-39 years than at 20 years, 5 to 6 times higher at 40-44 years, and 15 times higher after 45 years.
3.1.4.2 Nationality

Classically, women of non-European nationality have a higher maternal mortality ratio than do French or European women (Table 3). This remains true, with some nuances according to nationality. For example, French women, other Europeans, and women from North Africa have similar maternal mortality ratios (no statistical differences). On the other hand, women from sub-Saharan Africa and of some other nationalities (Latin America, Asia, and Oceania) have ratios approximately 3 times higher.

A specific analysis [BJOG, 2008] showed that the excess risk in France of maternal mortality for women from sub-Saharan Africa, compared with women from France, is linked to specific obstetric causes — complications of hypertension and infections — and is explained in part by a higher frequency of non-optimal management for women in these groups.
### TABLE 3

Number of maternal deaths, distribution expressed as a percentage and a ratio per 100,000 live births, according to mother's nationality

<table>
<thead>
<tr>
<th>Age</th>
<th>Numbers</th>
<th></th>
<th>Percentage</th>
<th></th>
<th>Ratio per 100,000 LB [95% CI]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>203</td>
<td>171</td>
<td>81</td>
<td>80</td>
<td>9.6 [8.3; 11.0]</td>
<td>8.0 [6.9; 9.3]</td>
</tr>
<tr>
<td>European</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>8.7 [2.4; 22.2]</td>
<td>8.3 [2.3; 21.1]</td>
</tr>
<tr>
<td>North Africa</td>
<td>9</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>9.8 [4.5; 18.7]</td>
<td>7.8 [3.4; 15.3]</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>21</td>
<td>13</td>
<td>8</td>
<td>6</td>
<td>36.3 [22.5; 55.5]</td>
<td>19.0 [10.1; 32.5]</td>
</tr>
<tr>
<td>Other nationalities</td>
<td>13</td>
<td>17</td>
<td>5</td>
<td>8</td>
<td>17.7 [9.4; 30.3]</td>
<td>25.0 [12.0; 32.9]</td>
</tr>
<tr>
<td>All</td>
<td>250</td>
<td>213</td>
<td>100</td>
<td>100</td>
<td>10.4 [9.2; 11.7]</td>
<td>8.7 [7.6; 9.9]</td>
</tr>
</tbody>
</table>

### 3.1.4.3 Regional disparities

Depending on the period, the region with the highest or lowest maternal mortality ratios varied, with two exceptions — Ile-de-France and the overseas districts (DOM) (Table 4). These two particular geographic areas had ratios systematically superior to the national mean. Compared with the rest of France, maternal mortality was 30% higher in Ile-de-France and more than 3 times higher in the DOM. These high ratios, combined with the high number of births, make these regions the principal contributors to maternal deaths in France (30% in Ile-de-France, 14% in the DOM). In view of the persistence of this problem and to describe it thoroughly, we present a detailed analysis of the profile of causes of maternal deaths in these two regions below (section 3.3).

### TABLE 4

Number of maternal deaths, maternal mortality ratio per 100,000 live births, by region, France, 2001-2003 and 2004-2006

<table>
<thead>
<tr>
<th>Region</th>
<th>Numbers</th>
<th>Corrected ratio per 100,000 live births [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001-03</td>
<td>2004-06</td>
</tr>
<tr>
<td>Alsace</td>
<td>5</td>
<td>7.4 [2.4-17.2]</td>
</tr>
<tr>
<td>Aquitaine</td>
<td>11</td>
<td>11.1 [5.5-19.9]</td>
</tr>
<tr>
<td>Auvergne</td>
<td>2</td>
<td>4.9 [0.6-17.8]</td>
</tr>
<tr>
<td>Basse-Normandie</td>
<td>1</td>
<td>1.8 [0.05-10.5]</td>
</tr>
<tr>
<td>Bourgogne</td>
<td>1</td>
<td>1.8 [0.05-10.3]</td>
</tr>
<tr>
<td>Bretagne</td>
<td>16</td>
<td>14.4 [8.2-23.4]</td>
</tr>
<tr>
<td>Centre</td>
<td>6</td>
<td>7.0 [2.6-15.2]</td>
</tr>
<tr>
<td>Champagne-Ardenne</td>
<td>7</td>
<td>14.1 [5.6-29.1]</td>
</tr>
<tr>
<td>Corsica</td>
<td>1</td>
<td>12.5 [3.2-69.5]</td>
</tr>
<tr>
<td>DOM</td>
<td>34</td>
<td>34.9 [24.1-48.7]</td>
</tr>
<tr>
<td>Franche-Comté</td>
<td>3</td>
<td>7.1 [1.5-20.8]</td>
</tr>
<tr>
<td>Haute-Normandie</td>
<td>7</td>
<td>10.5 [4.2-21.7]</td>
</tr>
<tr>
<td>Ile-de-France</td>
<td>68</td>
<td>13.0 [10.1-15.5]</td>
</tr>
<tr>
<td>Languedoc-Roussillon</td>
<td>11</td>
<td>13.4 [6.7-24.0]</td>
</tr>
<tr>
<td>Limousin</td>
<td>0</td>
<td>0.0 [0.0-16.9]</td>
</tr>
<tr>
<td>Lorraine</td>
<td>9</td>
<td>11.1 [5.1-21.1]</td>
</tr>
<tr>
<td>Midi-Pyrénées</td>
<td>12</td>
<td>13.9 [7.2-24.3]</td>
</tr>
<tr>
<td>Nord-Pas-de-Calais</td>
<td>8</td>
<td>4.7 [2.0-9.3]</td>
</tr>
<tr>
<td>Pays de la Loire</td>
<td>10</td>
<td>7.7 [3.7-14.1]</td>
</tr>
<tr>
<td>Picardie</td>
<td>5</td>
<td>7.1 [2.3-16.6]</td>
</tr>
<tr>
<td>Poitou-Charentes</td>
<td>3</td>
<td>5.8 [1.2-16.9]</td>
</tr>
<tr>
<td>PACA</td>
<td>11</td>
<td>6.5 [3.3-11.7]</td>
</tr>
<tr>
<td>Rhône-Alpes</td>
<td>19</td>
<td>8.3 [5.5-12.9]</td>
</tr>
<tr>
<td>Entire France</td>
<td>250</td>
<td>10.4 [9.2-11.8]</td>
</tr>
</tbody>
</table>

Data source: Inserm U953

* Provence-Alpes-Côte d’Azur
3.1.4.4 International comparisons

The EUROPERISTAT report (covering 2004 and published in December 2008) was the first collection of annual perinatal health data for all Member States and Norway. It simultaneously sought to harmonize definitions and calculations. This report used maternal mortality ratios from data made available by the national statistics departments of each country. The ratio for France (7.4/100 000) was similar to those for the United Kingdom (UK) (7.2), Finland (7.9), and the Netherlands (8.8); all these countries, like France, have a reinforced system for studying maternal mortality, but our ratio is more than 3 times higher than that of Sweden (2.0/100 000). This fact demands that we take steps to improve care.

Nonetheless, relatively important fluctuations are recorded within Europe (from 0 to 29/100 000 births), which must be interpreted with prudence because, on the one hand, some small countries have few births and consequently, few or no maternal deaths in a given year; on the other hand, the validity of the numbers of maternal deaths registered in countries that do not have a reinforced monitoring system (as the UK and France do) remains questionable. It is common knowledge that maternal deaths are not known accurately in any country, even the developed ones, in the absence of constant efforts to inventory all cases exhaustively. It is also very probable that the underestimation of maternal deaths varies from one country to another.

3.1.5 Obstetric causes, number of deaths, percentages, and ratios

Direct obstetric causes accounted for a very large proportion of maternal deaths (73%), first because of hemorrhages, which remain the leading diagnosis (25% of deaths, ratio of 2.4/100 000 live births), in 2001-2003 as in 2004-2006 (Figure 5 and Table 5). The second leading cause is amniotic fluid embolisms (AFE) (12.3%, 1.2/100 000), followed by thromboembolisms (9.9%, 1.0/100 000) and complications of hypertension (9.9%, 1.0/100 000). MM ratio from complications of hypertension decrease between 2001-2003 and 2004-2006, from 1.2 to 0.6/100 000 live births (p <0.05), a decrease to be interpreted prudently since the data collection methods differed slightly between the two periods. This was followed by infections (19 deaths of 463, unspecified obstetrical complications (22/463), and complications of anesthesia (7/463).

Among the indirect obstetric causes (129/463 deaths from 2001 to 2006), more than half (72/129) were due to cardiovascular accidents, two thirds of them strokes (43 strokes).

Comparison of data from the similar enquiry in the UK shows that our death ratio from hemorrhage was 3 to 4 times higher (0.8/100 000, including genital tract trauma in the UK), and the order of frequency for deaths from AFE and those related to eclampsia or preeclampsia was similar in both countries. Inversely the ratio of maternal deaths from thromboembolism in the UK (1.9/100 000) was twice as high as in France. A very large difference between the two countries comes from the high ratio of deaths from indirect obstetric causes in the UK (7.7/100 000 versus 2.7 in France).

Figure 5
Specific mortality ratios by major group of obstetric causes, France, 2001-2003 and 2004-2006
<table>
<thead>
<tr>
<th>CAUSES</th>
<th>2001-2003</th>
<th>2004-2006</th>
<th>RATIO*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Numbers</td>
<td>%</td>
<td>Numbers</td>
</tr>
<tr>
<td>Direct obstetric causes</td>
<td>178</td>
<td>71.2</td>
<td>156</td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>61</td>
<td>24.4</td>
<td>55</td>
</tr>
<tr>
<td>From ectopic pregnancy</td>
<td>7</td>
<td>2.8</td>
<td>9</td>
</tr>
<tr>
<td>From abortion</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Placenta praevia, placenta accreta</td>
<td>4</td>
<td>1.6</td>
<td>4</td>
</tr>
<tr>
<td>Hemorrhage preceding delivery</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>Hemorrhage during delivery</td>
<td>2</td>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>abruptio placenta</td>
<td>4</td>
<td>1.6</td>
<td>2</td>
</tr>
<tr>
<td>Postpartum hemorrhage</td>
<td>28</td>
<td>11.2</td>
<td>33</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>11</td>
<td>4.4</td>
<td>2</td>
</tr>
<tr>
<td>Surgical wounds and injuries</td>
<td>3</td>
<td>1.2</td>
<td>2</td>
</tr>
<tr>
<td>Amniotic fluid embolisms</td>
<td>23</td>
<td>9.2</td>
<td>34</td>
</tr>
<tr>
<td>Thrombotic embolism</td>
<td>26</td>
<td>10.4</td>
<td>20</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>22</td>
<td>8.8</td>
<td>18</td>
</tr>
<tr>
<td>Cerebral venous thrombosis</td>
<td>4</td>
<td>1.6</td>
<td>2</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>29</td>
<td>11.6</td>
<td>17</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>7</td>
<td>2.8</td>
<td>6</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>15</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>HELLP syndrome</td>
<td>4</td>
<td>1.6</td>
<td>3</td>
</tr>
<tr>
<td>Other hypertension</td>
<td>3</td>
<td>1.2</td>
<td>0</td>
</tr>
<tr>
<td>Infection</td>
<td>12</td>
<td>4.8</td>
<td>7</td>
</tr>
<tr>
<td>Septicemia</td>
<td>8</td>
<td>3.2</td>
<td>5</td>
</tr>
<tr>
<td>From abortion</td>
<td>2</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>0.8</td>
<td>2</td>
</tr>
<tr>
<td>Anesthesia complications</td>
<td>4</td>
<td>1.6</td>
<td>3</td>
</tr>
<tr>
<td>Other direct</td>
<td>23</td>
<td>9.2</td>
<td>20</td>
</tr>
<tr>
<td>Peripartum myocardiopathy</td>
<td>6</td>
<td>2.4</td>
<td>1</td>
</tr>
<tr>
<td>Postnatal depression</td>
<td>1</td>
<td>0.4</td>
<td>0</td>
</tr>
<tr>
<td>Pregnancy-related hepatic steatosis</td>
<td>1</td>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Complication of obstetric surgery</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>1.6</td>
<td>4</td>
</tr>
<tr>
<td>Death of obstetric origin, cause unspecified</td>
<td>11</td>
<td>4.4</td>
<td>11</td>
</tr>
<tr>
<td>Indirect obstetric causes</td>
<td>72</td>
<td>28.8</td>
<td>57</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>27</td>
<td>10.8</td>
<td>16</td>
</tr>
<tr>
<td>Cardiac diseases</td>
<td>10</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Aortic dissection</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Infectious and parasitic diseases</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>6</td>
<td>2.4</td>
<td>1</td>
</tr>
<tr>
<td>Cancer</td>
<td>4</td>
<td>1.6</td>
<td>6</td>
</tr>
<tr>
<td>Autoimmune diseases</td>
<td>3</td>
<td>1.2</td>
<td>4</td>
</tr>
<tr>
<td>Diseases of the nervous system</td>
<td>4</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Metabolic and endocrine diseases</td>
<td>1</td>
<td>0.4</td>
<td>2</td>
</tr>
<tr>
<td>Congenital diseases*</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>ALL CAUSES</strong></td>
<td><strong>250</strong></td>
<td><strong>100</strong></td>
<td><strong>213</strong></td>
</tr>
</tbody>
</table>

*aRatio per 100 000 live births

bOne Marfan’s syndrome and one neurofibromatosis
3.1.6 Site of maternal deaths

The largest number of maternal deaths (360/463 or 78%) took place in local public hospitals, 8% in private facilities, and 14% at home or other premises (Table 6).

The profiles of causes differ according to the premises: hemorrhages were always the leading cause and accounted for 25% of the deaths in public hospitals and at home but 37% of the deaths in private facilities. Similarly AFEs accounted for 12% of the public hospital deaths but 29% of those in private facilities. Thrombotic accidents and complications of hypertension were especially frequent in public hospitals (respectively 8% and 10%) and at home (25% and 12%).

### Table 6

<table>
<thead>
<tr>
<th>Causes</th>
<th>Public hospital</th>
<th>Private facility</th>
<th>At home, other place</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct obstetric causes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>86</td>
<td>14</td>
<td>16</td>
<td>116</td>
</tr>
<tr>
<td>Amniotic fluid embolisms</td>
<td>42</td>
<td>11</td>
<td>4</td>
<td>57</td>
</tr>
<tr>
<td>Thrombotic embolism</td>
<td>29</td>
<td>1</td>
<td>16</td>
<td>46</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>37</td>
<td>1</td>
<td>8</td>
<td>46</td>
</tr>
<tr>
<td>Infection</td>
<td>18</td>
<td>0</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Anesthesia complications</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Other direct</td>
<td>24</td>
<td>8</td>
<td>11</td>
<td>43</td>
</tr>
<tr>
<td>Indirect obstetric causes</td>
<td>117</td>
<td>3</td>
<td>9</td>
<td>129</td>
</tr>
<tr>
<td>All causes</td>
<td>360</td>
<td>38</td>
<td>65</td>
<td>463</td>
</tr>
<tr>
<td>%</td>
<td>77.8</td>
<td>8.2</td>
<td>14.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

3.1.7 Timing of death

A quarter of maternal deaths occurred during pregnancy, 9.5% of them before a gestational age of 22 weeks. One third occurred during the first 24 hours postpartum (32.6%) and another third (32.6%) during the postpartum period, after 24 hours but before 42 days. Finally, 6.5% were late maternal deaths, that is, after 42 days but before a year after the pregnancy ended (Table 7).

### Table 7

<table>
<thead>
<tr>
<th>Timing of death</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>During pregnancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 22 weeks</td>
<td>44</td>
<td>9.5</td>
</tr>
<tr>
<td>≥ 22 weeks</td>
<td>48</td>
<td>10.4</td>
</tr>
<tr>
<td>Term unknown</td>
<td>25</td>
<td>5.4</td>
</tr>
<tr>
<td>&lt; 24 h</td>
<td>151</td>
<td>32.6</td>
</tr>
<tr>
<td>Postpartum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1 d &lt; 42 d</td>
<td>151</td>
<td>32.6</td>
</tr>
<tr>
<td>≥ 42 d</td>
<td>30</td>
<td>6.5</td>
</tr>
<tr>
<td>Unknown</td>
<td>10</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>463</td>
<td>100</td>
</tr>
</tbody>
</table>
Distribution of autopsies according to place of death, France, 2001-2003 and 2004-2006

<table>
<thead>
<tr>
<th>Place of deatha</th>
<th>2001-2003</th>
<th></th>
<th>2004-2006</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of cases</td>
<td>% of autopsies</td>
<td>Number of cases</td>
<td>% of autopsies</td>
</tr>
<tr>
<td>Public hospital</td>
<td>194</td>
<td>21.7</td>
<td>166</td>
<td>28.9</td>
</tr>
<tr>
<td>Private facility</td>
<td>22</td>
<td>59.1</td>
<td>16</td>
<td>37.5</td>
</tr>
<tr>
<td>At home, elsewhere</td>
<td>34</td>
<td>26.4</td>
<td>31</td>
<td>22.6</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>25.6</td>
<td>213</td>
<td>28.6</td>
</tr>
</tbody>
</table>

aData from death certificates.

The performance of autopsies varied according to the cause of death: it was less frequent for hemorrhages, and highest in cases of AFEs and complications of anesthesia. The cause selected for this analysis is that determined by the Committee after consideration of the results of the post-mortem examination and its own assessment (Table 9).

### Table 9

Proportion of autopsies by major groups of causes of death, France, 2001-2003 and 2004-2006

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Of cases</td>
<td>% of autopsies</td>
<td>Number Of cases</td>
<td>% of autopsies</td>
</tr>
<tr>
<td><strong>Direct obstetric causes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>61</td>
<td>34.4</td>
<td>55</td>
<td>34.5</td>
</tr>
<tr>
<td>Amniotic fluid embolisms</td>
<td>23</td>
<td>56.5</td>
<td>34</td>
<td>55.9</td>
</tr>
<tr>
<td>Thrombotic embolism</td>
<td>26</td>
<td>19.2</td>
<td>20</td>
<td>10.0</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>29</td>
<td>13.8</td>
<td>17</td>
<td>11.8</td>
</tr>
<tr>
<td>Infection</td>
<td>12</td>
<td>16.7</td>
<td>7</td>
<td>28.6</td>
</tr>
<tr>
<td>Anesthesia complications</td>
<td>4</td>
<td>50.0</td>
<td>3</td>
<td>66.7</td>
</tr>
<tr>
<td>Other direct</td>
<td>23</td>
<td>26.1</td>
<td>20</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Indirect obstetric causes</strong></td>
<td>72</td>
<td>15.3</td>
<td>57</td>
<td>17.5</td>
</tr>
<tr>
<td><strong>All causes</strong></td>
<td>250</td>
<td>25.6</td>
<td>213</td>
<td>28.6</td>
</tr>
</tbody>
</table>

### 3.2 DATA FROM THE EXPERT ASSESSMENTS

#### 3.2.1 Validity of the enquiry procedure leading to the expert assessment 2001-2006

CepiDc referred 449 cases for the 2001-2003 period, and 441 for 2004-2006. These correspond to possible maternal deaths selected from death certificates because coded with items from the chapter "pregnancy, childbirth and puerperium" or because the box on the death certificate for "pregnancy or childbirth within the past year" was checked.

After the exclusion of deaths that involved coding errors and violent deaths unrelated to pregnancy or childbirth status, 371 deaths were included for the years 2001-2003 and 328 for the 2004-2006 (see §3.1.1.1 p 5) (Table 10). Nevertheless, the enquirie was unsuccessful, or no further information was available, for a substantial but variable proportion of deaths (40% on average, minimum 33% in 2006 and maximum 48% in 2003).
We can hope that with the shortening of the delay between the reports of deaths and the enquiry survey, this proportion will diminish, as was the case in 2006.

There is, nonetheless, a recurrent problem, not really remediable, when the death is certified by a physician who does not know the patient, that is, from mobile emergency services or a hospital emergency department. It is rare to obtain useful information for the expert assessment in these circumstances.

The Committee's analysis of 230 deaths in 2001-2003 and 191 in 2004-2006 determined that 171 and 142, respectively, were maternal deaths. The results about the avoidability of death and quality of care, as well as those presented in the clinical chapter that follows, concern these 313 (171+142) maternal deaths from 2001 through 2006.

### 3.2.2 Quality of care

Beyond assessing the (direct or indirect) obstetric nature of the cause of death, the experts made an overall judgment about the quality of the management.

Because of the simplification of the enquiry procedure adopted for the 2004-2006 period, the available information was often too limited to allow the experts to reach a judgment about the quality of care. Accordingly, no conclusion was reached about quality of care in 46% of the cases, compared with 15% for 2001-2003. Moreover, the information came directly from the certifying physician, which may change the nature of the contents. Consequently, the results about the quality of care for the 2004-2006 period are presented separately and must be considered with great prudence.

For 2001-2003, care was judged not optimal for 59% of the maternal deaths assessed, a stable proportion compared with the 1998-2000 period, as shown in Table 11. The quality of care varied according to the cause. The proportion of non-optimal care was highest for deaths from hemorrhages (86%, with no improvement over the previous period) and for deaths from infections.

### 3.2.3 Avoidability of maternal deaths

The proportion of deaths judged avoidable among those reviewed by the experts was analysed by three-year periods, except at the very beginning of the enquiry (Table 11). For 2001-2003, 46% of the deaths reviewed were considered avoidable (28%) or possibly avoidable (18%), a proportion not significantly changed from that in 1998-2000. This proportion — around 50% — has not changed significantly over time. The 2004-2006 period is not really comparable to the others since the simplified enquiry resulted in the collection of less information and fewer details than during the preceding periods.

### Table 10

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Reports</td>
<td>124</td>
<td>177</td>
<td>148</td>
<td>449</td>
<td>158</td>
<td>142</td>
<td>141</td>
<td>441</td>
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<tr>
<td>Cases excluded</td>
<td>11</td>
<td>34</td>
<td>33</td>
<td>88</td>
<td>46</td>
<td>33</td>
<td>34</td>
<td>113</td>
</tr>
<tr>
<td>Cases included</td>
<td>113</td>
<td>143</td>
<td>115</td>
<td>371</td>
<td>112</td>
<td>109</td>
<td>107</td>
<td>328</td>
</tr>
<tr>
<td>Cases assessed</td>
<td>74 (65.5)</td>
<td>96 (67.1)</td>
<td>60 (52.2)</td>
<td>230 (62.0)</td>
<td>59 (52.7)</td>
<td>61 (56.0)</td>
<td>71 (66.4)</td>
<td>191 (52.8)</td>
</tr>
<tr>
<td>Without information</td>
<td>39 (34.5)</td>
<td>47 (32.9)</td>
<td>55 (47.8)</td>
<td>141 (38.0)</td>
<td>53 (47.3)</td>
<td>48 (44.0)</td>
<td>36 (33.6)</td>
<td>137 (41.8)</td>
</tr>
</tbody>
</table>

*Number of cases divided by the number of included cases.

**Table 11**

<p>| Trends in global avoidability of maternal deaths since 1996 |
|---------------|---------------|---------------|---------------|---------------|</p>
<table>
<thead>
<tr>
<th>Period</th>
<th>Cases assessed</th>
<th>Unavoidable</th>
<th>Avoidable or might be avoidable</th>
<th>% avoidability</th>
<th>Cannot judge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-1997</td>
<td>123</td>
<td>49</td>
<td>67</td>
<td>54.5</td>
<td>7</td>
</tr>
<tr>
<td>1998-2000</td>
<td>146</td>
<td>58</td>
<td>59</td>
<td>40.4</td>
<td>29</td>
</tr>
<tr>
<td>2001-2003</td>
<td>171</td>
<td>78</td>
<td>78</td>
<td>45.6</td>
<td>15</td>
</tr>
<tr>
<td>2004-2006</td>
<td>142</td>
<td>53</td>
<td>34</td>
<td>23.9</td>
<td>55</td>
</tr>
</tbody>
</table>

*Number of avoidable and possibly avoidable cases divided by the total number of cases assessed.

French Institute for Public Health Surveillance- Report of the National Expert Committee on Maternal Mortality (CNEMM)-2001-2006-
3.2.4 Avoidability according to causes

The proportion of avoidable deaths varied according to cause, by a profile resembling that shown in the results for quality of care: the deaths most often considered avoidable were those related to hemorrhages (86%) and infections (Table 12). The deaths by AFE, always considered unavoidable in 1998-2000, were considered avoidable or possibly avoidable in 12% of the cases in 2001-2003.

Of the 78 avoidable or possibly avoidable maternal deaths in 2001-2003, the reasons for avoidability were inappropriate treatment in 59% of cases, delayed treatment in 36%, failure to diagnose in 32%, a treatment error in 27% and "negligence" of/by the patient or her family in 15% of the cases. The clinical chapter describes these causes in more detail.

| TABLE 12 |

Trends in avoidability of maternal deaths from specific causes since 1998

<table>
<thead>
<tr>
<th></th>
<th>1998-2000</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>No avoidable</td>
<td>Total avoidable</td>
<td>% avoidability</td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>37</td>
<td>4</td>
<td>25</td>
<td>67.6</td>
</tr>
<tr>
<td>Amniotic fluid embolisms</td>
<td>16</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>17</td>
<td>3</td>
<td>9</td>
<td>52.9</td>
</tr>
<tr>
<td>Thrombotic embolism</td>
<td>17</td>
<td>11</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>Infection</td>
<td>7</td>
<td>2</td>
<td>5</td>
<td>71.4</td>
</tr>
<tr>
<td>Indirect causes</td>
<td>42</td>
<td>22</td>
<td>12</td>
<td>28.6</td>
</tr>
<tr>
<td>All</td>
<td>146</td>
<td>58</td>
<td>59</td>
<td>40.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2001-2003</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>No avoidable</td>
<td>Total avoidable</td>
<td>% avoidability</td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>37</td>
<td>3</td>
<td>32</td>
<td>86.5</td>
</tr>
<tr>
<td>Amniotic fluid embolisms</td>
<td>17</td>
<td>15</td>
<td>2</td>
<td>11.8</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>16</td>
<td>5</td>
<td>7</td>
<td>43.8</td>
</tr>
<tr>
<td>Thrombotic embolism</td>
<td>14</td>
<td>7</td>
<td>6</td>
<td>42.9</td>
</tr>
<tr>
<td>Infection</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>90.9</td>
</tr>
<tr>
<td>Indirect causes</td>
<td>43</td>
<td>16</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>All</td>
<td>171</td>
<td>78</td>
<td>78</td>
<td>45.6</td>
</tr>
</tbody>
</table>

The absence of significant changes in hemorrhages, for either quality of care or avoidability, might seem surprising given the publication in 2004 of French Clinical Practice Guidelines for postpartum hemorrhages (PPHs). This absence may be explained by the short period of time that elapsed between their publication and the years in which these deaths were recorded. Moreover, there was a trend towards a decrease in the mortality ratio. This suggests the start of an improvement that we hope will be confirmed soon.

Acknowledgements

Many people have been involved in this work, to varying degrees, and without them, there would not have been results. First, the physicians who completed the death certificates and agreed to participate in the enquiry; CepiDc, which provides the reports for the confidential enquiry and the routine statistics; then the assessors, who had the difficult task of meeting with the obstetric and resuscitation teams.

3.2.5 References for the complementary studies conducted by INSERM unit 149/953


Monica del Carmen Saucedo, Catherine Deneux-Tharaux, Marie-Hélène Bouvier-Colle


3.3.1 Introduction

Maternal mortality is a rare event in France. It is treated comprehensively at the national level, but regional disparities are clear. Thus, the Ile-de-France (IdF) is notable for its mortality ratio, approximately 30% higher than the national mean (official ratio) [1]. It also appears that the situation in the Overseas districts (Départements d’outre-mer DOM), although not well known, is still more unfavorable [2].

Until now, there has been little effort to study these regional disparities, partly for methodological reasons (small number of deaths), even though such investigations might lead to the identification of subgroups at a higher risk of death or suggest potential dysfunctions in the organization of health care system. Moreover, such an approach would help to clarify the priorities for regional objectives and the definition of local management policies. The analysis of the geographic disparities of maternal mortality is particularly pertinent in the current context of the regionalization of the organization of health care in obstetrics.

Only since 2000 have the official maternal mortality statistics covered all of France. Until then, death certificates from the DOM covered only the events recorded there (and not those officially domiciled there) and thus could not be treated with those for metropolitan France.

In 1996, France implemented a reinforced system of maternal mortality surveillance. This monitoring is based on a dual system of data collection: information from the death certificate and that from a confidential enquiry conducted by the CNEMM. The new method of estimating maternal mortality, first applied to deaths in 2001 (see §3.1.1.3 p 6), allows a more reliable analysis of regional disparities and is also applicable to the DOM.

Our objectives in this study were to compare the frequency of maternal mortality, the profile of causes, the women’s characteristics, and the quality of care in 3 geographic areas — the DOM, IdF, and the rest of metropolitan France.

3.3.2 Methods

This descriptive study analyzes ENCMM data from 2001 through 2006. The enquiry identified maternal deaths as defined in ICD-10 [3]. CepiDc reports to ENCMM all deaths for which the certificate suggests concomitant pregnancy, childbirth, or puerperal status. After contact with the physician who signed the death certificate, a confidential enquiry was conducted by a team of assessors comprising an obstetrician and an anesthetist. Using a standardized detailed abstraction form, the assessors collected the relevant clinical information related to the woman and her death through interviews and a review of hospital records and autopsy reports. These deaths were then anonymized and reviewed by the CNEMM, which issued an opinion about the cause of death, its avoidability, and the quality of care. An assessment was made regarding 1) the underlying cause of death, 2) whether the death was a maternal death (according to the ICD definition), and 3) the quality of care provided in case of a maternal death. The detailed methodology of this enquiry was described in the article Épidémiologie des morts maternelles en France 2001-2006 [4].

The maternal deaths were studied according to the region where death occurred in three categories: DOM (Guadeloupe, Martinique, French Guiana and Réunion), IdF, and the other regions of metropolitan France grouped together (all of metropolitan France except the IdF). To calculate the maternal mortality ratios, the denominator was the number of live births in each of these areas, according to the information provided by INSEE [5], and based on birth certificates. The age-standardized ratios were calculated with "the other regions of metropolitan France" as the reference population for the distribution of births by maternal age group.

We compared the profile of maternal mortality in the three geographic areas: crude maternal mortality ratio; distribution according to age and age-standardized ratios; distribution according to mother’s nationality; distribution and ratios for specific causes of death.

Given the particular context of French Guiana [6], secondary analyses were conducted to examine possible differences between it and the three other overseas districts.

Moreover, for the deaths assessed by the CNEMM, avoidability (death avoidable/possibly avoidable/unavoidable) and the quality of obstetric care (optimal/not optimal) were analyzed and compared between the three areas. These two dimensions were not systematically associated. A
death can be judged avoidable for reasons not directly related to the content of the care provided (such as maternal compliance or problems associated with the general organization of care), and the care can even be judged optimal. Inversely, a woman may not have received optimal care, but her death may nonetheless be judged unavoidable, because some causes are judged lethal regardless of the management (massive AFE, for example).

The chi-2 test was used to test the different comparisons between the three regions.

### 3.3.3 Results

From 2001 to 2006, 463 maternal deaths were identified in France, 29% of them in IdF and 14% in the DOM. Table 13 describes the crude and standardized ratios for each area. The maternal mortality ratios were significantly higher in IdF (1.7 times higher) and in the DOM (4.3 times higher) than in the rest of France. Although the ratios in French Guyana were the highest in the DOM (Table 13), this difference relative to the other overseas districts was not statistically significant.

The age group with the lowest maternal mortality ratios in IdF, DOM and in the rest of metropolitan France, was that aged 20-24 years (6.6, 5.2, and 6.1/100 000 live births, respectively). In IdF, the ratio were higher for the women younger than 20 years (3.5 times higher ) and 25 to 39 years (from 1.5-2 times higher) than in the other regions (figure 6) but they were statistically significantly higher only for the age groups younger than 20 and from 25-34 years. In the DOM the ratio were higher (by a factor of 4-5) than in the other regions of metropolitan France from the age of 25 years ( figure 6), and these differences were statistically significant. The age-specific maternal mortality ratios for French Guyana did not differ statistically from those of the other three DOM.

The analysis of nationality-specific ratios showed that the risk of maternal mortality in women of French nationality was higher in IdF (1.4 times) and in the DOM (4 times) than in the other regions (Table 14). Women of foreign nationality accounted for 38% of the deaths in IdF, 22% in the DOM, and 9% in the other regions, (p<0.001). In IdF, maternal mortality ratios for women from sub-Saharan Africa — 28.9/100 000 live births — and from Asia and America — 23/100 000 — were higher than those for French women — 10.2/100 000. More than two thirds of the deaths of foreign women in the DOM occurred in French Guyana (9 deaths, all Latin American women). This district thus had a maternal mortality ratio for non-French women (all foreign nationalities combined) of 46.6/100 000. Nonetheless maternal mortality for the French women in French Guyana was also quite high (49.1/100 000), as it was in the other DOM (41.9 in Guadeloupe; 19.5 in Martinique, and 24.6 in Reunion). These ratios did not differ significantly.

<table>
<thead>
<tr>
<th>TABLE 13</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crude and age-standardized maternal mortality ratios in the Ile-de-France region, the overseas departments, and the rest of the regions of metropolitan France, 2001-2006</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Region</th>
<th>Live births</th>
<th>Deaths</th>
<th>Crude ratio [95% CI]</th>
<th>Standardized ratio [95% CI]a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ile-de-France</td>
<td>1059478</td>
<td>131</td>
<td>12.4 [10.314.7]</td>
<td>11.6 [9.6-13.6]</td>
</tr>
<tr>
<td>DOM</td>
<td>196760</td>
<td>63</td>
<td>32.0 [24.6-41.0]</td>
<td>30.8 [22.8-38.8]</td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>43815</td>
<td>17</td>
<td>38.8 [22.6-62.1]</td>
<td>34.9 [17.3-52.5]</td>
</tr>
<tr>
<td>Martinique</td>
<td>32499</td>
<td>7</td>
<td>21.5 [8.7-44.4]</td>
<td>15.5 [3.6-27.3]</td>
</tr>
<tr>
<td>French Guyana</td>
<td>33417</td>
<td>16</td>
<td>47.9 [27.4-77.8]</td>
<td>54.9 [25.9-84.0]</td>
</tr>
<tr>
<td>Other regions b</td>
<td>3573628</td>
<td>269</td>
<td>7.5 [6.7-8.5]</td>
<td>7.5 [6.7-8.5]</td>
</tr>
<tr>
<td><strong>Entire France</strong></td>
<td><strong>4829866</strong></td>
<td><strong>463</strong></td>
<td><strong>9.6 [8.7-10.5]</strong></td>
<td><strong>9.6 [8.7-10.5]</strong></td>
</tr>
</tbody>
</table>

Mortality ratio per 100 000 live births.

a Standardized rate were calculated with the standard structure, births by maternal age group in the regions of metropolitan France (excluding IDF).

b All regions of metropolitan France, excluding IDF.
FIGURE 6

Maternal mortality ratio per 100,000 live births by age in the three regions, 2001-2006

![Graph showing maternal mortality ratio per 100,000 live births by age in the three regions, 2001-2006.](image)

TABLE 14

Maternal deaths by mother’s nationality in the three regions, 2001-2006

<table>
<thead>
<tr>
<th>Nationality</th>
<th>IdF</th>
<th>DOM</th>
<th>Other regions a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths</td>
<td>%</td>
<td>Ratio [95% CI]</td>
</tr>
<tr>
<td>French</td>
<td>81</td>
<td>61.8</td>
<td>10.2 [8.1-12.7]</td>
</tr>
<tr>
<td>European</td>
<td>2</td>
<td>1.5</td>
<td>5.0 [0.6-21.8]</td>
</tr>
<tr>
<td>North African Sub-Saharan Africa</td>
<td>9</td>
<td>6.9</td>
<td>11.5 [5.3-21.8]</td>
</tr>
<tr>
<td>Other b</td>
<td>24</td>
<td>18.3</td>
<td>28.9 [18.5-43.1]</td>
</tr>
<tr>
<td>All</td>
<td>131</td>
<td>100.0</td>
<td>12.4 [10.3-14.7]</td>
</tr>
</tbody>
</table>

Chi2 Test comparison of proportions of deaths by nationality p<0.001.

a All regions of metropolitan France, excluding IdF.

b “Other nationality” includes countries in Asia, North and South America, and Oceania.

Although most deaths — nearly 80% — took place in public hospitals, deaths still occurred at home. The ratio of these home deaths was lower in IdF (3.8%) than in the other regions (12.6%) or in the DOM (14.3%) (p<0.001).

Table 15 shows the detailed causes of maternal mortality in the three areas. The distribution of maternal deaths by cause differs significantly between IdF and the rest of metropolitan France (p<0.01). First, the proportion of unspecified obstetric causes is clearly higher in the DOM (12.7% of maternal deaths) than in IdF or in the other regions (3 to 4%) (p<0.01). This may result in an underestimation of accurately identified causes in the DOM.

In IdF, AFEs were as frequent as PPHs (16.8%); they were followed by complications of hypertension (11.5%) and thromboembolism (6.1%), and then by cardiac diseases and strokes, in the same proportion (4.6%).
### Distribution of maternal deaths according to detailed obstetric causes in the three areas, 2001-2006

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>IDF</th>
<th>%</th>
<th>DOM</th>
<th>%</th>
<th>Other regions *</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Direct obstetric causes</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhages</td>
<td>104</td>
<td>79.4</td>
<td>54</td>
<td>85.7</td>
<td>176</td>
<td>65.4</td>
</tr>
<tr>
<td>From ectopic pregnancy</td>
<td>40</td>
<td>30.5</td>
<td>22</td>
<td>34.9</td>
<td>54</td>
<td>20.1</td>
</tr>
<tr>
<td>From abortion</td>
<td>5</td>
<td>3.8</td>
<td>3</td>
<td>4.8</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Placenta prævia, placenta accreta</td>
<td>3</td>
<td>2.3</td>
<td>0</td>
<td>0.0</td>
<td>5</td>
<td>1.9</td>
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<tr>
<td>Hemorrhage preceding delivery</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>1.6</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Hemorrhage during delivery</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>1.6</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Abruptio placenta</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>1.6</td>
<td>3</td>
<td>1.1</td>
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<tr>
<td>Postpartum hemorrhage</td>
<td>22</td>
<td>16.8</td>
<td>13</td>
<td>20.6</td>
<td>27</td>
<td>10.0</td>
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<tr>
<td>Uterine rupture</td>
<td>5</td>
<td>3.8</td>
<td>2</td>
<td>3.2</td>
<td>7</td>
<td>2.6</td>
</tr>
<tr>
<td>Surgical wounds and injuries</td>
<td>1</td>
<td>0.8</td>
<td>0</td>
<td>0.0</td>
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<td>1.6</td>
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<tr>
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<td>3.7</td>
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<tr>
<td><strong>Indirect obstetric causes</strong></td>
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<td>3.2</td>
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<td>1.6</td>
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<td>1.5</td>
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<td>3.4</td>
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<td>63</td>
<td>100.0</td>
<td>269</td>
<td>100.0</td>
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</table>
In the DOM, PPHs constituted by far the leading cause (20.6%), followed by the unspecified obstetric causes mentioned above, complications of hypertension (11.1%), thromboembolisms (9.5%), and finally septicemia (4.8%).

The profile differed in the other regions: the most frequent cause was strokes (13.4%), an indirect obstetric cause, followed by thromboembolisms (11.9%), AFEs (11.2%), PPHs (10.0%), and finally complications of hypertension (8.9%).

The differences between the three areas for cause-specific ratios are striking. Accordingly, mortality by obstetric hemorrhage was 7 times higher in the DOM (11.2/100 000) and twice as high in IdF (3.8/100 000) as in the rest of metropolitan France (1.5/100 000) (figure 7). AFEs were more than twice as frequent in IdF (2.1/100 000) and in the DOM (2.5/100 000) as in the other regions (0.8/100 000). Complications of hypertension showed fewer disparities; the ratio of indirect obstetric causes in IdF was identical to that in the rest of metropolitan France, but twice as frequent in the DOM.

**Figure 7**

Maternal mortality ratio by specific cause in the three areas, 2001-2006

Of the 463 maternal deaths identified in 2001-2006 for France as a whole, the Committee was able to assess 313 (67.6%). The proportion of cases assessed was lower for the DOM (46% compared with 70% in IdF and 71% in the other regions, p<0.01), where the proportion of non-response from the physicians who signed the death certificate remains considerable despite a recent improvement in participation.

Among the cases assessed and for which management could be evaluated, the proportion of cases considered avoidable was 54.3% (38/70) in IdF, 50.0% (10/20) in the DOM, and 41.8% (64/153) in the other regions. Nonetheless these differences were not statistically significant. Deaths from hemorrhages were those most often judged avoidable in all three areas (86 to 95% of cases).

Moreover, of the files that could be analyzed, the proportion of deaths for which care was judged not optimal by the experts was 75% (54/72) in IdF, 53% (9/17) in the DOM, and 60% (80/133) in the rest of metropolitan France. Globally, these differences were not statistically significant, although the proportion of non-optimal care was significantly higher in IdF than in the rest of metropolitan France (p=0.03). For the DOM, care was judged non-optimal in 53% (9/17) of deaths (a proportion not statistically different from the other regions). Nonetheless, because of the small number of cases considered in this analysis, the result must be interpreted prudently.
3.3.4 Discussion

Clearly, there are large disparities in maternal mortality across France, both in terms of maternal mortality ratios and in the profile of obstetric causes of death. The variations in ratios, higher in IdF and in all the DOM than in the other regions, are not explained by maternal age structure, since the crude and standardized ratios are very similar. The direct obstetric causes, especially hemorrhages (all types combined), are the leading cause of death in IdF and the DOM, unlike the other regions of metropolitan France, where indirect causes are the leading cause. According to the expert analysis by the CNEMM, the proportion of avoidability is invariably around 50% in all three areas; nonetheless, the quality of care was assessed as non-optimal more often in IdF as in the other regions of metropolitan France.

Nonetheless, the scope of this study is limited by some of its limitations, in particular, the high ratio of non-response from the physicians signing death certificates, especially in the DOM. Moreover, the data available for the three populations studied do not allow us to study the risk factors for maternal mortality at an individual level. Finally, it may appear arbitrary to combine the four DOM into one group. Although the social and demographic context of French Guyana is different from that of the French districts in America [6], the principal results for maternal mortality in French Guyana did not differ significantly from those of the other overseas districts, perhaps because of the small number of deaths analyzed.

It is nonetheless true that some notable differences were observed. Although they must be confirmed, they are already guiding research aimed at understanding the reasons.

The maternal mortality profile (ratio and obstetric causes) of the other regions of metropolitan France is very similar to that of the Netherlands or Finland, while that for the DOM is closer to that of the countries of eastern Europe [7]. The populations of IdF and the DOM differ from the other regions of metropolitan France for other characteristics as well. IdF is home to a high percentage of women from sub-Saharan Africa who are, as we know, exposed to an excess risk of maternal mortality [8]. These nationalities are part of the most recent waves of immigration into metropolitan France, especially IdF, and may represent the populations at highest risk for difficulties in access to health care. This obstacle to access to care may also be involved, although in a different context, in French Guyana for the immigrants from Latin America. Nonetheless, our results showed that nationality does not explain the excess risk of maternal mortality in IdF and the DOM. Certainly, maternal mortality is higher in women from sub-Saharan Africa in IdF, and in women of other nationalities in the DOM, but the regional disparities reported persist for women of French nationality.

Although national standards exist for the organization of care, it is possible that their application differs according to region. IdF is characterized by a concentration of specialized centers; it is probable that many pregnancies at high risk or with severe postpartum complications in other regions are referred to or attracted by these centers. Similarly, we must bear in mind the particular situation, especially in French Guyana, where women from elsewhere cross the border to give birth in better health conditions.

Nonetheless, neither the difficulty of access to the health-care system, for populations distant from hospital centers, nor the geographic context explains everything. We must consider the question of the efficacy of these services, for there appears to be more non-optimal care in IdF.

Studies targeted more specifically at populations at risk of severe maternal complications are necessary to determine in greater detail the factors involved not only at a geographic but also an individual level. This should make it possible to develop public health policies better adapted to the needs of the populations in each region.

3.3.5 References

4. Clinical analysis

4.1 HEMORRHAGES

S. Favrin, G. Levy and MH Bouvier-Colle

4.1.1 Epidemiology

Hemorrhages remain the leading cause of maternal mortality in France. Between 2001 and 2006, 116 maternal deaths related to a hemorrhage were recorded, including those during the first trimester of pregnancy; this represents a mortality ratio of 2.4/100 000 live births.

The CNEMM analyzed 68 of these cases (Table 16).

<table>
<thead>
<tr>
<th>Causes</th>
<th>Total number</th>
<th>Mode of delivery</th>
<th>Vaginal delivery</th>
<th>Vaginal delivery, Instrumental</th>
<th>Cesarean</th>
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<td>From ectopic pregnancy</td>
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<td>Placenta praevia, and p.accreta</td>
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<td>Hemorrhage during delivery&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Abruptio placentae</td>
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<td>Postpartum hemorrhage</td>
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<td></td>
</tr>
<tr>
<td>Uterine rupture&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical wounds and injuries&lt;sup&gt;c&lt;/sup&gt;</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All hemorrhages</td>
<td>68</td>
<td></td>
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</tbody>
</table>

<sup>a</sup> Both cases involve hemorrhages during cesarean delivery.
<sup>b</sup> Including 2 deaths during pregnancy; 1 in utero death without delivery and one uterine rupture at 14 weeks gestational age (weeks) in malformed uterus.
<sup>c</sup> Including 2 cervical lacerations, 1 cervicovaginal laceration, 1 vaginal laceration and 1 lesion of the collateral artery of the internal iliac

The women’s ages ranged from 17 to 49 years (mean age: 34.1 (SD±6.1) years).

Of the 60 women who died from a hemorrhage and who gave birth, 37 died during the immediate postpartum (<24 h), 19 between the first and seventh day (D1-D7) postpartum, and 4 after the first week. In 44 cases, the women gave birth at term (between 38 and 41 weeks), while 9 women gave birth between 32 and 37 weeks and 4 between 28 and 32 weeks. Finally, 2 women gave birth between 19 and 22 weeks, and the last at 19 weeks (a medically-induced termination of pregnancy after an in utero fetal death).

Twelve women were nulliparas, and it was the first pregnancy for nine. Twenty-eight women had given birth once or twice before, 19 women, 3 to 5 times, and 2 women more than 6 times. Seven records contained no information about obstetric history.

In a majority of cases, the pregnancy could have been classified in advance as at risk of hemorrhage, for example: 6 women had uterine scars, 2 twin pregnancies, and 2 women were older than 40 years and had received oocyte donations abroad. Both of the latter had preterm cesareans (at 34 and 31 weeks, for chorioamnionitis and hepatic cytolysis, respectively).

In principle, the other women were at low risk of complications, but 2 had no prenatal care and gave birth at home, 9 had labor induced by prostaglandins or oxytocin despite the lack of specific indications, and the Bishop score was not always mentioned. In 11 other cases, labor began spontaneously, with subsequent dynamic dystocia in 3.

Avoidability could be assessed only for the 53 files with sufficient information. In all, 48 deaths were considered certainly or perhaps avoidable (90.6%). The quality of care could be analyzed in 52 deaths.
and was determined to be non-optimal in 49 (94%). We present 5 illustrative cases below.

4.1.2 Illustrative Cases

4.1.2.1 Case 1: hemorrhage due to atony complicating a vaginal delivery

A 36-year-old woman, gravida 4, para 3, with heterozygous sickle-cell anemia, no other known medical or surgical history, and no known complications at previous deliveries, was managed correctly throughout her uneventful pregnancy. At 40 weeks of gestational age, labor was induced by oxytocin perfusion after the observation of stained amniotic fluid on amnioscopy. The cervix was 2-cm long, resistant, 2-fingers dilated, with an “applied” cephalic presentation; at 3 cm, an epidural was placed. Dilatation was completed at 4 h and 10 min. Delivery was spontaneous: a healthy girl weighing more than 3 kg. The afterbirth was natural and complete. Nonetheless, because of a “beginning hemorrhage, with debris and clots” after the third stage, a manual uterine examination was quickly performed.

- In the 30 minutes after the examination, because the bleeding was assessed as substantial, Syntocinon® (10 IU) was injected by IVP (intravenous push), 20 supplementary IU were administered by perfusion, and a uterine massage was performed.
- With bleeding still considered abnormal 65 min after the hemorrhage diagnosis, the physician was called. Fifteen IU of Syntocinon® (oxytocin) was administered into the uterine wall.
- Ninety minutes after diagnosis, the patient was receiving oxygen; a second manual examination and a speculum examination had been performed, without result, and fluid resuscitation with Voluven began.
- Ten minutes later, Nalador® (sulprostone) administration began by electric syringe (1 ampoule in 1 hour); blood pressure was 90/70, and hemoglobin was at 6.6 g/100 mL.
- Nearly 2 hours after diagnosis, radiologists were contacted for an embolization, but were unavailable. Based on her unstable blood pressure and thready pulse, she was transferred to the OR for laparotomy. Four units of packed red blood cells and 4 of fresh frozen plasma were ordered.
- During the laparotomy, the following procedures were performed successively: ligation of the hypogastric arteries, B-Lynch sutures, and then a subtotal emergency hysterectomy. Unrecoverable cardiac arrest occurred at the end of the procedure.

Comments

Care was assessed as non-optimal, and the death as avoidable. Contrary to guidelines, the third stage of labor was not actively managed; the intrauterine injection of Syntocinon® was futile, and most especially, more than 90 minutes elapsed between the diagnosis that led to a rapid manual examination and the appropriate management of persistent bleeding — Nalador®, blood tests, fluid resuscitation, and ordering the appropriate blood products.

This case is a perfect example of “too little too late”.

The management for these situations complicating vaginal delivery was clearly set forth in the guidelines published in 2004 by the HAS (French Authority for Health, Haute autorité de santé) and the CNGOF:

- from the obstetric perspective, three successive stages occur at intervals of 20-30-minutes, marked by: manual vaginal examination or manual removal of the placenta, where appropriate, speculum examination, and the administration of Syntocinon®, administration of Nalador®, invasive procedures appropriate to the patient and the severity of the situation.
- and at the same time: timed monitoring of the patient and relevant indicators, as shown below on a monitoring sheet for PPH, rapid blood tests for hemoglobin and for a fuller hemostasis work-up, appropriate management for fluid resuscitation, blood transfusions, and major resuscitation (central venous access if necessary, invasive monitoring of blood pressure, and a transfusion accelerator and blood warming device).

4.1.2.2 Case 2: hemorrhage after emergency cesarean

A 36-year-old woman, gravida 7 para 5, had no history of complications, adequate prenatal monitoring, and no particular known problems. At a gestational age of 40 weeks, she was admitted for uterine contractions.

- Two hours after admission, uterine hypertonia was observed, but cardiotocography showed no disturbing findings. The presentation was cephalic and mobile, the cervix posterior, long, and dilated 2 cm; and the glove finger tinged with blood.
- Four hours after admission, an oxytocin perfusion was set up, 7 hours after admission,
the cervix was thick and dilated to 4 cm, and 10 hours later, the cervix was dilated to 5 cm, still very posterior. Almost 11 hours after admission, major uterine hypertonia appeared, with fetal bradycardia lasting 5 minutes. The oxytocin perfusion was stopped, replaced by a prescription for 5 ampoules of Spasfon® by direct intravenous administration, with a half an ampoule of Prépar® (ritodrine). Over the next 10 minutes, uterine hypercontractility developed, with a very steady fetal heart rhythm: another half-ampoule of Prépar® was administered.

- Eleven and a half hours after admission and 45 minutes after the modification of fetal heart rhythm, an obvious consequence of uterine hypertonia and hypercontractility, a cesarean was performed. A 3.9-kg boy was born, and recovered quickly. Manual removal of the placenta proved difficult, because of the absence of a plane of cleavage; however, histological examination did not confirm the suspicion of placenta accreta. Vaginal bleeding continued; with hemoglobin at 7 g/L 30 min after the cesarean, the hypogastric arteries were ligated. The hemorrhage continued; the round and the utero-ovarian ligaments were ligated and the lower segment plicated, but the woman remained hemodynamically unstable. Concentrated red cells and fresh frozen plasma were transfused, but the patient nonetheless developed disseminated intravascular coagulation (DIC); an AFE was suggested. It was nonetheless decided to close the incision and transfer her to the intensive care unit (ICU).

- Due to aggravation of hemodynamic instability (hypotension and falling hemoglobin), an emergency hysterectomy was performed 6 hours after the cesarean. A large effusion of non-clotting intraperitoneal blood was observed; the transfusion continued. Two hours and 20 minutes later, she was again transferred to the ICU, where transfusion continued, together with the administration of antifibrinolitics.

She returned to surgery for a hemoperitoneum (18 hours after the cesarean and 10 hours after the hysterectomy); 4 liters of blood were removed by peritoneal washing; diffuse bleeding of coagulated blood was observed. Four Tetra sterile drapes were placed for compression, and the incision was closed. She returned to the ICU, where hepatocellular and kidney failure occurred. Resuscitation was possible after the first cardiovascular arrest, but she died from the second, 72 hours after admission. In all, 10 units of concentrated red cells, 6 of fresh frozen plasma, a package of serum albumin and several (quantity unspecified) packages of lactated Ringer’s solution were transfused. The precise chronology of the resuscitation measures is unknown.

Comments

This death was judged avoidable and the quality of care non-optimal because the cesarean was not performed rapidly after the first signs of acute fetal distress. The Committee also considered that for a 36-year-old woman with 6 children it was unreasonable to ligate the hypogastric arteries and then the round ligaments and then the utero-ovarian pedicles, and then plicate the lower segment, rather than simply starting with an immediate emergency hysterectomy.

Moreover, this was not the only case where the desire to treat grand multiparas conservatively led to their deaths. The Committee also points out that any substantial and prolonged hemorrhage leads to DIC.

4.1.2.3 Case 3: hemorrhage after emergency cesarean and obesity

This 36-year-old woman, gravida 2, para 1, had previously had a normal vaginal delivery. Irregular ovulation, however, was associated with fertility problems. Her medical and surgical history included chemonucleolysis, tonsillectomy, and obesity, with a body mass index (BMI) of 31. The pregnancy resulted from ovarian stimulation and was monitored regularly, with no abnormal events noted.

- At 39 weeks, labor was induced by oxytocin and artificial rupture of the membranes, despite the lack of any indication for this procedure. Then, lack of progress in dilatation and abnormalities in the fetal heart rate led to an emergency cesarean, performed with an epidural, which delivered a 3-kg girl. During the procedure, uterine inertia and moderate bleeding were treated by manual uterine examination and oxytocin. Monitoring in the recovery room observed no abnormalities. Subsequent monitoring in the hospital was performed by a registered nurse; the standard indicators were recorded as normal.

- Seven and a half hours after the birth, the patient complained of pain; she was agitated and was treated with Perfalgan® (paracetamol) and Profenid® (ketoprofen). Fifteen minutes later, she was found dead in her bed; 600 c of blood was found in the Redon drains, the sanitary napkins with soaked with blood, and the uterus very large. An autopsy was performed, but its results were unavailable.

The death was due to PPH. It was thus a direct obstetric cause. The death was judged avoidable and the care non-optimal care in view of the delayed diagnosis. A doctor should have been called in view of the pain and state of agitation.

Comments

The study period covered both the development of clinical practice guidelines for PPH by CNGOF and
HAS and their publication in 2004. Once again, what must be stressed for cesareans is the need for diagnosis and intraoperative solutions to hemorrhage and the absolute need for flawless monitoring in the recovery room, as well as during postpartum care after this procedure that has become so banal. Doctors and midwives must be especially wary of induced labor and dystocia in pregnancies that are either abnormal or involve a risk factor. Instrumental interventions and emergency cesareans are incontestably risk factors. Instrumental interventions and emergency cesareans are incontestably circumstances that involve a risk of hemorrhage and require specific and systematic vigilance.

4.1.2.4 Case 4: hemorrhage during a planned cesarean and complicated by placenta accreta

A 32-year-old woman, gravida 3, para 2 (both children delivered by cesarean), had no significant medical history and was requesting tubal ligation. The pregnancy was followed by a general practitioner, who had diagnosed gestational diabetes and treated it by diet. During the 9th month, the woman consulted at the maternity ward where delivery was planned, and a third cesarean was scheduled. It was performed at 39 weeks of gestation and a healthy girl, weighing 3.4 kg, was born. The placenta proved to be encrusted in the right horn, making manual removal difficult, although eventually successful. The tubal ligation took place, and the incision was closed.

- An hour after the cesarean, uterine atony was diagnosed and moderate bleeding observed; Nalador® was administered and the uterus massaged.
- At 1 hour and 40 minutes after the cesarean, reoperation under general anesthesia took place, because the bleeding had not stopped. The hypogastric arteries were ligated, and B-Lynch sutures placed;
- 2 hours and 40 minutes after the cesarean, an emergency hysterectomy was performed, followed immediately by a state of shock. After 25 minutes of resuscitation maneuvers, including electric shock, adrenaline, and external cardiac massage (ECM), the sinus rhythm resumed;
- 5 hours post-cesarean, the hemorrhage recurred; further surgery was decided upon; hemoglobin was 5.6 g. She was transferred to the ICU, but her clinical state deteriorated and she died in the hours that followed.

An autopsy was performed; it did not show an AFE. The pathology examination of the hysterectomy tissue indicated placenta accreta. The death was due to PPH complicating placenta accreta. It was thus a direct obstetric cause, judged avoidable. Care was not optimal: no risk was detected before delivery, although the patient had already had two cesareans, and the emergency hysterectomy should have been performed much early as the woman had requested sterilization.

Comments

Severe hemorrhages following cesareans account for slightly more than half of all complications of delivery.

This case is a good illustration of the risk of an abnormal placental insertion in the scarred uterus, and the number of cesareans increases this risk. The site of placental insertion must be assessed by targeted and reliable ultrasound at the end of pregnancy.

It also illustrates the absolute necessity in such cases:

- of monitoring these patients systematically and effectively, in verifying especially uterine retraction and hemodynamic signs (according to a written and timed protocol) in the immediate postoperative period but also during the postpartum period;
- of resolving the problem rapidly by an appropriate surgical solution and assessing its effectiveness before closing, because revision surgery is always correlated with a worse prognosis.

4.1.2.5 Case 5: uterine rupture

The woman in this case was 34-year-old, gravida 5, para 2, with no known problem at the previous deliveries. Prenatal care for this pregnancy was provided by a general practitioner, and there were apparently no complications. At term + 5 days, she was admitted to the hospital for induction of labor with intravaginal Prostine® gel (2 mg). Dilatation was rapid and expansive efforts began an hour after the induction, but Tamier forceps were used because these efforts were ineffective; the fetal head was in midcanal in left occipito-posterior position, and was delivered in occipito-posterior. Shoulder dystocia occurred; after the failure of Mc Roberts position, Jacquemier's maneuver was performed.

- One hour and 20 minutes after induction began, a 3.9-kg girl was born and transferred to the ICU. The third stage was natural and complete within 30 minutes. There does not appear to have been any manual examination of the uterine cavity.
- Fifteen minutes later, the mother complained of malaise, and her blood pressure was low. The anesthesiologist began immediate procedures (Elohes 500 mL, placement in the Trendelenburg position, oxygen mask, ephedrine 18 mg, and Hemocue at 10), but her hemodynamic state nonetheless worsened (hypotension, pallor, agitation, dyspnea, and hemoglobin 5.1).
One hour and 25 minutes after delivery, 3 units of concentrated red cells were ordered. The abdomen was distended, and ultrasound showed a voluminous intraperitoneal effusion.

More than 2 hours after delivery and more than 90 min after the first medical event, the decision was made to return to surgery, and anesthesia was induced. The laparotomy removed a hemoperitoneum of 1.5 L and showed a 10-cm uterine rupture, on the left edge of the lower segment and extending to its posterior side. A series of cardiac arrests occurred during this surgery, and she died approximately 4 hours after delivery.

Comments
This death was determined to be avoidable and the care non-optimal, because the staff, misled by the absence of exterior bleeding and the HemoCue of 10, did not correctly assess the gravity of her condition — malaise with agitation and hypotension — 15 minutes after delivery. Although her hemodynamic state continued to deteriorate, more than 90 minutes passed between the first malaise and surgery.

When the parturient has no external bleeding through the vagina and her hemodynamic status is deteriorating, it is essential to consider a hemoperitoneum and to intervene rapidly.

4.1.3 Recommendations
As a general matter, the Committee recommends:

- the rapid performance of the invasive measures described in the French clinical practice guidelines when Nalador® fails;
- using a monitoring sheet for PPH, following the model below;
- that the organization of all maternity units provide for calling a surgeon (obstetrician-gynecologist or not) able to perform the relevant emergency surgery for hemostasis, that is, vascular ligation, uterine suturing (B-Lynch), or hysterectomy, when the doctor on duty lacks those skills;
- embolization, rather than a surgical procedure, must be envisioned for hemodynamically stable patients if it is accessible and able to be implemented rapidly;
- the organization of care at all facilities offering obstetric services such that the initial surgical hemostasis procedures can be performed onsite when the severity of the hemorrhage so requires.

Finally, the application of these guidelines within each department requires the drafting of a written protocol that is validated and easily accessible in each maternity ward. The teams must also practice its implementation regularly and systematically review all cases of PPHs for in-house verification that the protocol was performed correctly.

4.1.4 References


### Monitoring form for post-partum hemorrhage

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4.2 PREGNANCY-RELATED HYPERTENSION

Henri Cohen

The ENCMM recorded 46 maternal deaths associated with complications of hypertension, for an overall ratio of 0.93/100 000 live births for the 2001-2006 period, but with a significant reduction between 2001-2003 (1.2/100 000) and 2004-2006 (0.6/100 000). The Committee analyzed 26 of these cases.

4.2.1 Analysis

Of the 26 deaths assessed by the experts, 4 took place at home, 2 in the maternity ward and 18 in the ICU. The median age was 33 years (range: 15-45 years), and the distribution of deaths was uniform for each 10-year age group (10 deaths among women aged 20-29 years, 10 among 30-39 year-olds, and 5 among 40-45 year-olds). For one third of these women, it was the first pregnancy to reach a gestational age of 22 weeks; 11 women were multiparas (from 1 to 3 previous deliveries), and one 45-year-old woman had eight previous children. There were no multiple pregnancies. The mean term at death was 34 weeks and the range 29 to 41 weeks, with a slight excess of deaths in the period of 30-34 weeks. Inadequate prenatal care was noted in 2 cases, hypertension in 4, and obesity in 4. No history was found in 10 cases. Seven women died before delivery and 19 after; 3 had vaginal deliveries and 16 cesareans. In 9 cases, death occurred within 24 hours after birth, while in the others (10), it took place from D1 to D10 postpartum.

4.2.1.1 Causes

All these deaths were considered to be due to a direct obstetric cause; there were 6 complications of severe preeclampsia, including one stroke and one liver hematoma. Seven cases of HELLP syndrome included 3 with a stroke, and 12 complications of eclampsia included 5 strokes. Finally, one woman died of complications of chronic hypertension. The specific analysis of the deaths was made more difficult by the very low number of autopsies: 2 of 26 is very insufficient. Nonetheless, computed tomography (CT) or MRI allowed a satisfactory analysis in 13 cases, and the laboratory results confirmed the initial cause of death in another.

Care was assessed as non-optimal in 11 of 26 cases. Ten deaths were considered avoidable or probably avoidable, and 6 were inevitable. Avoidability could not be determined in 10 cases because the Committee lacked sufficient data. Overall, 20% of these deaths were considered unavoidable. In the other cases (80%), the deaths were certainly or probably avoidable, especially if we consider the lack of data to be an indicator of poor management.

4.2.1.2 Illustrative Cases

A 45-year-old woman had had a normal vaginal delivery, 7 years earlier. This pregnancy followed in vitro fertilization in Canada. Very little information was available about her prenatal care, in a private facility far from her home; a cesarean was planned. Two days before the scheduled date, she called emergency medical services to her home because of chest and abdominal pain and vomiting. Her blood pressure was 160/110, with albuminuria at 3+. She was transferred to the closest public hospital with a maternity ward. On arrival, the rapid onset of impaired consciousness was noted, with hypertension reaching 200/210, convulsions, and cardiac arrest, successfully treated this time with ECM.

An immediate cesarean under general anesthesia delivered a liveborn 2700-g girl. Hemostasis during suturing was difficult, but was considered satisfactory at the end of the procedure. An hour after her transfer to the ICU, hemorrhaging began, both vaginal and parietal. Embolization of the hypogastric arteries and the transfusion of 9 units of packed red blood cells and 7 of fresh frozen plasma successfully treated the hemorrhage, but she did not emerge from her coma. Organ donation took place.

The death was associated with HELLP syndrome. It was thus a direct obstetric cause, and perhaps unavoidable. Care was not optimal. Although little is known about her prenatal care, it was located too far from her home, especially given that age is a certain risk factor. Moreover, the emergency medical team did not provide antihypertensive treatment.

The next case involved a 32-year-old woman, gravida 3, para 0, with an unremarkable history. She was followed regularly in a private clinic (10 visits in all). During the second and early third trimester, she was treated for a slightly shortened cervix with Loxen® and Salbumol®. Her blood pressure readings during prenatal care visits were normal: 120/80, 110/65, and 110/70 mm Hg.

At 33 weeks, an epigastric cramp radiating to the back, accompanied by vomiting, was diagnosed as gastroesophageal reflux (BP: 105/60). At 34 weeks and 2 days, at a consultation for suspected intrauterine growth restriction noted on ultrasonography two weeks earlier, her blood pressure was 180/84 and, after lying down for 10 minutes, 204/125. She refused immediate hospitalization that day for personal reasons. She was not admitted until the next afternoon, when she had a headache and a blood pressure of 170/100. A perfusion of Loxen® 4 mg/h was begun.

Two days later, as her clinical signs (abdominal pain, headaches, oliguria) worsened, it was decided to transfer her to a level 3 unit; three hospitals were contacted but had no space; the fourth responded positively to the request, but then had to delay the
admission for lack of a bed. On arrival, she had severe epigastric pain (Chaussier sign), a headache, and facial edema. With the Loxen® perfusion, her blood pressure was 160/110. An immediate cesarean under spinal anesthesia delivered a liveborn 1700-g girl. The patient was returned to her room. She complained of severe should pain; an hour later, she received Profenid®, a half hour later, dyspnea developed, combined with chest tightness; 2 hours later oxygen treatment was ordered. Two and a half hours later, the patient rang to complain of dyspnea and shoulder pain, but no treatment followed. Four hours after the first complaint, she was found in cardiopulmonary arrest.

The autopsy concluded that she had preeclampsia with a subcapsular hematoma of the liver. The death was therefore from a direct obstetric cause and avoidable. The severity of the situation was not assessed correctly. The patient’s refusal of immediate hospitalization when her blood pressure was already very high could have led rapidly to a dramatic situation. The transfer decision could have been made earlier, before her clinical condition worsened. Postoperative monitoring should have taken place in the ICU.

The third example is the case of a 15-year-old girl, from the West Indies, who had regular prenatal care (15 visits), with no abnormalities noted. Vaginal delivery of a 3500-g girl took place at 37 weeks, with epidural anesthesia. The immediate postpartum period was without incident. On D10, the family brought her to the emergency room at the end of the day for tetany symptoms that had developed after lunch. Her blood pressure was then 193/116 and she responded only to physical stimulation. Eclampsia was suspected, and she was treated with magnesium sulfate. Her condition worsened. In view of the respiratory disorders and vomiting, she was intubated, ventilated, and then transferred to another hospital. At her arrival at its ICU, brain death was observed. No autopsy was performed. The committee considered that the death was associated with a postpartum eclamptic seizure, a direct obstetric cause, and unavoidable. Nonetheless, we must note that the family became alarmed only several hours after the initial event, probably because they were unaware of the risks involved.

4.2.2 Discussion

The quality of care and the avoidability of these cases could not be studied in 14 of these 26 deaths, because of the lack of data and especially of autopsies. This phenomenon has been mentioned in previous reports and has not been corrected.

The causes of deaths may nonetheless be quite specific: pure eclampsia in 11 cases, eclampsia associated with another disease (ruptured aneurysm, intracerebral bleeding, multiple organ failure, acute pregnancy-related steatosis) in 6, HELLP, either isolated or associated with another disease (renal or cerebral) in 6, subcapsular hematoma of the liver with preeclampsia in 1, and hypertension with cerebrovascular disease in another.

There is also an association between hypertension and the stroke deaths discussed in another section, since some of the indirectly caused deaths were associated with a cerebral disease (8).

The overall quality of management was very inadequate, with only four files considered to report optimal care. The other 22 files either reported less than optimal care or could not be analyzed for this criterion, which in any case demonstrates mediocre data collection.

We note that the clinical history of these cases are not remarkable in any way. The literature shows that the risk of recurrence after a hypertensive incident during a first pregnancy is around 10%. The early onset of the first accident, before 28 weeks, can increase this risk to more than 50%. Preexisting hypertension, before pregnancy, is associated with a 15% risk of preeclampsia recurrence for moderate hypertension and 50%, for severe hypertension [Barton, Sibai, 2008].

Age was not a particular risk factor for death in these cases.

The principal period for these incidents was the third trimester, but 2 cases of eclampsia occurred postpartum, with no preliminary clinical signs.

4.2.3 Conclusion and recommendations

The preceding report concluded that pregnancy-related hypertension and its complications are a major cause of maternal deaths and are avoidable in nearly two-thirds of cases. It also stressed the consideration of these risks during pregnancy and the delays in appropriate management. Autopsies were performed very rarely, contrary to good practice guidelines. For the most part, these observations remain true.

It is evident that a precise collection of information about events in previous pregnancies is essential for assessing the risks during a current pregnancy and for planning appropriate management. The rapid management of patients with hypertension must include closer monitoring, together with specific information to the patient about the clinical signs of severity.

Management of the serious forms of preeclampsia is multidisciplinary; it must follow the guidelines common to the following 4 learned societies: the French society of Anesthesiology and Resuscitation (SFAR), the National French college of gynecologists and obstetricians (CNGOF), the French Neonatology Society (SFNN), and the French Society of Perinatal Medicine (SFMP). These guidelines were published on January 27, 2009.

These guidelines, after presenting the definitions, considered all aspects of medical management:
- organization in networks;
• pre- and inter-hospital management (figure 8);
• hospital management (figure 8);
• criteria for termination of pregnancy;
• the management of complications of preeclampsia;
• anesthesia in women with preeclampsia;
• after preeclampsia.

Practitioners must know the specific procedures to be followed and must adopt them as references.

**Algorithm for the prescription of antihypertensive treatment (MBP: Mean blood pressure = \frac{[systolic BP+ 2 \times diastolic BP]}{3})**

- **SBP>180 mm Hg or MBP>140 mm Hg**
  - Treatment:
    - nicardipine IV: Bolus of 0.5-1 mg then: 4-7 mg in 30 min

- **SBP<180 mm Hg or MBP<140 mm Hg**
  - Maintenance treatment
    - Nicardipine: 1-6 mg/h or labetalol IV: 5-20 mg/h

**Assessment of efficacy and tolerance of treatment after 30 min**

- **140<SBP<160 mm Hg, 100<MBP<120 mm Hg**
  - continue the nicardipine maintenance treatment 1-6 mg/h or

- **SBP 160>mm Hg or MBP>120 mm Hg:**
  - combine nicardipine: 6 mg/h with either labetalol 5-20 mg/h or clonidine 15-40 µg/h (if contraindication to β blockers).

**Secondary effects (headaches, palpitations, etc...)**

1. Reduce the nicardipine dose &
2. add either labetalol 5-20 mg/h or clonidine 15-40 µg/h (if contraindication to β blockers)

- **SBP<140 mm Hg and MBP<100 mm Hg**
  - reduce or even stop the treatment

**4.2.4 References**


4.3 AMNIOTIC FLUID EMBOLISMS

André Benbassa, Dominique Chassard

AFEs were described for the first time in 1926 by Meyer, but it was Steiner and Lushbaugh [1] who provided the first clinical description in 1941, based on 9 maternal deaths. Autopsies objectively demonstrated squamous cells and mucus, probably of fetal origin, in the pulmonary circulation. These histologic observations after death during labor with cardiovascular shock and pulmonary edema are the basis of the concept of AFE. This rare disease remains an enigma and an obstetric catastrophe.

It is an enigma because the specific pathophysiology is not always shown, the diagnostic criteria are not specific, and the etiological circumstances remain controversial. It is an obstetric catastrophe because regardless of the speed and level of the resuscitation procedures employed, 80% of the women diagnosed with AFE die. For 2001 to 2006, the Committee's study counted 36 cases of well-documented AFE among the 43 assessed and 57 recorded. AFE is therefore the second leading cause of maternal death, after hemorrhages. Its frequency appears to have increased very slightly.

4.3.1 Epidemiology and risk factors.

Because of the difficulty of reaching a confirmed diagnosis, it is hard to determine the frequency of AFE. In France, the frequency appears to be approximately 1 per 80,000 births [Audipog 2008]. The death ratio from AFE was 1.2/100,000 births, a frequency similar to that reported in the English enquiry for 2003-2005 (0.8/100,000). The women’s median age was 34 years. We note that mean age at delivery in France over this study period was approximately 30 years. The median number of pregnancies in this group was 3.4, and median parity was 1.8. Median gestational age was 38.5 weeks, which indicates that most AE occurred during term deliveries. Overall, the population could be described as having been pregnant several times, not young, and delivering at term.

4.3.2 Modality of onset

4.3.2.1 Period

In the series analyzed here, AFE was manifested by suggestive symptoms during labor in 60% of the cases, during a cesarean in 20%, and during the third stage of labor or immediate postpartum period in 20%. In North American registries [2] and the Chinese report [3], the syndrome occurred most often during labor (70% of patients); it occurs after the third stage in 11%, and during a cesarean after delivery of the child in 20%.

4.3.2.2 Role of induction

Labor was induced in 23% of the cases, either by prostaglandins or oxytocin. We note that during the same period in France, labor was induced in approximately 20% of deliveries. Accordingly, induction of labor does not appear to be a factor promoting AFE.

4.3.2.3 Membrane status

Sixty percent of the patients with symptoms during labor had ruptured membranes. According to the literature, AFE occurs most often after rupture of the membranes, whether spontaneously (one third of cases) or artificially (two thirds). These observations suggest that in some conditions modifications of intrauterine hemodynamics may promote the passage of fetal or amniotic components into the maternal circulation. The association in several cases of an AFE and placental detachment is also consistent with this hypothesis.

4.3.2.4 Role of oxytocins

The management of labor of most cases of AFE, whether during labor or cesarean, used oxytocins. The same is true for the third stage, also most often assisted by an intravenous bolus of oxytocin. It is standard to consider artificially induced (prostaglandin or oxytocin) uterine hyperactivity as a risk factor. Since the widespread use of epidural analgesia during deliveries, oxytocins have also become common during labor. Moreover, according to a 1995 publication [2] of one of the North American AFE registries, established in 1988, there was no significant correlation in the 46 cases analyzed between AFE and either the use of oxytocin or an abnormally long labor. Uterine hypertonia is often observed at the same time as the first events of this syndrome, but it appears to be a uterine response to prolonged and sudden tissue hypoxia.

4.3.3. Symptoms

It is particularly suggestive when AFE signs occur during labor or during the cesarean, as it does in approximately 80% of cases. In the other cases, 5 of them well documented, it was a postpartum (third-stage) hemorrhage secondary to an AFE that may have occurred during labor but was not noticed, probably because its symptoms were so fleeting.

- Respiratory events combining coughing, chest pain, dyspnea, cyanosis, facial edema, and bronchospasms.
- Cardiovascular shock and then shock with thready pulse and unobtainable blood pressure.
- Neurological events with malaise, nausea, agitation, loss of consciousness, convulsions, and then sometimes a coma.

When these symptoms occur during labor, they are accompanied by acute fetal distress that requires rapid delivery. There were 15 emergency cesareans
and 5 instrumental interventions, for 20 rapid operative interventions among the 36 cases analyzed. These obviously do not include the cases of AFE during cesareans or post partum. This urgency demonstrates the need to save the child and at the same time resuscitate the mother because everyone knows that effective resuscitation requires in priority an empty uterus. In the 20 cases where suggestive symptoms began during labor, the child survived in 14.

Gilbert [8] found DIC disorders in 45 to 60% of cases, and Clark [2] in 83%. These are manifested in cardiorespiratory sequelae when active resuscitation saves the patient during the inaugural episode. This fact takes into account 19 emergency hysterectomies in 27 PPHs (75% of the cases), while in the other cases, this procedure was not or could not be performed, probably because of the speed of the developments. We noted only one attempted embolization, followed by a hysterectomy. DIC coagulation disorders can be the only symptom of AFE and may be manifested by a profuse but isolated hemorrhage [5]. Morgan [6] reports that DIC is the only symptom of AFE in 10 to 15% of cases.

AE thus involves sudden symptoms during labor: respiratory disorders, malaise, and hypotension followed rapidly by cardiovascular shock, coagulation disorders with hemorrhaging, and frequently cardiopulmonary arrest. Frequently, neurological events slightly precede or accompany these symptoms.

4.3.4 Time course

We estimated the time course as the time from delivery to death, because of the difficulty of knowing the exact point during labor that symptoms began. Apart from the four cases in which the deaths occurred substantially more than 24 hours after birth, the time until death ranged from 1 to 24 hours, thereby demonstrating the speed of this development. The mean time elapsed until death was 3.9 hours for 2001-2003 and 9.5 hours for 2004-2006. Time of survival was better in the second period, but the outcome remained the same. These figures must be kept in mind when making treatment decisions.

4.3.5 Neonatal outcome

Among these 36 cases, 25 babies survived and 11 died (either stillbirths or neonatal deaths). All the children delivered before the onset of AFE symptoms survived. The shorter the interval between the initial episode and delivery is, the greater are the child’s chances of survival without long-term complications [2].

4.3.6 Pathophysiology

The pathophysiology of AFE involves numerous unknowns. The passage of amniotic fluid into the maternal circulation does not lead inevitably to the catastrophic clinical syndrome described by Steiner and Lushbaugh. Animal experiments [7] have shown that the injection, even massive, of autologous amniotic fluid in pregnant animals, is not accompanied by irremediable cardiopulmonary changes. We must therefore distinguish the passage of amniotic fluid with no or few symptoms into the pulmonary circulation, demonstrated in pulmonary blood samples taken when labor is being monitored for other reasons, from the clinical syndrome of AFE, rapidly fatal in the absence of treatment.

This clinical syndrome requires an accidental breach (rupture of membranes or uterine veins, especially in the isthmic or cervical region [8] and a biological conflict. The embolism is perhaps not only amniotic; an abrupt passage of fetal blood with all its cellular components is likely.

Clark [2] and Benson [9] have likened it to anaphylactic shock due to fetal antigens, but no specific antigen has been identified and no maternal antibodies of the IgE or IgG-STS types have been described as initiating the maternal reaction. An immunological conflict of another type (acute rejection), starting at the pulmonary endothelium, especially the post-capillary endothelium, cannot be ruled out; it might activate several biological inflammation systems: the complement system, the contact system, coagulation, and fibrinolysis. Activation may also occur in other highly vascular organs: the brain, kidneys, and uterus. This may explain symptoms such as agitation, seizures, and uterine atony.

In any case, the eruption at the level of pulmonary vessels, of an unknown factor — tissular, cellular, or protein in nature — carried by or with amniotic fluid, especially meconium, triggers vascular and biological cascades that may lead within hours to an irreversible situation.

Coagulation disorders, when they have the time to appear, result mainly from a defibrination by DIC (thrombocytopenia, elevated levels of fibrinogen degradation products, and soluble complexes) with secondary fibrinolysis. In our series, virtually all observations of laboratory-documented hemorrhage revealed DIC. Primary fibrinolysis was very rare.

Because no early hemodynamic work-ups were performed in these series, we cannot analyze the development of the cardiovascular disorders. They seemed to develop in two phases:

- the first, brief, involved: pulmonary hypertension, normal pulmonary capillary pressure, lesional edema and DIC, corresponding to a pulmonary vascular spasm associated with microcapillary obstruction and local microcoagulation [2];
- the second, several hours later, combining: left ventricular failure, elevated pulmonary capillary pressure, hemodynamic edema, and severe hypotension that responded poorly to treatment [6].
4.3.7 Diagnosis

Diagnosis is difficult, to the extent that we might ask: do women die from AFE or with it?

- **Clinical diagnosis** is based essentially on the combination of 4 suggestive clinical signs [10]: onset of symptoms during labor or cesarean delivery, or more rarely during the third stage of labor; sudden hypotension, and then cardiovascular shock or cardiac arrest; dyspnea with cyanosis, agitation, and convulsions; coagulation disorders, with massive bleeding seen clinically and DIC seen in the laboratory, and with secondary fibrinolysis.

Finally, and especially, by ruling out the other possible diagnoses: pulmonary embolism but also other types of hemorrhagic shock, eclampsia, and also other rarer diagnoses, such as anaphylactic reaction, myocardial infarction, cerebral thrombosis, and cerebral bleeding.

- **Laboratory diagnosis** has recently been enriched by several tests aimed at identifying fetal or amniotic components in the maternal circulation: search for fetal mucin with TKH-2 monoclonal antibodies [11]; search for meconium in maternal serum by a Zn-Coproporphyrin assay [12]; search for amniotic cells in the maternal blood by the central line and in the pulmonary alveoli by bronchoalveolar lavage; assay of serum tryptase, a marker of an anaphylactic reaction to fetal antigens [9,13]; and Kleihauer test in the case of suspected fibromuscular hyperplasia.

Unfortunately in practice none of these results can be obtained on an emergency basis, and no specific profile has really been validated. A kit should be developed and validated for samples in cases of suspected AFE, to be kept available in the delivery room, because it is only through systematizing sample collection we can build up a serum bank and hope to find a specific marker of AFE.

It is still currently the post-mortem examination that provides the most convincing arguments, identifying fetal components in blood from the right heart, in the pulmonary circulation, the alveoli, and sometimes in other highly vascular organs: keratinized squamous cells, lanugo down, clumps of mucus, vernix caesosa, and syncytiotrophoblast cells [14]. Local edema and leukocyte aggregates are also often associated with microcoagulated material. This research must be performed on numerous samples, especially in the lungs, with staining and specific monoclonal antibodies. This work is painstaking, long, and expensive. The results are often missing from the autopsy reports. The most useful specimens (lungs) are rarely conserved.

In addition, fetal elements including squamous cells and fetal fats have been identified in the pulmonary circulation of patients who did not have AFE [6]. The identification of these components in small quantities does not formally demonstrate AFE [15,16]. Finally, blood sampling techniques may introduce squamous cells from the mother, or even the operator, into either the maternal circulation or the tubes [10]. It is thus the presence of a large amount of amniotic material and impaired local tissue structures, associated with the clinical setting, that strongly suggests the diagnosis of AFE. It has been reported that when these items are found in hysterectomy specimens, especially in vessels of the cervical isthmus, an AFE diagnosis is likely [8].

When everything is uncertain, clinical data are what remain, together with the quite unsatisfactory method of diagnosis by elimination.

This 32-year-old patient was a gravida 2 primipara, 1.63 m, 77 kg. Depakine® (valproic acid) 500.2/d.

Labor was induced at 41 weeks, with Prostine administered at 10h15; membranes ruptured spontaneously at 14h30, and Syntocinon was administered. Transient discomfort at 14:56; Ringer’s, ephedrine, and oxygen were administered.

Improvement was noted. At 16 h, the baby was born, weighing 3620 g. The third stage of labor was actively managed with intravenous oxytocin. The placenta was delivered at 16h15, and manual examination performed for serious hemorrhage. Despite intensive medical management, the bleeding persisted. A hysterectomy was performed at 17 h. The patient died at 18h40. An autopsy confirmed the final diagnosis — AFE, with sudden DIC. The care was optimal and the death unavoidable.

4.3.8 Management

Of the 36 cases examined and considered to involve AFE during the period 2001-2006, the Committee concluded that 33 of the deaths were unavoidable while 3 could have been avoided. It did not, however, consider the management flawless, especially for 9 cases. It insists on the importance of the time factor, which might perhaps improve prognosis in the future.

There is not currently any specific codified and validated treatment. Treatment must therefore be symptomatic.

When this diagnosis is suspected, clinical monitoring is required every quarter hour, with laboratory monitoring of coagulation and blood electrolytes every hour, from the first symptoms for at least 6 hours if all goes well. The medical team (obstetrics and anesthesia-resuscitation) must be put on alert immediately, reinforced if necessary, and the blood bank must be contacted even in the absence of overt bleeding.

Respiratory failure requires oxygen or even mechanical ventilation. In case of pulmonary edema, when echocardiography or pulmonary artery catheterization shows signs of left ventricular dysfunction, diuretics and positive inotropic drugs should be prescribed and perfusions reduced. In cases of severe shock,
catecholamines (dopamine, norepinephrine, and epinephrine) should be used, if possible with invasive monitoring of systemic and pulmonary arterial pressure and cardiac output [17]. If the context allows, circulatory and respiratory assistance by intra-aortic contrapulsation and extracorporeal membrane oxygenation may be considered [17].

The treatment of bleeding, related simultaneously to uterine atony and DIC, requires a hierarchical approach:

• vaginal verification and manual uterine examination immediately followed by a perfusion of Nalador;
• in the case of failure or persistent bleeding, even minor, immediate surgical intervention is necessary;
• an emergency hysterectomy performed without waiting has some chance of saving the woman (19 hysterectomies were performed but perhaps too late).

The maintenance of an "effective" blood volume remains delicate: any overcharge or hemodilution can trigger or exacerbate pulmonary edema, whether due to lesions or the hemodynamic situation. Crystalloids are not indicated. While awaiting blood products (fresh frozen plasma, units of packed red blood cells, albumin, platelets), stanches can be used with catecholamines. Perfusion of fibrinogen alone is not useful. Antifibrinolytic drugs may be prescribed, depending on the laboratory results. Antithrombin to improve the DIC and the prognosis seems logical at the beginning of AFE, but appears dangerous during severe bleeding and has not been validated.

4.3.9 Conclusion

AFE therefore remains an unpredictable accident; its pathophysiology is always mysterious and its prevention still impossible to organize.

Its frequency is low but is not well assessed because of the lack of objective criteria. However, it is likely that many PPHs involve this mechanism but are not reported when the outcome is favorable.

Positive early in vivo diagnosis is not yet possible, in the current state of knowledge. It must, on the other hand, be suspected from non-specific but suggestive clinical symptoms. Overdiagnosis is a reasonable attitude because it has the advantage of mobilizing the health care team.

These immediately or very rarely major clinical situations (acute respiratory failure, circulatory collapse, coma, cardiac arrest) are often beyond the usual therapeutic possibilities.

On the other hand, medical control of rapidly progressive bleeding developing after suggestive signs can radically modify the prognosis, which was considered fatal in 80% of cases. A prepared team of obstetricians and d’anesthesiologists, an operational laboratory, and a blood bank are the factors that can determine the prognosis of this fearsome syndrome.

We thank especially Prof. Jean Motin for his contribution.

4.3.10 References

4.4 Thromboembolisms
Frédéric J Mercier

The last report, which focused on deaths in 1999-2001, placed thromboembolic complications as the third leading cause of maternal mortality among the direct obstetric causes. This rank has not changed over the 2 periods (2001-2003 and 2004-2006) analyzed in this report (see Table 2). Thromboembolisms accounted for 26 and 20 deaths during these 2 three-year periods, for an overall ratio of 0.95 maternal deaths per 100,000 live births. They thus represent approximately 10% of all maternal deaths collected over these 6 years. We note as well that the number of maternal deaths that the Committee could analyze and relate to this cause has also remained very stable over these 3 periods: 14 in 1999-2001 and in 2001-2003, and 13 in 2004-2006. Nor has their distribution between pulmonary embolisms (PE) on the one hand (89%) and cerebral venous thrombosis (CVT) on the other (11%) changed notably.

4.4.1 Pulmonary embolisms (n=24)

The patients’ mean age was 33 ± 8 years [18-9]. Parity was unavailable for 3. Of the other 21, 5 women were nulliparous, 3 primiparous, and 13 multiparous (including 7/13 with a parity of 4 or higher). Weight and BMI were rarely completed precisely (3 cases: 155 kg, BMI of 29 and 35), but the number of patients reported as obese (BMI ≥ 30) was high: 8/24 (33%).

Only 2 patients had a personal history of thromboembolic disease. No biological thrombophilia was known or subsequently documented. One woman had had a pulmonary embolism after a cesarean 7 years earlier, and then phlebitis, 3 years before her death. It had begun at the very beginning (6 weeks) of a known pregnancy for which she was not yet receiving prenatal care, and she did not receive anticoagulant prophylaxis. The other patient had presented phlebitis of the superficial saphenous vein, also in early pregnancy, apparently treated for 6 weeks by AVK; no further information about continued anticoagulation was available; prophylactic treatment by low-molecular-weight heparin (LMWH) had been prescribed with compression stockings for the first month postpartum. The patient stopped her treatment between the second and third week, and she died suddenly at home, in circumstances very suggestive of PE.

There was also a foreign-born 49-year-old woman (gravida 8 para 7), who had venous insufficiency of unknown longevity, aggravated at 32 weeks by pain in the right foot. The Doppler ultrasound was normal. A prophylactic dose of LMWH (4000 IU) had been prescribed to but not taken by the patient. She experienced acute right heart failure at home, probably related to a PE; the ambulance service administered thrombolytic treatment onsite. The transient hemodynamic improvement made it possible to bring her to the hospital. The fetus had died in utero, and the mother died 6 hours later.

No patient was receiving prophylactic anticoagulant treatment when the fatal PE occurred, except for one overweight patient (BMI 29: 75 kg/161 cm) who had a cesarean delivery at 38 weeks for a breech presentation; she had received a first dose of prophylactic LMWH on D0; when she awoke the next morning, her clinical condition was highly suggestive of PE. It should also be noted that this patient had had mild signs of threatened preterm delivery 5 weeks earlier (at 33 weeks), without any details available about the bed rest and immobilization that might have resulted.

We also note 4 other cases of hospitalization and bed rest at the end of the second trimester (1 case associated with obesity) or during the third trimester for threatened preterm delivery (2 cases) or vaginal bleeding (1 case).

Moreover, the patients had no severe associated medical conditions; nonetheless, 5 smoked, 1 had untreated chronic hypertension, 2 gestational diabetes (including 1 treated with insulin), and 1 asthma.

The thromboembolic event occurred before birth in 14 cases, or 58% (first trimester: 6 cases; second trimester: 2 cases; third trimester: 6 cases), per partum in 2 cases (8%), and postpartum in 8 (33%).

The 2 per-partum thromboembolic events were: a) a PE 3 hours after cesarean; the mother died on D14 of septic shock despite surgical embolectomy followed by a hysterectomy, and b) a massive bilateral PE (confirmed by CT angiography) seven hours after the start of a medical termination of pregnancy for fetal heart disease.

Among the 8 postpartum thromboembolic events, there were 6 vaginal deliveries (two with in utero deaths, including one associated with abruptio placenta, followed by an emergency hysterectomy, with no prophylactic anticoagulation until D8), and 2 uncomplicated cesareans.

The diagnosis was made 9 times based on a highly suggestive cardiopulmonary clinical picture, once on the suggestive cardiopulmonary picture preceded by a diagnosis of femoral and iliac venous thrombosis visualized by Doppler ultrasound, 3 times by CT angiography and 4 by autopsy. A fifth autopsy was performed, but the results were unavailable to the investigators because the judicial authorities did not release them due to an ongoing legal procedure. In one case, the family refused an autopsy.

4.4.1.1 Two selected cases of pulmonary embolism, with comments

Emergency medical services were called for a woman with a malaise on the street. This 31-year-old obese woman, with no other known medical history, had abdominal pain, with dyspnea, intercostal retraction,
seesaw respiration, facial cyanosis, and bradycardia. She was immediately intubated and perfused (fluid resuscitation, isoprenaline, dopamine), but nonetheless went into cardiopulmonary arrest very rapidly. Treatment (ECM, and adrenaline for an hour) was unsuccessful. The autopsy found a bilateral, proximal, and massive pulmonary embolism and a gravid uterus corresponding to a first-trimester pregnancy (long axis of uterus less than 10 cm). The care was assessed as optimal, and the death as unavoidable.

Another case involved a 35-year-old woman who presented with an in utero fetal death at 37.5 weeks. She was gravida 5, para 4 (4 vaginal deliveries), moderately obese (BMI: 30), and in the process of stopping smoking. She also had gestational diastolic hypertension and did not comply adequately with the insulin treatment. Labor was induced under epidural analgesia, and a manual examination performed after delivery. Parlodel® (bromocriptine mesylate), paracetamol and ibuprofen were to be continued after discharge. On D19, the patient was brought to the ER by emergency medical workers for chest pain, agitation, dyspnea, and hemoptysis. She was advised to see a psychiatrist because she was very anxious, and she went home with prescriptions for Diantalvic® (paracetamol and dextropropoxyphene and Valium® (diazepam) and nothing else. On D36, her husband brought her in for “malaise and spasmophilia”. Her BP was 98/72 mm Hg; she was confused and intensely pale. Cardiorespiratory arrest occurred rapidly; she was revived after intubation-ventilation, ECM (20 min), and adrenaline. Cardiac ultrasound showed distention of the right ventricle, which led to attempted rescue thrombolytic treatment. Nonetheless, her cardiopulmonary status remained precarious, and she died 4 hours later, in the ICU. Although there was no autopsy, death was most likely due to a massive pulmonary embolism, judged preventable and linked to suboptimal care in view of the very suggestive signs that were present but not taken into account and that did not lead to appropriate work-ups when she was seen in the ER on D19.

4.4.1.2 General comments on the deaths from pulmonary embolisms

Most of these deaths occurred before delivery, evenly divided between the first and third trimesters. As pointed out in the UK CEMACH triennial enquiry of deaths over the same period, 2003-2005, risk factors are often found. They nonetheless seem slightly less frequent in this French series of deaths from 2001 to 2006 (50%) than in the British series (78%). We found no cases here related to either airplane flights or surgery during pregnancy. The risk factors here were principally obesity, then bed rest during pregnancy, most often for threatened preterm delivery, and then, much more rarely, individual thromboembolic history. There was also a unique but important case of phlebitis followed by a fatal PE 8 days after a major hemorrhage had finally been controlled by an emergency hysterectomy. The postpartum period after hemorrhage requiring emergency surgery has been identified as a high-risk situation for PEs (OR: 12) [Bourjeily 2009].

No biological thrombophilia was known or subsequently documented. Yet it is one of the highest potential risk factors for venous thromboembolism (VTE) (OR: 52) [RPC SFAR 2005, Bourjeily 2009]. The alternative to the improbable likelihood that it was never present is that it was sometimes not recognized or not noticed. The French guidelines identify severe biological thrombophilias and a personal history of thromboembolism as the two major elements of thromboembolic risk, the only ones that justify anticoagulant prophylaxis in the prenatal period (i. e., from the beginning of pregnancy). This probably explains in large part why only one third of the deaths in the 3-year periods of 2001-2003 and 2004-2006 were considered avoidable or perhaps avoidable (see Table 2). On the other hand, a British register of prenatal PE has focused primarily on 2 other risk factors: multiparity (OR: 4) and obesity with BMI ≥ 30 kg/m$^2$ (OR: 2. 7) [Knight 2008]. Grand multiparity appears to be overrepresented in this French collection of PEs. Moreover, very recent data suggest that the association of obesity and bed rest (immobilization) is a very strong risk factor for VTE in the prenatal period (OR: 62) [Bourjeily 2009], a finding consistent with the risk factors for death from PE observed most often in this report.

Individual examination of the deaths from PE showed especially the failure to consider the diagnosis in a context and with signs suggestive of it, resulting in a delayed or never-reached diagnosis. Algorithms for suspected phlebitis or PE during pregnancy are nonetheless available, as is appropriate treatment [Chunilal 2009, Bourjeily 2009]. Other information can be downloaded from the website of the SFAR, in the FAQ (frequently asked questions), under the heading of “venous thromboembolic disease in postpartum”. D-dimer tests, Doppler ultrasound of the lower limbs, ventilation perfusion scintigraphy, and especially emergency CT angiography are the key elements in this diagnostic procedure. Cardiac ultrasound can be useful in guiding diagnosis towards a severe PE when it shows the right cavity to be dilated, and pulmonary hypertension, if it can be measured. On the other hand, cardiac ultrasound cannot rule out this diagnosis.

Finally, we must stress that a PE diagnosis can rarely be demonstrated by autopsy (20%) if it could not be shown by imaging before cardiopulmonary arrest. It is thus often difficult to reach a definitive diagnosis and therefore possible that this cause is overestimated (through lack of awareness of a differential diagnosis) or conversely underestimated (diagnosis not mentioned).

The avoidability ratio of one third of the PE deaths is clearly lower than that reported for most other direct obstetric causes. Nevertheless, the elements reported above and the simple measures described below (see Recommendations) should help to reduce it substantially more.
4.4.2 Cerebral venous thrombosis (n=3)

The patients were aged 20, 27, and 32 years. Two were nulliparous (one with no previous pregnancies and the other with 2 miscarriages), while the third was gravida 3 para 3. The oldest was obese. None had any notable history.

The first woman had right facial paralysis at 35 weeks, for which she was hospitalized for 2 days. No further details were available, but she apparently had neither CT nor MRI at that time. Several days later (at 36 weeks), she had seizures at home; while en route to the hospital in an ambulance, there were 2 additional seizures with intercritical impaired consciousness. The dead fetus was delivered by cesarean, and the brain CT showed CVT (left lateral sinus). The patient, intubated, ventilated, and receiving heparin, died of cerebral edema on D4.

The second patient had nausea and headaches at 12 weeks of gestation, and seizures 3 days later. The initial diagnosis was meningoencephalitis, based on an MRI and lumbar puncture, and a probabilistic antibiotic therapy was begun. She was transferred 2 days later to a reference center, where a diagnosis of CVT appeared very probable in view of the MRI findings. Heparin treatment was thus added to the antibiotic therapy. She died 4 days later with cerebral edema and uncontrollable intracranial hypertension.

The third case also involved tonic-clonic seizures, apparently occurring this time with prodromes on D40 postpartum. The diagnosis was based on MRI findings (CVT of the longitudinal sinus). Despite an emergency neurosurgery procedure as well as medical treatment, she died 3 days later.

CVT is a rare disease and thus easy not to recognize initially. Any abnormal neurological sign in the pre-and postpartum periods should suggest this diagnosis among other neurological complications and lead to emergency brain imaging (MRI if available, or CT) without waiting for more severe manifestations (seizures or coma), which may nonetheless occur immediately. The prognosis appears to depend on the earliness of heparin treatment and the adequacy of the dose and seems fairly good if it begins before the onset of a coma or intracranial hypertension [Nabil 2002, Messaoudi 2007].

4.4.4 References


4.4.3 Recommendations

Improvement of the consideration of family and personal risk factors for thromboembolic accidents is essential to ensure appropriate prophylactic treatment (cf. SFAR clinical practice guidelines, 2005: www.sfar.org).

Compression stockings must be systematically prescribed before delivery for women required to remain in bed (for threatened preterm delivery or bleeding), and it appears useful to add prophylactic anticoagulation for women with obesity (BMI = 30 kg/m² or higher).

PE must be considered when the context or signs are suggestive, to avoid any delay in appropriate exploration (CT angiography, especially) and in implementing anticoagulant treatment. An autopsy should be performed for any maternal death without confirmed PE to prevent both overdiagnosis and underrecognition.

Thanks to Pr Lévy and to the members of INSERM U953 for reading this and for the data they furnished.
4.5 STROKES

Henri Cohen

4.5.1 Overall incidence

From 2001 to 2006, there were 43 maternal deaths from strokes, for a ratio of 0.89/100 000 live births. The Committee assessed 36 of them and considered all to be indirect obstetric causes. Deaths from strokes associated with pregnancy-related hypertension were analyzed above, in the section on such hypertension.

4.5.2 Analysis of strokes classified as indirect causes

4.5.2.1 Place of death

Almost all the women died in the hospital, most often in the ICU (31 cases), 2 in the maternity ward, and 1 in the ER. One woman died in the ambulance after a malaise in the street while en route to the hospital for the third time because of headaches after giving birth 8 days earlier.

4.5.2.2 Age and Parity

Age at death varied from 22 to 44 years; the median was 34 years, and the distribution fairly uniform over this interval. It was the first or second pregnancy for 10 patients; 18 had already given birth at least twice; and a 44-year-old smoker had 9 previous pregnancies. Hers was the only death from an ischemic cause.

4.5.2.3 Mechanism of the lesion

The diagnosis was made in almost all cases by CT; only 2 autopsies were performed, one after CT and the other because the death occurred unexpectedly, during hospitalization for well-controlled hypertension.

The principal mechanism was the rupture of an arterial aneurysm or an arteriovenous malformation (17 cases). A parenchymal or brain stem hemorrhage was found in 13 cases, subarachnoid hemorrhage in 5, and cerebral ischemia once.

4.5.2.4 Timing of the stroke

In all, 21 strokes occurred during the pregnancy, mainly during the third trimester (15 cases). The period from 32 to 34 weeks’ gestation is overrepresented (9). The stroke occurred postpartum in 15 cases, 9 during the first week, 3 during the second, and 3 times still later(D21, D40, and D60).

4.5.2.5 Timing of death

Nine women died without giving birth, 26 others in the postpartum period (10 with vaginal deliveries and 15 cesareans). Among those who gave birth, 4 died the day of the cesarean, while the rest spent from one to several days in the ICU.

4.5.2.6 Avoidability of maternal deaths

Most of the cases were considered unavoidable (27). In 2 cases, prodromes could have led to a faster diagnosis, but we don’t know whether a faster diagnosis would have made it possible to avoid the deaths. The committee could not reach a conclusion about avoidability for 6 deaths, because of inadequate information. Only 3 cases were judged to be possibly avoidable, because of non-optimal care.

4.5.2.7 Risk factors

One of the women who died had had a subarachnoid hemorrhage during a previous pregnancy. A neurological alert had occurred previously in two cases: one as a malaise with headaches of unknown etiology, the other a sensorimotor deficit of the arm, which the patient neglected.

Two woman had relevant family histories — ruptured aneurysm and cerebral hemorrhage.

The headaches were found in the clinical histories during the acute event, sometimes quite a bit earlier, without this having led to any particular investigations.

4.5.2.8 Illustrative Cases

The first case concerned a 35-year-old woman, gravida 3, para 2, who was followed by her private gynecologist. Her pregnancy was unremarkable up to 31 weeks. At this point, her general practitioner referred her to a clinic for loss of consciousness, with urinary incontinence and postcritical disorientation and headaches. She was sent back home after the laboratory tests came back with normal results. That same day, however, her gynecologist sent her back to the clinic for a neurological work-up. Results of the cerebral CT and the ocular fundus examination were normal, the headaches disappeared, and discharge was planned when she was found dead in the shower. Subarachnoid hemorrhage secondary to a ruptured aneurysm was the cause of death.

Another case was that of a 32-year-old woman, gravida 2, para 1, who had a family history: her mother had had a subarachnoid hemorrhage. Retro-orbital and occipital headaches resulted in her admission to a local public hospital at a term of 6 weeks. The MRI showed a large thrombosed left carotid aneurysm. She was then transferred to the neurology department of a level 3 university hospital, where external ventricular drainage was performed under general anesthesia. The hemorrhage recurred in the ICU; MRI confirmed brain death.
The third case was a 33-year-old woman, gravida 2 and nulliparous, who was seen regularly in a local public maternity unit. She had a history of ophthalmic migraines. She had 16 prenatal consultations in all, and 2 short hospitalizations at 31 and 34 weeks for uterine contractions. At 40 weeks, she was hospitalized for rupture of the membranes. Antibiotic therapy and cervical ripening with prostaglandins were performed because she was known to carry streptococcus B. The vaginal delivery was uneventful, and the baby weighed 3500 g.

On D3, scintigraphy confirmed a pulmonary embolism. Treatment by LMWH began, together with oral anticoagulants. The night after the diagnosis, she developed headaches, soothed by class 1 (analogous to class A) analgesics. Serious vomiting rapidly appeared, followed by impaired consciousness, and a left sensorimotor deficiency. She was revived after cardiac arrest. Emergency CT showed massive cerebral hemorrhage with flooding of all four ventricles and the brainstem. After transfer to the ICU, she died on D6, due to progressive hemodynamic impairment.

The death was associated with a massive intracerebral hemorrhage. It was thus an indirect obstetric cause, judged unavoidable. Care was considered to have been optimal. No association was established between the anticoagulants and the cerebral hemorrhage.

4.5.3 Discussion

The morbidity rate from intracerebral hemorrhages during pregnancy and in the postpartum period was 9/100 000, almost identical to that of ischemic strokes (11/100 000), with risk higher in the postpartum period (RR: 28) [Sharshar 1995, Kitnner 1996].

Hemorrhagic accidents predominated heavily in our collection of death data, in contrast to the available studies of morbidity data.

Risk factors described for both mechanisms are age above 35 years, migraines, hypertension, smoking, African origin, heart disease, diabetes, lupus, addiction to alcohol and cocaine, sickle cell anemia, thrombophilia, high parity, preeclampsia, and eclampsia [James 2005].

The cases of both ischemic and hemorrhagic strokes were concentrated in two periods, the third trimester of pregnancy and especially the postpartum period [Kitnner 1996]. The higher proportion of deaths from strokes in the third trimester in our study may have several causes: aggravation of the stroke by the pregnancy, the greater difficulty in management because of the pregnancy, or the clearly worse prognosis for cerebral hemorrhages [Sharshar 1995].

A population study in the United States examining WHO codes from 1993 through 2002 identified 423 patients with intracerebral hemorrhaging during pregnancy or postpartum, for a ratio of 6.1/100 000 [Bateman 2006]. Mortality among women hospitalized for this reason was 20%. The same risk factors were found.

Strokes occurring during pregnancy were associated with preeclampsia or eclampsia in 25 to 45% of cases [Duckitt, 2005]. They were covered in the section on hypertension of this report.

4.5.4 Conclusion

The topology of maternal deaths from strokes has not changed from those studied in the periods 1996-1998 and 1999-2001, and the same comments can be made.

If we suppose that in the general population ischemic and hemorrhagic strokes occur at an essentially identical frequency, hemorrhagic strokes present a much higher risk of death during or after pregnancy. The occurrence of a hemorrhagic stroke during the third trimester of pregnancy is probably a poor prognostic factor.

It remains difficult to identify risk factors (besides hypertension) that might alert physicians before the stroke occurs. Nonetheless, the data is collected mainly from obstetric items; research targeted on neurological data may be required to improve our knowledge, especially since new clinical practice recommendation for the rapid management of strokes are currently being established.

4.5.5 References


4.6 INFECTIONS

Francis Puech

4.6.1 Introduction

All health professionals must know the symptoms and signs of maternal sepsis. They must be aware of the speed with which severe sepsis and septic shock may become lethal. Maternal tachycardia and abdominal pain must be considered a medical emergency from the onset of septicemia with a portal of entry through the genital tract.

All departments of gynecology and obstetrics should have protocols to direct the investigation and management of such sepsis. A high-dose, wide-spectrum antibiotic treatment must be started as soon as sepsis is suspected, without awaiting microbiology results [1-3,5].

4.6.2 Epidemiology

The Committee assessed 15 deaths associated with a genital tract infection from 2001 through 2006 (direct causes). The women's ages ranged from 19 to 43 years (mean age: 31). One patient was primiparous, while 14 had from 1-4 children.

Five women gave birth before 22 weeks. Among the other 10 women there was one twin pregnancy, with 2 liveborn children, and 9 singletons, including 1 in utero death and 1 very premature delivery at 25 weeks of a liveborn child.

Eleven women gave birth by vaginal delivery, and 4 had cesareans. The deaths occurred between D1 and D41, but most often before D5.

All died in the ICU. The deterioration of clinical status was rapid in most cases, leaving little opportunity for treatment once the life-threatening signs appeared to change the course of events. Care was considered to have been optimal and the deaths unavoidable in only 2 of the 12 cases that could be analyzed for this question. Death was considered avoidable in 7 cases and possibly avoidable in 3.

These cases demonstrate that onset may be insidious or deceptive with an extremely rapid clinical deterioration and that rapid transfer to an adult ICU is essential.

Ten other deaths occurred in contexts where the pregnancy was not the primary factor in the cause of death (indirect causes). There were 4 deaths of women with AIDS, 2 with malaria, and 1 death associated with each of sickle-cell anemia, intestinal obstruction, endocarditis, and lung disease. Overall, of 7 assessable deaths, 2 were considered unavoidable.

4.6.3 Microorganisms involved

The microorganisms involved were reported in only 9 cases; the most frequently identified were the beta-hemolytic streptococci of Lancefield group A (4 cases) and Escherichia coli (4 cases). Clostridium and Serratia marcescens were each found once. Some women had mixed infections with two or more microorganisms. No pathogenic agent was identified for 4 women. Staphylococcus aureus, multidrug-resistant E. coli, Bacteroides, and Pseudomonas aeruginosa developed in two women who had prolonged stays in ICUs, but this was not the determining factor in their deaths.

4.6.4 Illustrative Cases

4.6.4.1 Sepsis and delivery before 22 weeks

These 4 cases illustrate the contexts in which septic shock must be identified as rapidly as possible to avoid a poor outcome.

The first case was a woman homoyzgous for sickle-cell anemia, who died after amniocentesis performed to diagnosis this disease in the child. Chorioamnionitis (by uterine evacuation) performed too late led to a very serious hemorrhagic syndrome contemporaneous with septic shock.

The second death occurred during an ectopic pregnancy treated by methotrexate. She had constant pelvic pain, vomiting, fever, and neutropenia (0.2.10⁹/L), which was related to the treatment. In reality she had fatal septic shock and severe pain, with inappropriate antibiotic treatment.

The third death occurred 6 hours after admission of a young woman with peritonitis (Clostridium and Peptostreptococcus) following a uterine perforation related to an illegal abortion.

The fourth death followed premature rupture of the membranes at 17 weeks' gestation. The patient refused a medical termination of the pregnancy. The following day, pelvic pain and fever changed her mind; the procedure was scheduled for the next day. That night she miscarried, had septic shock (E. coli), and DIC. Transfer to the ICU did not prevent the death.

4.6.4.2 Deaths before delivery

One patient with Crohn's disease died before delivery. During a disease flare and simultaneous threatened preterm delivery, she experienced severe pain and had a fever; she was transferred from a clinic (that delivered 330 infants/year) to the surgical ward of a hospital, where the need for immediate surgery was noted. Peritonitis secondary to a double perforation of the small intestines required a right hemicolectomy. It did not, however, prevent death in the hours that followed, during which she was transferred by helicopter to a surgical ICU after the observation of fetal death in utero and of an iatrogenic event involving the subclavian catheter.
4.6.4.3 Sepsis during the postpartum period, after vaginal delivery

Six women died of sepsis after vaginal deliveries.

Two deaths, attributable to septic shock, were related to a PPH.

One woman had 3 manual examinations of the uterus. Previous reports have described this practice. We must stress the professionals' lack of knowledge about the role of septic shock in hemorrhages and bleeding disorders and therefore the delay in and inappropriateness of treatment.

One death occurred after surgery.

The patient underwent surgery for band occlusion; 7 days later she gave birth to a very preterm live child. She was transferred to the ICU on D5 postpartum because of hemodynamic instability and a Hb of 7.8 g. Associated with these were hypoxia-related pneumonia, fever, tachycardia (130-170 b/m), and then progressively less effective circulation, with circulatory failure despite resuscitation by ECM.

Two deaths involved the patients' own decisions, although that does not clear the medical teams of some responsibility.

The first patient delivered a liveborn 3100-g girl at home; placental delivery was spontaneous. No manual uterine examination was performed when she was admitted to the maternity ward. On D2 postpartum, fever appeared, with an impaired general status, vomiting that was treated by Augmentin® (amoxicillin and clavulanate potassium), with gentamicin added, and then Flagyl® (metronidazole). The next day, the first septic shock led to an exploratory laparotomy. A second shock was followed by cardiac arrest, a second laparotomy, and a second and final cardiac arrest. The septic shock was due to gram-negative E. coli.

The second patient had a cough when she arrived at the maternity ward. She left against medical advice on D5, with fever. She initially refused readmission despite suggestive and troubling signs of infection. On D12, she was readmitted in a state of shock related to a non-nosocomial group A streptococcus (GAS) infection.

The last death

This 32-year-old obese (102 kg) woman, gravida 2, had pregnancy-related diabetes, labile hypertension, and repeated urinary infections (E. coli). Labor was induced at 38 weeks; a 3840-g baby girl was born after a difficult delivery, with epidural anesthesia. Systematic cervical examination was performed with a speculum. The senior obstetrician sutured the episiotomy. On D3, dyspnea, tachypnea, and severe hypoxia were observed: anticoagulants were administered for right upper quadrant pain, and Augmentin® for fever (38° C). On D4, the symptoms were identical; oxygen was administered, and an occlusive syndrome appeared. Beta-hemolytic GAS was found in a vaginal sample. She was transferred on D8: cellulitis of the pelvis and right side indicated the need for reoperation and drainage. On D24, respiratory distress syndrome occurred, together with candidiasis and a rectoanal abscess (Bacteroides, E. coli, and Pseudomonas aeruginosa). New drainage did not prevent aggravation of her condition, multiple organ failure, and death on D41.

4.6.4.4 Post-cesarean sepsis

Four women died following a cesarean, three with septic shock and necrosis — cutaneous, digestive, cellulitis, and fasciitis. Two are perfectly documented from a bacteriologic perspective, with GAS present. Deaths can be extremely fast, in 24 hours as in the next case.

A 33-year-old woman, gravida 3, para 2, with no identified risks, had a cesarean with prophylactic antibiotics at 39 weeks because of a transverse presentation. That night she was in great pain, with a fever of 38° C, dyspnea, and shivering. By the next day, she was in an "unexplained" state of shock and was transferred immediately to the ICU. Septic shock was manifest, with tachycardia at 160 bpm, lactic acidosis (pH: 6.9), and DIC. Antibiotic therapy with Augmentin® and Gentalline® (gentamicin) was begun, followed by an exploratory laparotomy that observed complete abdominal necrosis (that is, of the small intestines, cervix, uterus, and retroperitoneum). Death occurred 6 hours later. The blood culture was positive for GAS.

The second case involved a woman aged 29, gravida 2, para 1. A cesarean was performed during labor for fetal indications. Her condition continued to worsen, with abdominal pain, tachypnea, impaired vigilance, leukopenia (2400 white cells/mm³), and early renal failure. On D5, she had a fever, extensive mottling, and severe abdominal pain; the abdominal wall appeared necrotic and she was in cardiovascular shock. She was then transferred to a surgical ICU where emergency surgery combined a hysterectomy, evacuation of pus from pelvic peritonitis, and careful examination of parietal necrotizing fasciitis. After the identification of GAS and Proteus mirabilis, the antibiotic treatment combined Tazociline® (pipracillin and tazobactam), Flagyl®, and Gentalline®. Despite repeated reoperations for necrosis excision and lavage, multiple organ failure developed; in addition, coagulase-negative staphylococcus and E. coli were both isolated, and Tienam® (imipenem and cilastatin sodium) and vancomycin were added to the treatment. Death occurred on D18 postpartum.

The third cesarean death involved a patient with a twin pregnancy, following a cesarean performed for preeclampsia. She was transferred to the ICU 10 hours after the delivery. Major refractory hypoglycemia developed, masking the septic shock due to E. coli, which was determined to be the cause of death.

The fourth of these deaths involved infection with chikungunya. A cesarean performed because of this infection delivered a live born child. Subsequently
anuric septic shock developed, with necrotizing cellulitis of the cesarean scar and cutaneous cellulitis of both legs. Her condition worsened in the days that followed, shock due to acute respiratory distress syndrome developed, and she died of multiple organ failure. The germ was not identified but the clinical picture was suggestive of GAS infection.

4.6.5 **Recommendations**

The fundamental approach in these situations is to be constantly aware of and looking for the early clinical signs of sepsis. To review, the most important signs are: maternal tachycardia and constant abdominal pain. From the onset of septicemia, these signs must be considered a medical emergency.

Vomiting and diarrhea associated with abdominal pain are symptoms of genital infection but are often attributed to gastroenteritis (a digestive disease). A skin rash may be observed. Discoloration or motting of the skin can indicate cellulitis. Fever should always be investigated and treated, but it is not always present. Elevated C reactive protein and white blood cells or neutropenia are important signs and must be explored further.

Vital signs must be monitored, and intake and output reported. Blood gases must tested very early to look for metabolic acidosis.

Persistent tachycardia, a drop in blood pressure, oliguria, metabolic acidosis, increased respiratory rate, and decreased oxygen saturation — all indicate a critical situation requiring urgent care.

Severe postpartum bleeding may be a factor promoting the development of a serious infection, as it may be secondary to an infectious process. In both cases, it is important not to ignore the extremely serious nature of their association.

Its potential severity was often unrecognized or underestimated, which led to a delay in transfer to an appropriate department or facility, in administration of the appropriate antibiotic treatment, and in the involvement of the most experienced staff.

The cases of classic “puerperal sepsis” due to GAS show that by the time that sepsis is clinically apparent, the infection is already well established. General deterioration, combining metabolic acidosis, acute respiratory distress syndrome and multiple organ failure, is therefore often irreversible.

Although all the women died in a medical or surgical ICU, most of these cases demonstrate that the onset may be insidious or deceptive, clinical deterioration very fast, and rapid transfer to an adult ICU often too late.

A multidisciplinary team with hematologists, microbiologists, anesthesiologists, and intensivists, must be mobilized quickly.

4.6.6 **Reminders from the previous report**

4.6.6.1 **About antibiotic treatment [4]**

In the circumstances that we are studying, the specific microbes have not always been identified at the moment of the prescription. The principal concern is efficacy: because both aerobic and anaerobic microorganisms must be covered, an empirical antibiotic therapy combining 2 or 3 high-dose antibiotics must be initiated. Delay in the prescription of intravenous antibiotics is a recurrent factor in the cases described here and in the preceding reports. It is required to ensure that serum levels of antibiotics are within the therapeutic range. The advice of an expert consultant microbiologist must be sought as early as possible.

Some important reminders include:

- a beta-lactam and a beta-lactamase inhibitor must be combined with an aminoglycoside, to cover at least enterobacteria, streptococci, enterococci, and anaerobes. The use of a third-generation cephalosporin justifies the addition of a nitro-5-imidazol as the cephalosporin in a combination with an aminoglycoside;
- an allergy to penicillin presents a real problem. Other alternatives include either the combination of clindamycin and an aminoglycoside or of uoroquinolone and an aminoglycoside with nitro-5-imidazole;
- for an obstetric portal of entry (choorioamnionitis), beta-hemolytic streptococcus and *E. coli* are the most common microbes, and the combinations proposed might be a beta-lactamase inhibitor or a third-generation cephalosporin combined with an aminoglycoside;
- for the urinary gateway, the germs most frequently encountered are the Enterobacteriaceae (*E. coli, Klebsiella species, P. mirabilis*) or enterococci. The first-line treatment should be a third generation cephalosporin in allergic patients — for Enterobacteriaceae, a uoroquinolone (e.g., oxacine), and for enterococci, a glycopeptide (vancomycin);
- for a pulmonary gateway, the pneumococci and commensal streptococci of the mouth and *Haemophilus influenzae* must be covered by a beta-lactam and a beta-lactamase inhibitor or a third-generation cephalosporin.

4.6.6.2 **About group A streptococcus infections [n=5]**

Invasive infections by GAS are rare but severe nosocomial infections. Because of the rare and particular nature of these specific microorganisms, it is mandatory to report these nosocomial infections to the interregional coordination center of nosocomial infection control (CCLIN) and to the district health and welfare bureau (DDASS), which transmits them to the InVS;
subsequent death should also be reported (decree n° 2001-671 dated 26 July 2001).

Humans are the reservoir of these microorganisms, which are transmitted from infected individuals or asymptomatic carriers. Carriage may be pharyngeal, cutaneous, anal, or vaginal; transmission takes place in aerosols of droplets or by direct contact, from a carrier or infected person, or more rarely by indirect contacts via objects. The prevention of invasive nosocomial infections by GAS requires compliance with basic hygiene guidelines during care: standard precautions, hand washing and antisepsis, and specific measures in the delivery and operating rooms (masks). The hygienists contacted mention difficulties in the successful application of these guidelines. Flaws in hygiene practices were shown in most of these episodes, especially for the wearing of masks in the delivery room.

4.6.7 References


4.7 MATERNAL MORTALITY AND ANESTHESIA

D. Chassard, D. Fillette and F. Mercier

4.7.1 Analysis of new cases

The ratio and number of deaths associated directly with anesthesia are low. The first French report published for the period 1996-1998 described a woman who died from Mendelson syndrome during general anesthesia for emergency surgery for a hemorrhage. This report found 4 deaths for 2001-2003 and 3 for 2004-2006, for a mean ratio of 0.14/100 000 live births.

The last two English reports also describe low maternal mortality directly attributable to anesthesia [1]. There were 6 cases for the period 2000-2002 (5.7%) and 6 for 2003-2005 (4.5%), which yields a mean ratio of 0.30/100 000 births, twice the French ratio.

We describe 5 cases in detail in this report, classified in 2 categories.

4.7.1.1 Allergic events

The first case is that of a 34-year-old woman, gravida 2 para 2, with a history of asthma, who gave birth rapidly and spontaneously to a liveborn child at 37 weeks of gestation. It was impossible to place an epidural as she had arrived at the maternity ward at 10 cm of dilatation. Placental retention led to a decision to attempt a manual uterine examination under general anesthesia, specifically a combination of propofol and succinylcholine (suxamethonium). Injection was followed immediately by tachycardia, an abrupt drop in blood pressure, and generalized erythema. Despite a well-conducted resuscitation, she died 12 h afterwards, with DIC, pulmonary edema, and kidney failure. Serum tryptase was almost 4 times the normal level (49 µg/L). After consultations with allergy specialists, the diagnosis was determined to be anaphylactic shock due to succinylcholine.

This is the first case of allergic shock to succinylcholine documented in obstetrics in several years in France. Although the resuscitation was performed correctly, the patient died. Questions could be raised about the need for a manual uterine examination under general anesthesia with intubation in this specific case (rapid sequence induction). The patient was not obese, the bleeding was moderate, and the patient had eaten less than 3 h earlier. Spinal anesthesia was probably a possible solution in this situation to avoid a difficult tracheal approach with a full stomach and the use of intravenous anesthesia with a highly allergenic potential. General anesthesia with spontaneous ventilation, therefore without curare, was not indicated in this situation.

The second cases was a nullipara aged 39 years, obese (BMI: 48), hypertensive, with type 2 diabetes that became insulin-dependent during pregnancy and Ventoline® (salbutamol)-sensitive asthma. Cesarean delivery under spinal anesthesia was planned because of the poor obstetric conditions. An epidural was placed when the spinal anesthesia failed. After delivery of the child, general anesthesia was induced because of persistent pain. After injection of Nesdonal® (thiopental) and Celocurine® (suxamethonium) for tracheal intubation, the patient developed bronchospasms complicated by electromechanical dissociation (pulseless electrical activity). The patient died less than 2 h later, despite intensive resuscitation. The autopsy revealed no cruric or amniotic embolisms or cardiac injuries. On the other hand, we note the presence of a significant level IgE for Celocurine, accompanied by a nearly normal tryptase rate. After consultations with specialists, the very probable diagnosis was determined to be anaphylactic shock due to succinylcholine. In addition, the physicians had suggested a diagnosis of gas embolism that might explain the severe cardiac disorders but this hypothesis could not be verified.

The third case was a 49-year-old woman, gravida 3, para 3 (cesarean for P1, vaginal delivery for P2), with a severe psychiatric history and placenta previa in this pregnancy. A cesarean with general anesthesia at 38 weeks of gestation was planned. A nurse-anesthetist in training intubated the esophagus during anesthetic induction with Celocurine® and Nesdonal®. Immediate detection of this error by the capnograph reading allowed the anesthesiologist to reposition the catheter in the trachea at once. Atracurium was then injected. Ventilatory difficulties persisted, and profound desaturation ensued, with an expired CO₂ level near zero. The correct position of the catheter was again verified, but arrhythmia and cardiac arrest followed. The still-born infant was delivered, and cardiovascular resuscitation performed according to guidelines, but the patient died quickly. The autopsy was negative. The physicians considered a diagnosis of anaphylactic shock. Assays were performed soon after the accident (approximately 30-45 minutes). Tryptase was 12 µg/mL, and the results for IgE for curare were of intermediate significance. The esophageal intubation does not appear to have played a role in this patient's death. In conclusion, there is a strong suspicion that this case involved an allergy to curare.

4.7.1.2 Accidents associated with the airway approach

The fourth case involved a 30-year-old woman with several previous pregnancies, admitted to the ER for confusion and fever. A lumbar puncture and blood work-up showed pneumococcal meningitis. Generalized seizures and cyanosis developed rapidly. She was intubated with a Sellick maneuver and an injection of Pentothal® (thiopental) and Celocurin®. Immediately after intubation (verification of catheter position by auscultation), a bronchospasm occurred, together with...
hemodynamic instability and circulatory failure; ECM was performed and adrenaline administered. ECM continued as the patient was transferred to surgery. On arrival, manual ventilation was necessary because of the bronchospasms, oxygen saturation (SpO₂) of 56%, and a capnograph with undetectable CO₂. A girl (Apgar 3 then 5) was extracted. The patient died during the cesarean. Urinary trypstat was negative in the early phase, and the rest of the lab results were not found in the file. Two diagnoses were considered: esophageal intubation or allergy to any of an anesthesia product, latex, or an antibiotic.

The last of these deaths was of a 33-year-old woman, gravida 3, para 3, who gave birth by vaginal delivery at 40 weeks, with epidural anesthesia. A PPH required a hysterectomy, this time under general anesthesia. Myocardial failure then required a left ventricular assistance device (Thoratec®). This assistance was removed on D20 but the patient remained intubated for continued ventilation. During an episode of agitation, she pulled the tube out; reintubation was difficult and Mendelson’s syndrome occurred. The patient died immediately of this complication, although her cardiac status had been improving. This case reminds us that Mendelson’s syndrome exists not only during anesthesia induction but also in resuscitation. The file does not describe the conditions of reintubation in detail, but obviously the rules about intubation on a full stomach also apply to resuscitation. Moreover, prolonged intubations are also accompanied by vocal cord dysfunction, which complicates the situation.

### 4.7.2 Synthesis

The number of deaths related to anesthesia is higher than in the last report but this report also covers a longer period: 2001-2006. Five of 311 deaths were directly attributable to anesthesia. All were classified as avoidable.

We observe the appearance of anaphylactic shock as a cause of maternal mortality, although it was not mentioned either in the preceding series or in the last English reports. CEMACH’s 2000-2002 report did describe one death from anaphylactic shock in a patient undergoing curettage at the very beginning of pregnancy, with anesthesia combining succinylcholine and propofol: the attributability of the death to shock is uncertain; only trypstat was assayed, but not curare IgE. Five cases of non-fatal anaphylactic shock (incidence 0.03/1000 pregnancies) were reported in the 2003-2005 report; neither their specific causes nor the term at occurrence was mentioned.

The cause of these accidents is an allergy to a curanform agent — succinylcholine. Allergy to curanform drugs is the leading cause of anaphylactic shock in anesthesia (60%) and occurs in approximately 1/6500 anesthesia inductions that use these drugs [2]. Several case reports have described anaphylactic shock in late pregnancy or during a cesarean. Among pregnant women, in order of descending frequency, the most allergic agents are latex, antibiotics, and occasionally muscle relaxants (succinylcholine), oxytocin, and ranitidine [3-4]. Nonetheless these data must be interpreted cautiously in view of the lack of a prospective study.

The clinical signs in pregnant women are not different from these in the general population: hypotension, cutaneous signs, and bronchospasms. The risk is maternal but especially fetal (cerebral anoxia because of hypotension); for this reason an emergency cesarean is often proposed to save the child if fetal bradycardia persists. On the other hand, if the fetal heart rate recovers at the same time as the mother’s, rushing into a cesarean, which could cause new complications, does not seem useful if vaginal delivery is still possible [5-6].

The treatment of allergic shock by a vasopressor agent in a woman at the end of pregnancy is logical but in this case it raises numerous questions about its effects on uterine flow. Many authors recommend ephedrine in first line over adrenaline precisely because of the former’s lesser alpha-adrenergic effect on uterine artery flow. The dose of ephedrine is 10 mg IVP every 1 to 2 min (total dose 0.7 mg/kg) associated with fluid resuscitation and a lateral left decubitus position. If this is ineffective or if the collapse is major from the outset, adrenaline should be used (100 mcg IVP, to be repeated up to 1 mg, and then continuous infusion) [5,7]. Initial resuscitation by adrenaline is proposed because it corrects the blood pressure and therefore the uterine flow much more rapidly. An etiological investigation is essential to identify the agent responsible and is based on assays of trypstat, leukotrienes, and specific IgE in the blood. Plasma histamine is not useful at the end of pregnancy because of the strong histaminase activity of the placenta [8]. These assays must be performed if possible before death [9]. When death follows shock rapidly, the investigation is much more difficult because cutaneous tests are no longer possible. An autopsy and the clinical context are sometimes the only items that indicate anaphylactic shock.

The other 2 deaths were more usual, as they were due to the problem of airway approach in pregnant women, with the risk of difficult intubation (8 to 10 times more frequent) and the standard risk of Mendelson syndrome. The indications for intubation in this series were not always obvious; they must be weighed carefully in pregnant women. There is always a risk of Mendelson syndrome on a full stomach. In many cases, local or regional anesthesia may be performed, and it is essential not to rush to general anesthesia if it fails. It is better to ensure that the regional anesthesia is effective before beginning the surgical procedure rather than have to complete it with IV agents. New techniques such as the instillation of local anesthetics in the surgical site are now proposed if regional anesthesia turns out to be only partially effective as surgery advances. Nonetheless, it is sometimes necessary to change to general anesthesia, because it is unacceptable to perform a cesarean when regional anesthesia is incomplete.
The last case may illustrate the dangers of precipitation. Was it really necessary to reintubate the patient immediately? Often, self-extubations in resuscitation should be monitored to see if the patient was not finally right to pull the tube out. Our criteria for extubation are sometimes found wanting in one way or another, and it is possible to be pleasantly surprised to see a patient tolerate extubation even though the predictive criteria and weaning tests were not yet perfect. This case also demonstrates that circulatory assistance is a technique that should be considered in patients with major heart failure, as occurs sometimes during cardiopulmonary embolisms or peripartum cardiomyopathies.

4.7.3 Recommendations

Rapid sequence induction of anesthesia with succinylcholine is used for general anesthesia with tracheal intubation in obstetrics. Nonetheless, whenever it is possible, a regional technique should be considered for pregnant women.

In a state of shock, it is essential to take blood samples for the secondary diagnosis of this allergy. A kit for blood samples for severe allergies and suspected AFE should be ready in every maternity ward.

France must work to develop the practice of systematic autopsies for maternal deaths. In many cases they can support or rule out clinical diagnoses that are often only hypothetical.

4.7.4 References

4.8 INDIRECT OBSTETRIC CAUSES

Daniel Fillette, Frédéric Mercier and Serge Favrin

Maternal deaths from an indirect obstetric cause are those that "result... from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy".

Over the period 2001-2006, 129 deaths from indirect obstetric causes (2.7/100 000 live births) were recorded, and 112 could be appraised (86.8%). Although they are included in the indirect causes, strokes (36 cases) were studied separately and will not be treated here.

Among the indirect causes assessed by the Committee, we distinguish: cardiovascular disease: 30; bronchopulmonary disease: 10; cancer: 10; psychiatric disorders: 2; and other diseases: 24. Within this set of very dissimilar deaths, the Committee analyzed the management for 62 cases including 42 unavoidable deaths (67.7%) and 20 deaths that were preventable or possibly preventable (32.3%). Care was considered to have been non-optimal in two thirds of the cases.

The deaths from cardiovascular causes were the most frequent. They can be classified in several etiological groups (listed here in decreasing order): 17 deaths were associated with a heart disease, including 6 deaths in patients with pulmonary arterial hypertension and 2 from myocardial infarction; 13 deaths were related to a vascular disease — arterial dissections or aneurysms.

The 24 “other diseases” (preexisting or appeared during pregnancy) were very disparate: diverse infections: 3; sickle-cell anemia: 2; lupus: 2; juvenile rheumatoid arthritis: 2; and malaria: 2. To these 11 deaths should be added the following 13, due to: thrombotic process, intestinal ischemia, thyrotoxicosis, diabetes, Still disease, intestinal obstruction, rupture of splenorenal anastomosis, metabolic disorders, hypokalemia, Guillain-Barre syndrome, thrombotic thrombocytopenic purpura, rupture of a hepatic adenoma, and a pulmonary embolism. The last case involved an obese 42-year-old woman 4 weeks pregnant, with thrombophlebitis in one leg. The experts considered this to be an indirect obstetric death.

### 4.8.1 Cardiovascular diseases

<table>
<thead>
<tr>
<th>Vascular disease</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic artery aneurysm</td>
<td>3</td>
</tr>
<tr>
<td>Renal artery aneurysm</td>
<td>1</td>
</tr>
<tr>
<td>Aortic dissections</td>
<td>7</td>
</tr>
<tr>
<td>Aortocaval tear (neurofibromatosis)</td>
<td>1</td>
</tr>
<tr>
<td>Ehlers-Danlos syndrome (type IV)</td>
<td>1</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarct</td>
<td>2</td>
</tr>
<tr>
<td>Valvulopathies</td>
<td>3</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>1</td>
</tr>
<tr>
<td>Myocardiopathy</td>
<td>1</td>
</tr>
<tr>
<td>Heart failure without known cause</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary artery hypertension (PAH)</td>
<td></td>
</tr>
<tr>
<td>Idiopathic</td>
<td>2</td>
</tr>
<tr>
<td>Eisenmenger's syndrome</td>
<td>2</td>
</tr>
</tbody>
</table>

With a total of 29 deaths (37%), cardiovascular complications were the leading indirect cause of maternal deaths. Vascular accidents by dissections and ruptured aneurysms were most frequent, with 12 cases. Among these,

- 4 ruptured aneurysms were assessed, 3 of the splenic artery and 1 of the renal artery;
- Eight patients died after aortic dissection: the thoracic aorta in 7 cases and a torn aorta and subrenal vena cava in a patient with neurofibromatosis;
- A final death was due to dissection of the iliac vessels in a woman with type IV Ehlers-Danlos syndrome.

Their mean age was 37.8 years, excluding the deaths associated with Marfan disease (28 years) and Ehlers-Danlos syndrome (30 years). No patient was morbidly obese. Smoking information was not routinely collected.

These deaths were considered unavoidable and to have had optimal care, except for 1 woman with known aortic ectasia who had been followed for 3 years. Cardiologic monitoring during pregnancy did not lead to the implementation of a disease-modifying treatment. At 26 weeks she was transferred from a local to a university hospital for premature rupture of the membranes. Salbutamol was prescribed for 1 month. At 29 weeks, ultrasound showed that the aorta had increased in size to 63 mm. She reported chest pain and dyspnea that disappeared spontaneously. A planned cesarean under spinal anesthesia delivered a healthy 1900-g girl. The immediate postoperative course was simple. On D1, however, she reported spasmodic epigastric pain and anxiety. A thoracoabdominal CT scan showed a complete aortic dissection. The patient was transferred for the placement of an aortic prosthesis, but she died in the postoperative period.

This death was considered avoidable for several reasons: the patient was not followed in an appropriate facility, she did not receive disease-modifying treatment with β-blockers, the β-mimetic (salbutamol) might have aggravated her condition, and appropriate ultrasound monitoring did not take place.
The increased cardiac output and the weakening of the vascular tissue induced by progesterone increase the risk of vascular dissection during pregnancy. Half of all vascular dissections in women younger than 40 years appear during pregnancy or in the postpartum period. These 6 women had a high mean age of 37.8 years, suggesting that late pregnancies are more exposed to this type of complication.

In the particular case of Marfan disease, management is well defined. A preconceptional consultation should make it possible to assess the risks involved and inform the patient of them. Ultrasound monitoring and β-blocker treatment must be added to the obstetric monitoring. All must continue into the postpartum period [1].

For Ehlers-Danlos syndrome, management must be multidisciplinary [2]. With an incidence of 1/50 000 births, a hereditary collagen disorder must be sought if there is a family or personal history of repeated hemorrhage or any disorder suggestive of tissue weakness.

Although no deaths from this cause were described during this study period, the vascular risk of patients with Turner syndrome and pregnant after an oocyte donation fits in this framework [3]. CNGOF has proposed guidelines [4] specifying the contraindications to pregnancy in these patients, the components of medical acceptance of the pregnancy, the appropriate prenatal monitoring, and the creation of a registry [4].

Although patients with collagen disorders are known to be at very high risk of vascular dissection, we note that 6 of these 9 deaths occurred in women without such a disease but who instead had a late pregnancy.

4.8.1.1 Cardiac diseases

Cardiac diseases vary, and we did not observe the predominance of any particular disease, contrary to the 2003-2005 United Kingdom enquiry, which found 12 deaths due to myocardial infarction, which was thus the leading cause of maternal mortality from heart disease [5].

In the CNEMM 2001-2006 enquiry, we found 11 deaths from cardiac diseases, only 2 of which were linked to a myocardial infarction.

4.8.1.2 Pulmonary artery hypertension

PAH was responsible for 6 deaths. Two involved Eisenmenger syndrome and the others idiopathic PAH. Most were young women, with a mean age of 24.8 years; one was 39 years old.

A single death was perhaps avoidable. Care was considered to have been non-optimal in 3 of the cases, however. Two women refused to terminate their pregnancy. At a gestational age of 19 weeks, the third had a cardiac arrest during termination, 10 minutes after the induction of anesthesia. She had a heart murmur and a history of syncope. These factors had not been considered.

Pregnancy is contraindicated in women with severe PAH, to whom pregnancy termination should be suggested. The risk of maternal death from PAH is on the order of 30 to 50%. Assessment of its severity is complex and should include consultation with the regional reference center for this disease. Multidisciplinary management is essential. It could be helpful to perform a cesarean in the immediate vicinity of a cardiovascular surgery unit. More and more specialized teams consider that a titrated regional anesthesia (epidural ± intrathecal sufentanil) is preferable to general anesthesia. The latter is often tolerated very poorly because of the hemodynamic effects of the intubation and of the positive pressure mechanical ventilation required in this setting [6]. If general anesthesia is used, it should not include nitrogen protoxide, high doses of halogenated agents, ketamine, or etomidate. Moreover adrenaline in situ, syntocinon and nonsteroidal anti-inflammatory drugs are all contraindicated.

4.8.2 Neoplasia

<table>
<thead>
<tr>
<th>Neoplasm</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast cancer</td>
<td>6</td>
</tr>
<tr>
<td>Melanoma</td>
<td>2</td>
</tr>
<tr>
<td>Glioblastoma</td>
<td>1</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1</td>
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</tbody>
</table>

Breast cancer was discovered during pregnancy in 4 cases. One received chemotherapy in her fifth month of pregnancy; hepatic and vertebral metastases were diagnosed at delivery, and she died 7 months later. In the other 3 cases, the diagnosis was made at the end of pregnancy with the appearance of hepatic metastases, elevated blood calcium, and kidney failure. The deaths occurred in the 15 days to 3 months after delivery and resulted from multiple organ failure.

Two women had previously had breast cancer. For one the lesion had been treated by surgery, radiation therapy, and chemotherapy 10 years before the pregnancy. Pleural metastases appeared 4 years before this pregnancy. Respiratory failure during the cesarean required respiratory assistance until death. The other had neglected a nodule discovered on her breast several months before the pregnancy; at delivery she had jaundice, ascites, and hepatic metastases of the breast cancer.

Breast cancer is the second leading cause of death in women aged 18-27 years and its frequency during pregnancy is increasing, due, according to some, to the increasing number of late pregnancies. It is the cancer most often diagnosed during pregnancy, with a frequency of 1/3000 to 1/10 000 pregnancies and an estimated incidence of 0.2-3.8%.

The influence of pregnancy on the onset or aggravation of all types of cancer has not been clearly established. The incidence of cancers in pregnant women is half that observed in women who are not pregnant. This finding
suggests that pregnancy may protect against the risk of cancer. This statement must be qualified for the hormone-dependent cancers, where pregnancy may accelerate tumor growth.

It has been established that multiparity, young age at first pregnancy, and breast feeding are associated with a reduced risk of breast cancer.

Pregnancy after treated breast cancer is not a risk factor considered to aggravate the prognosis. Epidemiologic evidence nonetheless suggests that there may be a dual relation between the onset of breast cancer and pregnancy: first a transient increase in the risk of cancer, maximal for 2 to 5 years after delivery, followed by a regular diminution of this risk.

Clinical practice guidelines were issued on management of these cancers during pregnancy in 2008 [7]. They insist especially on the importance of close monitoring of the pregnancy, because clinical diagnosis is difficult and diagnostic delay frequent. They also stress the usefulness of a specific national registry.

4.8.3 The special case of thrombotic thrombocytopenic purpura (TTP)

This 31-year-old woman, gravida 2, para 2, had lost her first child at the age of 1 month. She was allergic to penicillin and josacine (a macrolide antibiotic). At 8 months of gestation, her platelet count was 145.10^9/L. At a gestational age of 36 weeks and 6 days, labor began; the platelet count at that time was 17.10^9/L. A healthy child was born by a normal vaginal delivery.

HELLP syndrome was suggested by the combination of thrombocytopenia, transaminases at twice the normal level, moderate albuminuria, and regenerative hemolytic anemia. On D1, treatment combined transfusion of packed red blood cells and platelets and corticosteroid therapy. The thrombocytopenia worsened until D5, to 2.10^9/L. On platelets and corticosteroid therapy. The combined transfusion of packed red blood cells and normal level, moderate albuminuria, and of thrombocytopenia, transaminases at twice the HELLP syndrome was suggested by the combination of vaginal delivery.

The experts considered that this death was avoidable to the extent that the wrong diagnosis had led to inappropriate treatment. The platelet transfusion was not indicated and probably aggravated her condition, which would have benefited instead from plasmapheresis.

TTP is a rare cause of thrombocytopenia. The microthrombotic events of TTP are essentially neurological: confusion, headaches, ocular events, paresis, and sometimes convulsions and coma. These neurological effects are present in 75% of the cases and are associated with kidney failure and fever in 40%. The reduction in the platelet level is most often intense and sudden, as this case shows. It is therefore essential to collect the information necessary for diagnosis to be able to implement plasmapheresis, the efficacy of which is established [8].

4.8.4 Conclusion

The indirect causes of deaths remained much less numerous than the direct causes, contrary to the recent British enquiry in which indirect causes predominated.

More than one third of these deaths had a cardiovascular cause. Vascular dissections and pulmonary hypertension were the principal causes of cardiac deaths; the latter has been the object of recent progress in management. Most of the deaths from arterial dissection occurred in older mothers. There were very few deaths from coronary events.

Our data do not show that obesity, diabetes or smoking can be labelled promoting factors.

Although most of these deaths were considered unavoidable. When quality of care was qualified as non-optimal, it was related principally to diagnostic and treatment errors and to management in inappropriate facilities.

For these pre-existing diseases, it is useful to recall the importance, whenever possible:

- of planning the pregnancy;
- of referral to the relevant specialists or at least consulting them for their opinion;
- of organizing referrals, orientation, and management from the outset.

4.8.5 References

5. A conclusion in the form of highlights

Maternal mortality diminished regularly in France from 2001 through 2006. The current corrected ratio is 9.6 [8.7–10.5] per 100,000 live births.

The incidence of maternal mortality is similar to that of the United Kingdom and the Netherlands, but the causes are different: hemorrhages remain the leading cause, accounting for 22% of maternal deaths, a ratio of 2.1/100,000 births, twice that of the UK; the second leading cause is AFEs (12.3%), followed by complications of hypertension and thromboembolic events (9.9% each).

Important and statistically significant disparities exist between geographic areas. The ratio in the overseas departments (30.95/100,000 live births) is four times higher than in the regions of metropolitan France (7.5/100,000) minus Ile-de-France, where it is 11.6.

Women's age remains a factor that increases the likelihood of maternal complications, irrespective of her social situation or place of residence. The mean age of the women who died exceeded 35 years, compared with 30 years for all women giving birth. Similarly, the probability of fatal maternal complications is increased by the intense desire for pregnancy in some couples, despite definite medical contraindications (some severe forms of heart disease, rare diseases, etc.). It should also be noted that oocyte donation in older women can be fatal: 2 maternal deaths in women aged 47 and 49 years were recorded.

These observations lead us to repeat once again that in some situations specific information describing the risks involved must be provided to women and their partners before conception.

Non-optimal care remained frequent even though too few of the enquiry files were completed in sufficient detail. We continue to lack the specific data, available at the source, in particular the prenatal monitoring data and obstetrical files are often missing or of poor quality, and there are too few autopsies. To attempt to remedy some of these problems, a new system was set up in 2009. It involves the perinatal health networks more closely and should cover all potential maternal deaths, present and future. Pregnancy monitoring should be better recorded in patient files so that they can be analyzed and appropriate improvements proposed.

Many complications could have been managed differently, especially PPHs, by applying the guidelines published by CNGOF/HAS in 2004.

The Committee points out that all maternity units must be able to provide patients who are actively bleeding, especially during or immediately after a cesarean, with any necessary initial emergency surgery for hemostasis, before transfer to a reference center.

The detection of seriousness remains inadequately documented and undermines the effectiveness of management. Thus, several patients died after returning to their original department, after emergency treatment in the delivery or operating room, for serious forms of pregnancy related toxemia or obstetric hemorrhages. The Committee observed that close monitoring of these women in a continuous care unit or ICU was not considered. It also noted that the severity of the patients’ condition was frequently underestimated, probably related to the fact that the standard severity scores are unsuitable for pregnant women.

To improve patient safety, the Committee recommends the definition of criteria for enhanced surveillance tailored to the women in the peripartum period and the combination of obstetric surveillance with surveillance by anesthesiologists. The Committee also recommends that beds designed specifically for continuous monitoring or intensive care be developed in a specific well-defined site.
### Appendix 1 - Regional Assessors in Obstetrics and Anaesthesia

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<th>Clinique Saint jean  Toulon</th>
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### OBSERVATIONS

**Antécédents médicaux**
Indiquer comment ils ont été pris en charge, les décisions prises (surveillance plus importante de la grossesse actuelle, traitement...)

**Antécédents obstétricaux**
Indiquer comment ils ont été pris en charge, les décisions prises (surveillance plus importante de la grossesse actuelle, traitement...)

### III. ANTÉCÉDENTS DE LA FEMME AVANT LA GROSSEUR CONSIDÉRÉE

1) **Antécédents médicaux**
   
   Si oui, lesquels :
   
   1. Hypertension
   2. Diabète
   3. Maladie thrombo-embolique
   4. Autre(s), à préciser:

   Compléter la carte ci-contre

2) **Tabac**
   
   Plus ou pas de 6 cigarettes par jour :
   
   - avant la grossesse (0 : non, 1 : oui)
   - pendant la grossesse (0 : non, 1 : oui)

   Alcool :
   
   Plus ou pas de 2 verres par jour (0 : non, 1 : oui)

   Toxicomanie :
   
   Si oui, quel type de drogues :

3) **Antécédents obstétricaux**
   
   Si oui, remplir le tableau ci-dessous et se reporter au centre

<table>
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<tr>
<th>Grossesses antérieures et comprises les interruptions et F.I.U.</th>
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<tbody>
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<td>Année</td>
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* Grossesses antérieures, avortement spontané, prématuré, accouchement prématuré, décès de l'enfant, grossesse jumelé ou multiple.
### Consultations au cours de la grossesse

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<td></td>
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<td>RIAS, avis demandé à spécialiste, changement d’établissement de surveillance prénatale, hospitalisation dans l’établissement d’inscription, hospitalisation dans un autre établissement, raison médicale.</td>
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</table>

IV. HISTOIRE DE LA GROSSESSE CONSIDÉRÉE

1) Établissement où la femme est arrivée pour accoucher

- Nature :
  1. CHU/CHS
  2. Centre hospitalier général
  3. Etablissement privé participant au service public
  4. Clinique privée
  5. Autre, préciser :  

- Nombre annuel de naissances dans l’établissement:  

- Un gynécologue obstétricien est-il présent dans l’établissement :
  1. oui
  2. non

- Un anesthésiste-réanimateur est-il présent :
  1. dans le service de gynécologie obstétrique
  2. dans le service de chirurgie de l’abdomen
  3. dans le service de réanimation

- Si oui, est-il d’horaire :
  1. de jour
  2. de nuit

- Si un anesthésiste-réanimateur n’est pas présent sur place :
  1. de jour
  2. de nuit

- Une consultation d’anesthésie est-elle nécessaire :
  1. oui
  2. non

2) Date des dernières règles (jour, mois, annee) :  

3) Date prévue de l’accouchement (jour, mois, année) :

4) Grossesse simple ou multiple (indiquer le nombre) :

5) Consultations au cours de la grossesse :

Remplir le tableau ci-contre.
OBSERVATIONS

Risque particulier ou pathologie(s) grave(s) décédé au cours de la grossesse
Indiquer de façon détaillée la chronologie des événements et préciser de la façon la plus complète possible les examens pratiqués, les traitements entrepris ...

6) Pathologie et facteurs de risque de la grossesse actuelle
   (9 : non, 1 : oui)
   9) si oui, transfert* (0 : non, 1 : oui)

   8) MORT AU COURS DE LA GROSSESSE
      (0 : non, 1 : oui)
      8) si oui, transfert* (0 : non, 1 : oui)

   7) Autre et préciser :

   5) Hypertension artérielle
      (0 : non, 1 : oui)
      5) si oui, préciser :

   4) Infarctus du myocarde
      (0 : non, 1 : oui)
      4) si oui, préciser :

   3) Anémie
      (0 : non, 1 : oui)
      3) si oui, préciser :

   2) Accident vasculaire cérébral
      (0 : non, 1 : oui)
      2) si oui, préciser :

   1) Diabète de type 1
      (0 : non, 1 : oui)
      1) si oui, préciser :

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**Tableau**

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<td>Vomissements incontrôlables</td>
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<td>Toux sévère inespérée</td>
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<td>04</td>
<td>Edème ou oedème</td>
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<td>Tumeur maligne neurologique</td>
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*T : transfert signifie le passage d'une service à un autre service à l'intérieur d'un même établissement, ou d'un établissement à un autre.
V. TERMINATION DE GROSSESSE AVANT LE TRAVAIL

Détaillez les cas ci-dessous :

1) Date de la termination (jour, mois, année) :

2) Durée de gestation (en semaines d'aménorrhée) :

3) Nature de la termination de grossesse :
   1 : interruption médicale
   2 : interruption volontaire
   3 : interruption spontanée
   4 : grossesse multiple
   5 : grossesse évolutive (enceinte)
   6 : G.E.U.

   En cas de G.E.U. :
   - lieu du premier examen :
   - lieu du diagnostic :
   - par qui le diagnostic a-t-il été fait :
   - par qui(s) régie(s) a-t-il été fait :

4) Lieu de la termination :
   1 : maternité
   2 : service de chirurgie
   3 : centre I.V.G.
   4 : domicile
   5 : autre, préciser :

5) État clinique à l'arrivée :

6) Traitement entrepris, intervention pratiquée :

7) Y a-t-il eu anesthésie ?
   Si oui, remplir la fiche correspondante (page 19)
OBSERVATIONS
Si l'accouchement n'a pas eu lieu dans l'établissement où la femme avait prévu d'accoucher, indiquer les raisons de ce changement :

VI. ACCOUCHEMENT ET SUITES DE COUCHES

1) Etablissement où a eu lieu l'accouchement
   Possibilités : 1 : CHU CHR
                  2 : Centre hospitalier général
                  3 : Etablissement privé participant au service public
                  4 : Clinique privée
                  5 : Autre, à préciser :

2) Nombre annuel de naissances dans le service :

3) Etablir l'établissement où la femme avait prévu d'accoucher (O : non, 1 : oui) :
   si oui, situer ci-contre :

4) Un gynécologue obstétricien est-il présent dans le service :
   1 : de jour, 2 : de nuit
   si non, est-il d'astrerie : 1 : de jour, 2 : de nuit

5) Un anesthésiste-réanimateur est-il présent :
   dans le service du gynécologue obstétricien :
   0 : non, 1 : de jour, 2 : de nuit
   ou pour l'ensemble de l'établissement :
   0 : non, 1 : de jour, 2 : de nuit

6) Si un anesthésiste-réanimateur n'est pas présent sur place :
   est-il d'astrerie pour l'ensemble de l'établissement :
   1 : de jour, 2 : de nuit
   ou pour le service de gynécologie-obstétrique exclusivement :
   1 : de jour, 2 : de nuit

7) Une consultation d'anesthésie est-elle :
   1 : Proposition systématiquement à toutes les femmes enceintes
   2 : Proposition si pathologie associée ou intervention prévue
   3 : Fait lors de la transmission ou de l'accouchement

8) Y a-t-il dans l'établissement :
   une banque ou un dépôt de sang (O : non, 1 : oui)
   une radiologie interventionnelle (O : non, 1 : oui)
   un laboratoire d'analyses médicales (O : non, 1 : oui)

Début et déroulement du travail

2) Date et heure d'arrivée en salle de travail :
   Heure de l'accouchement :

3) Âge gestationnel (en semaines d'aménorrhée) :

4) Rappel des antécédents médicaux :

5) L'éve nue du début du travail (en heure et minute) :

### Observations

Pathologie(s) grave(s) en cours de travail et thérapeutiques particulières mises en œuvre.

- Début du travail : 1 : spontané  2 : provoqué
  - en cas de travail spontané :
    - durée du travail en heures :  
    - de la phase de béance :  
    - de la phase active :  
    - de l'expulsion :  

  - en cas de déclenchement provoqué, indiquer par quelle(s) méthode(s) et pourquoi :
    1 : rupture antérieure des membranes  
    2 : oxytocines  
    3 : prostaglandines  
    4 : césarienne  
    5 : autre, à préciser

  - Indiquer les raisons :  

- Date et heure de rupture des membranes :  

- Surveillance du travail :
  - partogramme (0 : non, 1 : oui)  
  - Si possible, joindre une photographie

- Pathologie(s) en cours de travail :
  0 : non  1 : oui

| 09 | Hyperthermie > 38°C |
| 10 | Hypertonie artérielle |
| 11 | Hyperthermie intraopératoire |
| 12 | Cécité  
| 13 | Cécité  
| 14 | Cécité  
| 15 | Cécité  
| 16 | Cécité  
| 17 | Complication cardio-vasculaire  
| 18 | Complication neurologique  
| 19 | Complication psychiatrique  
| 20 | Complication digestive  
| 21 | Complication endocrinienne  
| 22 | Complication hématologique  
| 23 | Autre, préciser  
| 30 | Dysrhythmie cardiaque  
| 31 | Dysrhythmie tachioïde  
| 32 | Dysrhythmie atrio-ventriculaire  
| 33 | Dysrhythmie ventriculaire  
| 34 | Dysrhythmie auriculaire  
| 35 | Dysrhythmie auriculo-ventriculaire  
| 36 | Dysrhythmie ventriculo-auriculaire  
| 37 | Dysrhythmie ventriculaire  
| 38 | Dysrhythmie ou atrio-ventriculaire  
| 39 | Dysrhythmie auriculo-ventriculaire  
| 40 | Dysrhythmie auriculo-ventriculaire  
| 41 | Dysrhythmie ventriculo-auriculaire  
| 42 | Dysrhythmie ventriculaire  
| 43 | Dysrhythmie auriculo-ventriculaire  
| 44 | Fatigue maternelle  
| 45 | Aubaine maternelle  
| 50 | Disproportion bêta-périmètre  
| 55 | Ulcération  
| 60 | Césarienne de principe, après début de travail spontané  
| 61 | Césarienne de secours  
| 62 | Césarienne de répétition |
### OBSERVATIONS

**Complications au moment de la naissance**

**Complications au moment de la délivrance**

### Naissance

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>12) Date et heure de l'accouchement</td>
<td>par</td>
</tr>
<tr>
<td>13) Par qui l'accouchement a-t-il été effectué ?</td>
<td></td>
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<tr>
<td>14) Terminaison de la grossesse</td>
<td>1 : accouchement par voie basse, normal</td>
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<tr>
<td>15) Césarienne programmée réalisée en urgence</td>
<td>4 : césarienne programmée réalisée en urgence</td>
</tr>
<tr>
<td>16) Episiotomie (O : non, 1 : oui)</td>
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<tr>
<td>17) Nombre total d'enfant(s) né(e)s au cours de l'accouchement :</td>
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<td>18) État du nouveau-né</td>
<td>1er enfant</td>
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<tr>
<td>- vivant</td>
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<tr>
<td>- mort-né</td>
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<tr>
<td>- né vivant mort</td>
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<tr>
<td>- décédé dans les 24 h</td>
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<tr>
<td>- décédé entre 24 h et 7 jours</td>
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<tr>
<td>19) Sexe</td>
<td>M ou F</td>
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<td>20) Poids de naissance</td>
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### Délivrance

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
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<tbody>
<tr>
<td>20) Délivrance</td>
<td>1 : spontanée</td>
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<td>21) Rénovation utérine (O : non, 1 : oui)</td>
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<td>S'il/elle, pourquoi ?</td>
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Est-elle systématiquement effectuée dans le service ? : |

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
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<tbody>
<tr>
<td>22) Déchirure péritonéale</td>
<td>0 : non, 1 : dirigée, 2 : complétée, 3 : compliquée</td>
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<tr>
<td>23) Autres lésions traumatiques (O : non, 1 : oui)</td>
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<td>24) Examen du cœpus ou du placenta (O : non, 1 : oui)</td>
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<td>25) Anomalies du placenta (O : non, 1 : oui)</td>
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<tr>
<td>S'il/elle, préciser lesquelles ?</td>
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OBSERVATIONS

Pathologies de la délivrance
Indiquer quand la complication a été détectée, quand le diagnostic a été fait, quel traitement a été entamé

Pathologies dans les suites de couches
Indiquer quand la complication a été détectée, quand le diagnostic a été fait, quel traitement a été entamé

Décès pendant l'accouchement ou dans les suites de couches

26) Anomalies des menstruations (O : non, 1 : oui)
   Si oui, préciser lesquelles ?

27) Hémorragie de l'accouchement (O : non, 1 : oui)
   Remplir la fiche spécialisée (page 27) :

28) Y avait-il d'autres pathologies de la délivrance (O : non, 1 : oui)
   Si un exemple de pathologies graves, détailler ci-contre :

Suites de couches

29) Combien de temps la patiente est-elle restée en salle de naissance après l'accouchement (en minutes) :

30) Existe-t-il un dossier « surveillance du puerperium » (O : non, 1 : oui)

31) Pathologies dans les suites de couches (O : non, 1 : oui)
   Si oui, préciser lesquelles :

| 01 | Endométrite |
| 02 | Autre infection générale |
| 03 | Déhiscence de suture |
| 04 | Abcès de pariété |
| 05 | Infection urinaire |
| 06 | Autre complication urinaire |
| 07 | Lymphangite |
| 08 | Abcès du sein |
| 09 | Symptômes infectieux autres |
| 10 | Thrombose superficielle |
| 11 | Pneumothorax |
| 12 | Embolie pulmonaire |
| 13 | Hémorragie |
| 14 | Anémie |
| 15 | Complication cardio-vasculaire |
| 16 | Complication neuro-psychiatrique |
| 17 | Éclampsie |
| 18 | Autre, préciser |

Si l'il s'agit de HTA, éclampsie, hémorragie, infection ou embolie pulmonaire, remplir la fiche spécialisée correspondante.

Dans tous les cas, détailler ci-contre.

Si cette pathologie a entraîné un transfert, une anesthésie, une admission en réanimation, remplir les fiches correspondantes (pages 16, 17, 18).

Si la patiente est morte pendant l'accouchement ou dans les suites de couches, indiquer ci-contre quand la complication a été détectée, quand le diagnostic a été fait, et quel traitement a été entamé.
### Fiche Hospitalisation/Transport

**Indiquer de façon détaillée l'enchainement des hospitalisations et des transferts (d'ou passage en réanimation, en unité de soins intensifs ou en unité de surveillance continue intermittente pendant la grossesse, l'accouchement et la puericulture, ainsi que l'heure de la complication grave).** Indiquer le lieu d'hospitalisation ou du transfert en précisant la nature de l'établissement et de la structure ou service auxquels. En commentaires, préciser également si le transfert a été effectué en urgence ou pas, indiquer la qualité de la personne ayant pris la décision d’hospitaliser ou de transférer.

<table>
<thead>
<tr>
<th>Date et heure d'hospitalisation</th>
<th>Date et heure de transfert</th>
<th>Age gestationnel (SA)</th>
<th>Lieu d'hospitalisation</th>
<th>Motif et commentaires</th>
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### Fiche Anesthésie

1. Lieu où a été pratiquée l'anesthésie
   - bloc opératoire
   - salle de néonatologie
   - salle de réanimation
   - chambre d’hospitalisation

2. Surveillance et organisation
   - personnel anesthésiste
   - présence du médecin
   - service anesthésie
   - anesthésiste en charge de la réanimation néonatale
   - personnel anesthésie

3. Si anesthésie programmée, remplir et paragraphe:
   - Classe ASA (1-5):
   - Analgesie pour le travail
   - PAC III
   - infiltation de xyloïde
   - anesthésie locorégionale
   - anesthésie générale
   - anesthésie allongée
   - anesthésie continue

Complication:
- Incision
- Echec per ou inter
- Radiologue
- Bretèche
- Passage rétrograde
- Bretèche
- Lésion
- Nécrose

Autre complication, préciser : 

4. Date et heure :

5. Charte ASA (1-5) :

6. Analgesie pour le travail :

7. PAC III:

8. Infiltation de xyloïde :

9. Anesthésie locorégionale :

10. Anesthésie générale :

11. Anesthésie allongée :

12. Anesthésie continue :

13. Complication :

14. Incision :

15. Echec per ou inter :

16. Radiologue :

17. Bretèche :

18. Passage rétrograde :

19. Bretèche :

20. Lésion :

21. Nécrose :

22. Charte ASA (1-5) :

23. Analgesie pour le travail :

24. PAC III:

25. Infiltation de xyloïde :

26. Anesthésie locorégionale :

27. Anesthésie générale :

28. Anesthésie allongée :

29. Anesthésie continue :

30. Incision :

31. Echec per ou inter :

32. Radiologue :

33. Bretèche :

34. Passage rétrograde :

35. Bretèche :

36. Lésion :

37. Nécrose :

38. Charte ASA (1-5) :

39. Analgesie pour le travail :

40. PAC III:

41. Infiltation de xyloïde :

42. Anesthésie locorégionale :

43. Anesthésie générale :

44. Anesthésie allongée :

45. Anesthésie continue :

46. Incision :

47. Echec per ou inter :

48. Radiologue :

49. Bretèche :

50. Passage rétrograde :

51. Bretèche :

52. Lésion :

53. Nécrose :

54. Charte ASA (1-5) :

55. Analgesie pour le travail :

56. PAC III:

57. Infiltation de xyloïde :

58. Anesthésie locorégionale :

59. Anesthésie générale :

60. Anesthésie allongée :

61. Anesthésie continue :

62. Incision :

63. Echec per ou inter :

64. Radiologue :

65. Bretèche :

66. Passage rétrograde :

67. Bretèche :

68. Lésion :

69. Nécrose :

70. Charte ASA (1-5) :

71. Analgesie pour le travail :

72. PAC III:

73. Infiltation de xyloïde :

74. Anesthésie locorégionale :

75. Anesthésie générale :

76. Anesthésie allongée :

77. Anesthésie continue :

78. Incision :

79. Echec per ou inter :

80. Radiologue :

81. Bretèche :

82. Passage rétrograde :

83. Bretèche :

84. Lésion :

85. Nécrose :

86. Charte ASA (1-5) :

87. Analgesie pour le travail :

88. PAC III:

89. Infiltation de xyloïde :

90. Anesthésie locorégionale :

91. Anesthésie générale :

92. Anesthésie allongée :

93. Anesthésie continue :

94. Incision :

95. Echec per ou inter :

96. Radiologue :

97. Bretèche :

98. Passage rétrograde :

99. Bretèche :

100. Lésion :

101. Nécrose :

102. Charte ASA (1-5) :

103. Analgesie pour le travail :

104. PAC III:

105. Infiltation de xyloïde :

106. Anesthésie locorégionale :

107. Anesthésie générale :

108. Anesthésie allongée :

109. Anesthésie continue :

110. Incision :

111. Echec per ou inter :

112. Radiologue :

113. Bretèche :

114. Passage rétrograde :

115. Bretèche :

116. Lésion :

117. Nécrose :

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125. Anesthésie continue :

126. Incision :

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129. Bretèche :

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157. Anesthésie continue :

158. Incision :

159. Echec per ou inter :

160. Radiologue :

161. Bretèche :

162. Passage rétrograde :

163. Bretèche :

164. Lésion :

165. Nécrose :

166. Charte ASA (1-5) :

167. Analgesie pour le travail :

168. PAC III:

169. Infiltation de xyloïde :

170. Anesthésie locorégionale :

171. Anesthésie générale :

172. Anesthésie allongée :

173. Anesthésie continue :

174. Incision :

175. Echec per ou inter :

176. Radiologue :

177. Bretèche :

178. Passage rétrograde :

179. Bretèche :

180. Lésion :

181. Nécrose :

182. Charte ASA (1-5) :

183. Analgesie pour le travail :

184. PAC III:

185. Infiltation de xyloïde :

186. Anesthésie locorégionale :

187. Anesthésie générale :

188. Anesthésie allongée :

189. Anesthésie continue :

190. Incision :
4) Si anesthésie pour acte programmé, remplir ce paragraphe :
  - Généralités
    Date : __________/________/________ à ______ heures
    Classe ASA (1-5) : 
    Nature de l'acte nécessitant une anesthésie :
  - Type d'anesthésie :
    1 : Rénale ; 2 : Rénale générale
    3 : les deux combinés
  - Nature des produits (contenant le ou les produits utilisés) :
   ARGIN : 
    - Type :
      - Dose :
  - Nature des produits (contenant le ou les produits utilisés) :
    - Type :
      - Dose :
    - Autres actes à préciser :
      - intubation orotrachéale :
      - masque facial :
      - masque lancé :
      - anesthésie nature :
      - anesthésie de Sellick (0 : non, 1 : oui)

5) Si anesthésie urgente, remplir ce paragraphe :
  - Généralités
    Date : __________/________/________ à ______ heures
    Classe ASA (1-5) :
    Nature de l'intervention chirurgicale :
    Situation clinique au début de l'acte opératoire :
    Prise en charge initiale :
    Fréquence cardiaque :
    Sédations de remplissage ou produits sans intérêt en cours :
    1 : ouvert ; 2 : FPC ; 3 : Piqueure
    Prise de médicaments :
    Association médicamenteuse initiale de l'anesthésie :
    Antihypertenseur(s) et ou autres médicaments, à préciser :

4) Type d'anesthésie :
   1 : Rénale ; 2 : Rénale générale
   3 : Rénale générale/rénale combinée
   - Agents anesthésiques utilisés (en clair) :

   4 : Anesthésie générale, nature des produits (mentionner le ou les produits utilisés) :
    Pentothal
    Etanidazol
    Ketamine
    Morphine
    Type :
    - Dose :
    - Autres actes à préciser :
      - intubation orotrachéale :
      - masque facial :
      - masque lancé :
      - anesthésie nature :

6) Événements per-opératoires :
   - Complications respiratoires :
     - intubation difficile :
     - intubation impossible :
     - intubation sélective :
     - intubation avec stéthoscope :
     - SPO2 x 100 % pendant plus de 2' :
     - travail du coeur :
     - bronchospasme :
     - œdème parenchymate :
     - arythmie :
     - embolie gazeuse :

   - Complications hémostatiques :
     - Hémostase : 
     - paravasate :

   - Autres complications :
     - Hémorragie anormale :
     - Troubles de l'hémostase :

29
• Traitement des complications (plusieurs réponses possibles)
  1 : Oxygenothérapie
  2 : Intubation + ventilation mécanique
  6 : Agents adjuvants, préciser

8 : Remplacement vasculaire et transfusion :
Filtre/pompe et volumes

10 : Ligaturisation hypogastique 32 : Embolisation artérielle 61 : Anticoagulation :

Commentaire sur l'anesthésie
Si l'anesthésie a joué un rôle essentiel ou aggravant dans le décès, indiquer la chronologie des événements et joindre une copie de la ou des feuille(s) d'anesthésie.

---

**Fiche Embolie Pulmonaire**

1) Date et heure du décès :  
   - Jour :  
   - Mois :  
   - Année :  
   - Heure : 02 :  
   - Minute : 00 :

2) Les du diagnostic :
   - [ ] Diurésie
   - [ ] Douleur thoracique
   - [ ] Troubles du rythme cardiaque
   - [ ] Haematysie
   - [ ] Cœurs pulmonaire sigh
   - [ ] Choc avec hypotension
   - [ ] Syncope
   - [ ] Thrombose veineuse des membres inférieurs
   - [ ] Faites
   - [ ] Mort subite

3) Examen clinique ayant conduit au diagnostic :
   - Filtre de thorax
   - EOA
   - Gaz de sang normale
   - Ventilation pulmonaire de ventilation-perfusion
   - Angiographie (Obstruction ______ %)
   - Échocardiographie
   - Phlébographie
   - Échodoppler veineux des membres inférieurs

4) Examen d'urgence ayant permis d'affirmer le diagnostic :
   - [ ] Hémostatique
   - [ ] Anticoagulation instançante significative
   - [ ] Pénheits
   - [ ] Anticoagulation instançante

5) Traitement antitrombotique :
   - Durée :  
   - [ ] Hémostatique
   - [ ] Anticoagulation instançante
   - [ ] Pénheits
   - [ ] Anticoagulation instançante
   - [ ] Hémostatique
   - [ ] Anticoagulation instançante
   - [ ] Pénheits
**OBSERVATIONS**

Indiquer de façon détaillée la chronologie des événements, permettant de comprendre l'évolution du cas et préciser de façon plus complète les examens pratiqués, leurs résultats, les traitements reçus... Le cas échéant, si le compte rendu d'autopsie ne peut être joint, indiquer ci-dessous les conclusions principales.

6) Traitements associés
- Oxygène
- Dopamine/Dobutamine
- Fibrolytiques (urokinase, tPA)
- Autre, à préciser : ____________________________ 

7) Thrombose
- Cœur ventricle gauche
- Découverte à l'autopsie
- Décédé en postérité
- Décédé en postérité
- Décédé en postérité
- Autre, à préciser : ____________________________ 

8) L'encéphalopatie a-t-elle été confirmée à l'autopsie ?
(0 : non, 1 : oui)

S'il est nécessaire de rajouter les constats dans le cadre ci-cordon.
OBSERVATIONS

Indiquer de façon détaillée la chronologie des événements, permettant de comprendre l’évolution du cas et préciser de l’opinion prononcée, les examens pratiqués, leurs résultats...

FICHE HÉMORRAGIES GRAVES DU PER ET POST-PARTUM

1) Date et heure de l’identification de l’hémorragie : [ ] [ ] [ ] [ ] [ ] [ ] [ ]

2) Diagnostic en clair :

3) Lieu du diagnostic, à préciser :

4) Quantité de sang perdu, en ml :

5) Site de l’hémorragie :
   1 : Utérus 2 : Vagin 3 : Abdomen 4 : Autre, à préciser :

6) Durée de l’hémorragie en heure(s) et minute(s) :

7) Examen pratiqués : Indiquer heure et les résultats en clair en précisant les unités utilisées :
   - Hématocrite :
   - Hémoglobine :
   - Plaquettes :
   - Taux de prothrombine :
   - TCA ou TCT :
   - Fibrinogène :
   - d-Dimères ou complexes solubles :
   - Creatinine, diurèse :

   Date et heure 1er élan :
   Date et heure pancréas :
   Bilan à 24 h :

8) Détails ci-contre la chronologie des événements :

9) Remplissage :
   1 : Albumine 2 : Cristalloïdes 3 : Colloïdes

10) Y a-t-il eu transfusion (O : non, 1 : oui) :
   Si oui, préciser : le type de produits transfusés :
                     - le nombre de unités transfusées :

Détails ci-contre
### OBSERVATIONS

Indiquer, de façon détaillée, la chronologie des événements, permettant de comprendre l’évolution du cas et préciser de façon plus complète les décisions prises : traitement médical, chirurgical, transfert, ...

#### 10) Traitement médical :
- **Oxytocique**
  - Type :
  - Fosfocéglutérine
  - Type :
- **Anticonvulsivants**
- **Anticoagulants**
- Autre, à préciser :
  - Détail si contenu le traitement entrepris

#### 11) Traitement chirurgical :
- Réparation plaie génitale
- Résection utérine
- Embolisation artérielle utérine
- Ligature des hypogastriques
- Hystérectomie
- Autre, à préciser :
  - Détail si contenu le traitement entrepris

#### 12) Tension artérielle
- Niveaux minimum observés :
  - Date et heure :
  - Quel traitement a été entrepris (O : non, 1 : oui) :
  - Si oui, lequel ? :
  - Date et heure :
- Tension observée 1 heure après le début du traitement :

#### 13) Y a-t-il au passage en réanimation, en urgence, en salle intensifs ou en unité de surveillance continue (O : non, 1 : oui) Si oui, remplir la fiche nominative (Page 39)

#### 14) Prévention de l’hémostasie :
- Prescription de fer ou de ferroxyl (O : non, 1 : oui)
- Prescription de furosémide ou de diurétiques (O : non, 1 : oui)
- NFS du 0° mois (valorisé) :
- NFS en début de travail (valorisé) :
- Traitement par anticoagulants ou héparines à l’accouchement (O : non, 1 : oui)
- Défibrination chirurgie (O : non, 1 : oui)
OBSERVATIONS

Indiquer de façon détaillée la chronologie des événements, permettant de comprendre l'évolution du cas et préciser de façon plus complète les signes maternels et fœtaux manifestés, le traitement entrepris...

FICHE PRÉÉCLAMPSIES, SÉVÈRES, ÉCLAMPSIES ET HELLP

1) Accident au, date et heure :

2) Age gestationnel :

3) Tension artérielle :

   - Moment à laquelle on a observé le traitement de la pathologie gravidique :

   - Le traitement a-t-il été entrepris (0 : non, 1 : oui) :

   - Si oui, lequel :

   - Date et heure :

   - Tension observée 1 heure après le début du traitement :

4) La patiente a-t-elle manifesté :

   - Des mictions : (0 : non, 1 : oui)

   - Une oedème de la face : (0 : non, 1 : oui)

   - Des oedèmes de l'œdème : (0 : non, 1 : oui)

   - Des oedèmes abdominales basses : (0 : non, 1 : oui)

   - Des oedèmes de la tête : (0 : non, 1 : oui)

   - Des troubles de la vue : (0 : non, 1 : oui)

   - Une dyspnée : (0 : non, 1 : oui)

   - Une oedème : (0 : non, 1 : oui)

   - Une oligurie, préciser :

   - Une insuffisance rénale : (0 : non, 1 : oui)

   - Un œdème pulmonaire : (0 : non, 1 : oui)

   - Des convulsions : (0 : non, 1 : oui)

   Si oui, précisez la date et l'heure de début de la crise convulsive :

   Autres(s) signes(s) manifesté(s) par la femme, à préciser :

5) Signes fœtaux :

   - 0 : fœtus mort

   - 1 : fœtus vivant

   - Souffrance fœtale (0 : non, 1 : oui)

   Autres(s) signe(s)
OBSERVATIONS

Indiquer de façon détaillée, la chronologie des événements, permettant de comprendre l'évolution du cas, détailler l'évolution des résultats, les observations passées...

6) Examen pratiques (indiquer l'heure et les résultats en clair en précisant les unités utilisées)

<table>
<thead>
<tr>
<th>Date</th>
<th>Heure</th>
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</table>

- Protéines, hémoglobine, hématocrite, Urobilin, Creatinine, TCA ou TCT, D-Décalées du complexe activé, LDH, ASAT, ALAT, Hépatine

Détails concernant l'évolution des résultats:

7) Traitements
- Steroïdes
- Anticoagulants
- Antihypertenseurs
- Dérivés de la thyroïde
- Décoagulants
- Diurétiques
- Antiphospholipide
- Remplissage
- Vasodilatateurs
- Traitement symptomatique

8) Césarienne
- Néonatal
- Détails concernant le traitement et les décisions

9) Y a-t-il un HRP
- Oui

10) Y a-t-il eu un passage en réanimation, en unité de soins intensifs ou en unité de surveillance continue ?
- Si oui, remplir la fiche réanimation page 39
OBSERVATIONS

Indiquer de façon détaillée la chronologie des événements, permettant de comprendre l'évolution du cas, les examens pratiqués...

FICHE INFECTIONS GRAVES

(Le temps que pour les infections directement en rapport avec le décès)

1) Date et heure du diagnostic :

2) Diagnostic en clair :

3) Température

Température maximale observée :

Date et heure :

Température minimale observée :

Date et heure :

Un traitement a-t-il été entrepris ? (0 = non, 1 = oui)

Si oui, lequel ? :

4) Tachycardie

(0 = non, 1 = oui)

Difficultés respiratoires

(0 = non, 1 = oui)

5) Examens pratiqués (indiquer l'heure et les résultats en clair en précisant les unités utilisées)

<table>
<thead>
<tr>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Hérit</td>
</tr>
<tr>
<td>- Numération globules blancs</td>
</tr>
<tr>
<td>- PLT</td>
</tr>
<tr>
<td>- Hémoglobine</td>
</tr>
<tr>
<td>- Hématocrite</td>
</tr>
<tr>
<td>- Prothrombine</td>
</tr>
<tr>
<td>- TCA ou TCO</td>
</tr>
<tr>
<td>- D-Dimères</td>
</tr>
<tr>
<td>- ASAT</td>
</tr>
<tr>
<td>- ALAT</td>
</tr>
<tr>
<td>- Fibrinogène</td>
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<tr>
<td>- Célatrine</td>
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</tbody>
</table>

Compléter chaque case...
OBSERVATIONS

Indiquer de façon détaillée la chronologie des événements, permettant de comprendre l'évolution du cas, les traitements entrepris, les décisions prises...

9) Autres examens pratiqués

- Hémoculture
  - S'il y a eu hémoculture, préciser les germes :
  - (O : oui, non : 1 ; oui)

- Antibiogramme
  - (O : oui, non : 1 ; oui)

- Gamme du sang
  - (O : oui, non : 1 ; oui)

- Autres, à préciser :
  - (O : oui, non : 1 ; oui)

7) Y a-t-il eu :

- Chez septique
  - (O : oui, non : 1 ; oui)

- Atteintes hépatiques
  - (O : oui, non : 1 ; oui)

- Troubles de la coagulation
  - (O : oui, non : 1 ; oui)

- Insuffisance rénale
  - (O : oui, non : 1 ; oui)

- E.D.R.A.
  - (O : oui, non : 1 ; oui)

9) Traitements

- Anti-infectieux
  - (O : oui, non : 1 ; oui)

- Anticoagulants
  - (O : oui, non : 1 ; oui)

- Autres, à préciser :
  - (O : oui, non : 1 ; oui)

9) Y a-t-il eu passage en réanimation ou en unité de soins intensifs ou en unité de surveillance continue (O : oui, non : 1 ; oui)

(On ou non remplir la fiche manuscrite page 26)

10) Y avait-il une antibioprophylaxie systématique (O : oui, non : 1 ; oui)

- Pour éventuelle :
  - (O : oui, non : 1 ; oui)

- R.I.
  - (O : oui, non : 1 ; oui)

- Partage de streptococcus (O : oui, non : 1 ; oui)

- Autres, à préciser :
  - (O : oui, non : 1 ; oui)
<table>
<thead>
<tr>
<th>Complémentation et réanimation</th>
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</table>

**FICHE RÉANIMATION**

(A dupliquée si nécessaire)

1. Nature du service
   1. Unité de surveillance continue
   2. Unité de soins intensifs
   3. Unité de réanimation

2. Date et heure d'admission dans le service :

3. Moment de l'admission dans le service :
   1. Avant le travail (dans ce cas, préciser l'âge gestationnel en S.A. ____________)
   2. Au cours du travail (immediate < 24 h)
   3. Pendant les suites de couches < 42)

4. La patiente a bénéficié de transfert ? (Oui, non, oui)
   Si oui, remplir la fiche d'hospitalisation/ transfert (page 16)

5. État de la femme à l'arrivée :
   À préciser :

6. Score ISO (voir ci-contre)

7. Complication(s) ou diagnostic(s) à l'arrivée :
   À préciser :

8. Examen :
   - Cathétérisation Ganto (Oui, non, oui)
   - Pression capillaire systolique (Oui, non, oui)
   - Échographie cardiaque (Oui, non, oui)

9. Traitement en cours :
   1. antibiotiques
   2. anticoagulants
   3. vasopresseurs
   4. autres :
   À préciser :

10. Délai de transfert :
    1. Transfert en cours
    2. Transfert après l'intervention
    3. Transfert après l'intervention

11. Durée de séjour en réanimation (en jours) :

* Transfert signifie passage d'un service à un autre service de l'hôpital ou d'un établissement non-hospitalier ou d'un établissement à un autre.
CONCLUSION

Avis des assessors sur :

- L'enchaînement des événements ayant conduit au décès

- La cause du décès

-
### GROSESESSE

14) Cette femme était-elle suivie pour sa grossesse :  
0. Non  1. Oui  

15) La grossesse présente a-t-elle été obtenue par fécondation in vitro ?  
0. Non  1. Oui  

16) Nombre total d'échographies :  
I__I__I  

17) Une amniocentèse a-t-elle été réalisée :  
0. Non  1. Oui  

18) Hémorragie pendant le 2ème ou le 3ème trimestre :  
0. Non  1. Oui  


19) Hypertension pendant la grossesse (tension artérielle systolique ≥ 140 ou diastolique ≥ 90) :  
0. Non  1. Apparue pendant la grossesse  2. Présente avant la grossesse  

Si oui, précisez :  1. Sans protéinurie :  1  2. Avec protéinurie (≥ 0,3 g/l) : 2  

20) Rupture prématurée des membranes :  
0. Non  1. Oui  

Si oui, précisez :  (rupture au moins 12 heures avant le début du travail)  

21) Autre pathologie importante (diabète gestationnel, pathologie cardiaque, psychiatrique, ...) :  
0. Non  1. Oui  

Si oui, précisez :  

22) Hospitalisation au cours de la grossesse (en excluant l'accouchement ou le décès) :  
0. Non  1. Oui  

Si oui, précisez les raisons et l'âge gestationnel :  

Durée totale des hospitalisations (en jours) :  

23) Lieu de l'accouchement :  

24) Age gestationnel (en semaines révolues d'aménorrhée) :  

25) Début du travail :  
1. Spontané  2. Déclenché, précisez modalités :  (rupture artificielle des membranes, oxytocine, prostaglandines, ...)  3. Césarienne, précisez l'indication de la césarienne :  

Si césarienne, précisez combien :  

Pour toutes informations complémentaires vous pouvez contacter  
M.-H. BOUVIER COLLE, responsable de l'enquête, au 01 58 01 71 45 / 87  

| 1 |
26) Analgésie pour le travail:
0. Aucune  1. Péridurale  2. Rachianesthésie  3. Anesthésie générale  4. Autre, précisez:

27) Y-a-t-il eu des thérapeutiques particulières au cours du travail, telles que:

28) Accouchement :
1. Accouchement par voie basse non opératoire
2. Accouchement avec manœuvres instrumentales
3. Césarienne
Si césarienne, indication de la césarienne:

29) Naissance multiple :
0. Non  1. Oui, indiquez le nombre: __ __ __

30) État de l’enfant à la naissance :

31) Complications au cours du travail :
0. Non  1. Oui, détaillez (diagnostics, traitements, …):

32) Complications au cours de l’accouchement :
0. Non  1. Oui
Si oui, détaillez (diagnostics, traitements, …):

33) Complications dans la période du post partum :
0. Non  1. Oui
Si oui, détaillez (diagnostics, traitements, …):

34) Y-a-t-il eu transfert maternel :
0. Non  1. Oui
Si oui:
1. dans un autre service, précisez:
2. dans un autre établissement:
   1. CHU-CHR
   2. Centre Hospitalier Général
   3. Établissement privé participant au service public
   4. Clinique privée

Si transfert dans un autre établissement, dans quel service?

35) Préciser l’enchaînement des événements ayant conduit au décès:

36) Y-a-t-il eu anesthésie ?
0. Non  1. Oui, précisez:

37) Y-a-t-il eu transfert maternel pour réanimation ?
0. Non  1. Oui
Si oui, dans quel type d’unité:
1. unité de surveillance continue
2. unité de soins intensifs
3. unité de réanimation
4. Autre, précisez:

Duree du séjour (en jours):

38) Quel a été le diagnostic final?

39) Quels sont les examens ayant appuyé ce diagnostic?
1. Autopsie  2. Imagerie médicale  3. Autres méthodes, précisez:

40) Selon vous, existe-t-il un lien entre le décès et la grossesse de cette femme?
0. Non  1. Probablement  2. Certainement

NOUS VOUS REMERCIONS D’AVOIR COMPLETÉ CE QUESTIONNAIRE
SI CELA EST POSSIBLE MERCII DE JOINDRE LES COPIES ANONYMISEES DES PIECES IMPORTANTES DU DOSSIER (compte-rendu opératoire, examens biologiques, rapport d’autopsie, partogramme, enregistrement cardiotocographique, …)
MISE AU POINT

Épidémiologie de la mortalité maternelle en France, fréquence et caractéristiques

Maternal mortality in France: epidemiological study, prevalence and characteristics

M.-H. Bouvier-Colle, avec le concours de M. Philibert

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MOTS CLÉS
Mortalité maternelle ; Obstétrique ; Réanimation


Introduction

La mortalité maternelle a été retenue parmi les indicateurs de surveillance de l’état de santé en France, depuis la loi de santé publique d’août 2004 [1]. Cela pourrait paraître paradoxal, dans l’absolu, alors que la mortalité maternelle se situe à un niveau extrêmement bas, moins de 100 cas par an pour 800 000 naissances. Il n’en a pas toujours été ainsi. En 1950, 739 décès maternels avaient été dénombrés pour 858 000 naissances [2]. Des progrès incontestables furent accomplis en santé périnatale dont la mère a pu bénéficier, même si parfois l’impression existe que les plans successifs, et notamment la réglementation, accordaient beaucoup de place au fœtus et au nouveau-né, mais semblaient oublier la femme.

En fait, un tel intérêt se justifie pleinement et constitue l’aboutissement logique de travaux de recherche menés sur la santé maternelle, depuis les années 1990, à l’Inserm, en collaboration avec certains gynécologues-obstétriciens du Collège national des gynécologues et obstétriciens français (CNGOF) et anesthésistes-réanimateurs de la Sfar. Ces travaux sont partis de l’hypothèse que la mortalité maternelle est un signal d’alarme d’un éventuel dysfonctionnement du système de soins. Depuis la publication de l’Atlas européen des morts évitables, les décès maternels sont considérés comme des causes « évitables » de la mortalité féminine [3]. Dans les conditions actuelles d’accès de la population à des soins de qualité, et en raison du degré élevé des techniques médicales, il ne devrait plus y avoir de décès maternels dans les pays de l’Union européenne. Si un tel décès survient, il faut considérer que les soins ont été inadaptés ou de moindre qualité ou sont intervenus à contretemps, face à une complication, généralement imprévisible.

En 1996, convaincue de l’intérêt d’une telle approche, la Direction générale de la santé (DGS) a doté la France d’un dispositif renforcé de surveillance de la mortalité maternelle. Cette surveillance repose sur un double système de recueil des données ; elle associe l’information issue du certificat médical de décès à celle d’une enquête confidentielle avec Comité d’experts.

Au moment où l’étude des événements indésirables graves, en milieu hospitalier, se généralise en France, il n’est pas sans intérêt de montrer ce qu’apporte l’étude approfondie de la mort maternelle, événement indésirable s’il en est.

La présente mise au point sur la situation épidémiologique en France rappelle la définition de la mort maternelle et les difficultés rencontrées pour son application ; décrit les incertitudes qui persistent sur la mesure de la fréquence de la mortalité maternelle et ses causes ; présente les facteurs de risque identifiés, les leçons issues du système renforcé de surveillance mis en place depuis une dizaine d’années ; esquisse la place de l’anesthésie réanimation dans ce secteur des soins maternels et enfin suggère quelques pistes d’études qui pourraient être entreprises.

Définitions et difficultés d’application

La mort maternelle a été définie depuis plusieurs années par l’Organisation mondiale de la santé (OMS) [4]. Cette définition conduit à inclure les décès liés aux avortements et aux grossesses extra-utérines, et à éliminer les morts sans relation avec l’état gravidopuerpéral, les morts violentes ou accidentelles, et les pathologies dont l’évolution n’a pas été aggravée par la grossesse. De plus, tous les décès dont la cause initiale figure dans le chapitre XV « grossesse, accouchement et puerpéralité » de la Classification internationale des maladies-dixième révision (CIM-10), sont considérés comme décès maternels [5].

Des difficultés apparaissent lorsqu’on veut appliquer ces définitions avec rigueur car plusieurs dimensions interviennent dans le classement : la notion d’état physiologique de...
Encadré 1 Définitions du décès maternel et du taux de mortalité maternelle selon l’OMS

- La mort maternelle est le décès d’une femme survenu au cours de la grossesse ou dans un délai de 42 jours après sa terminaison, quelle qu’en soit la durée ou la localisation, pour une cause quelconque déterminée ou aggravée par la grossesse ou les soins qu’elle a motivés, mais ni accidentelle, ni fortuite. Les morts maternelles se répartissent en deux groupes : décès par cause obstétricale directe et décès par cause obstétricale indirecte. Les décès par cause obstétricale directe résultent de complications obstétricales (grossesse, travail et suites de couches), d’interventions, d’omissions, d’un traitement incorrect ou d’un enchaînement d’événements résultant de l’un quelconque des facteurs ci-dessus. Les décès par cause obstétricale indirecte résultent d’une maladie préexistante ou d’une affection apparue au cours de la grossesse sans qu’elle soit due à des causes obstétricales directes, mais qui a été aggravée par les effets physiologiques de la grossesse.

- Le taux de mortalité maternelle est le rapport du nombre de décès maternels, observés une année, aux naissances vivantes de la même année.

La mortalité maternelle a été sous-estimée de 50 %, parce que des lacunes apparaissaient dans la déclaration des causes, le médecin certificateur n’étant pas toujours à même de connaître l’état de grossesse ou l’accouchement même récent, et parce que le choix de la cause initiale pour le codage avec la CIM, certains éléments d’information faisant défaut, n’était pas exact. Plus récemment, une nouvelle méthode permettant d’améliorer le recueil des décès maternels, par le châînage des événements d’état civil (fichiers des naissances et fichiers des décès), a été testée et a révélé que la sous-estimation des décès maternels dans la statistique des causes médicales de décès était de 30 % [7]. Ces particularités ne sont pas propres à notre pays. La sous-estimation de la mortalité maternelle est générale et connue de longue date [8]. Elle a été mise en évidence, lors d’une recherche comparant de manière rigoureuse deux états américains, le Massachusetts et la Caroline du Nord, et deux états européens, la France et la Finlande [9]. La sous-estimation était de 27 % en Caroline du Nord, 31 % en France, 57 % en Finlande et 90 % au Massachusetts. Elle était d’autant plus importante que le taux observé de départ était faible. Dans les séries du Royaume-Uni, une sous-estimation d’environ 40 % en moyenne a été mise en évidence depuis 1994-1996 [10].

Système renforcé de surveillance de la mortalité maternelle en France


Les données du CépiDC sont régulières et annuelles et couvrent systématiquement tout le territoire national puisque, lorsque survient un décès, ou qu’il se produise... un certificat médical de décès est obligatoirement rempli par un médecin, permettant ainsi à la mairie du lieu de délivrer le permis d’inhumer. À ces données permanentes, s’ajoutent les informations détaillées et confidentielles, collectées grâce à l’enquête ad hoc, questionnaire standardisé, assesseurs spécialistes d’anesthésie-réanimation ou de gynécologie-obstétrique) et analysées par le Comité national d’experts sur la mortalité maternelle (CNEMM).

Les décès qui ont été expertisés après compléments d’enquête, sont classés en outre selon leur « évitabilité » certaine ou probable. Lorsque les décès ont été jugés probablement évitables, les raisons en sont précisées. La méthodologie complète a été exposée antérieurement de façon détaillée, se reporter à comité [11].

Fréquence

Avec une soixantaine de décès en moyenne, officiellement enregistrés annuellement par le CépiDC en France métropolitaine, soit un taux de 6 à 8 pour 100 000 naissances vivantes, l’objectif de 5 pour 100 000 en 2008 fixé par la loi de santé publique, paraît accessible. Malgré tout, comme on l’a vu précédemment, ce taux est sous-estimé. D’après


Trois cent cinquante-neuf décès de causes obstétricales, de 1996 à 2002, expertisés par le comité, sont inclus dans notre analyse. La répartition des causes de décès est assez stable Tableau 1, les hémorragies sont la cause la plus fréquente (20 à 25 % des décès maternels) : elles résultent principalement de l’atonicité utérine ou de la rétention pla- centaire dans le post-partum immédiat (9 % des décès maternels), des ruptures utérines (5 %) et des hématomes rétroplacentaires (2 %). Les complications de l’hypertension artérielle représentent 12 à 14 % des décès (les éclampsies 6 %) et les embolies amniotiques 8 à 13 %. Les embolies pulmonaires représentent 7 % et les thromboses veineuses cérébrales 2 %. Les septicémies sont à 3-4 %.


Les causes indirectes, regroupant un ensemble disparate de pathologies cardiaques, neurologiques (accidents vasculaires cérébraux) ou psychiques, ainsi que des maladies de système, occupent une part en augmentation.

Dans le cas de l’étude comparée États-Unis-Europe, la répartition des causes différait notablement entre les pays, sans qu’on puisse lier ces différences à la fréquence globale. Notre pays se caractérise par une fréquence plus grande d’hémorragies et d’embolies pulmonaires que les états nord-américains de l’étude, mais nettement moins de complications cardiaques ou d’embolies amniotiques.

**Évitabilité** et soins

La plupart des décès maternels sont jugés évitables par le CNEMM, certainement dans 38 % des cas et probablement dans 16 %. Dans 20 % des cas, les experts manquaient
d’éléments pour conclure. La proportion de décès évitables n’a pas évolué depuis 1996.

- L’évitabilité certaine est variable selon les pathologies Tableau 2 : elle est maximum pour les anesthésies (83 %), mais cela ne concerne que très peu de cas (sept décès en sept ans). Elle est élevée (73 %) pour les hémorragies du post-partum immédiat (HPP), ce qui concerne 81 décès en sept ans ; elle est nettement moindre (17 %) pour les complications obstétricales, et pour les causes obstétricales indirectes, lesquelles comptent désormais pour un tiers des morts maternelles.

Les principales insuffisances relevées sont le retard au diagnostic ou la sous-évaluation de la gravité de l’état de la patiente (par exemple, dans le cas des HPP, sous-estimation de la spoliation sanguine qui n’est pas mesurée objectivement, mais jugée cliniquement) ; le délai trop long dans la mise en route de traitement, ou la contre-indication et même l’erreur de traitement. Les raisons


### Tableau 1 Répartition des décès maternels expertisés en France selon la cause obstétricale détaillée, de 1996 à 2002

<table>
<thead>
<tr>
<th></th>
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<tr>
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<td>39</td>
<td>22,38</td>
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<td>3</td>
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<td>Rupture utérine</td>
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<td>11</td>
<td></td>
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<td>Anomalies de la coagulation</td>
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<td></td>
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<td>10,06</td>
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<td>1</td>
<td></td>
</tr>
<tr>
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<td>Emboles pulmonaires</td>
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<tr>
<td>Infections</td>
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<td>Au cours d’un avortement</td>
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<td>Infections de l’appareil génito-urinaire</td>
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<td>2</td>
<td></td>
</tr>
<tr>
<td>Septicémie</td>
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<td>8</td>
<td></td>
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<tr>
<td>Complications obstétricales</td>
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<td>7</td>
<td>3,87</td>
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<td>1</td>
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<tr>
<td>Choc obstétrical</td>
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<td></td>
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<tr>
<td>Autres traumatismes obstétricaux</td>
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<td>5</td>
<td></td>
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<td>1,93</td>
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<tr>
<td>Effet adverse d’un traitement médicamenteux (bétamimétiques)</td>
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<td>Complications cardiaques de l’anesthésie</td>
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<td></td>
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<tr>
<td>Autres complications de l’anesthésie</td>
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<td>0</td>
<td></td>
</tr>
<tr>
<td>Myocardiopathie au cours de la puerpéralité</td>
<td>0</td>
<td>4</td>
<td>1,10</td>
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<td>3</td>
<td>9</td>
<td>3,31</td>
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<tr>
<td><strong>Total des causes obstétricales directes</strong></td>
<td>135</td>
<td>123</td>
<td>71,27</td>
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<tr>
<td>Troubles mentaux</td>
<td>4</td>
<td>4</td>
<td>2,21</td>
</tr>
<tr>
<td>Accidents cardiovasculaires d’origine</td>
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<td></td>
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</tr>
<tr>
<td>Cardiaque</td>
<td>7</td>
<td>13</td>
<td>5,52</td>
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<tr>
<td>Neurologique</td>
<td>8</td>
<td>22</td>
<td>8,28</td>
</tr>
<tr>
<td>Splénique</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Autre</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Maladies infectieuses et parasitaires</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Autres affections compliquant la grossesse, l’accouchement ou les suites</td>
<td>17</td>
<td>18</td>
<td>9,67</td>
</tr>
<tr>
<td><strong>Total des causes obstétricales indirectes</strong></td>
<td>40</td>
<td>64</td>
<td>27,73</td>
</tr>
<tr>
<td><strong>Toutes causes obstétricales</strong></td>
<td>175</td>
<td>187</td>
<td>100,0</td>
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</table>
plus détaillées ainsi que les recommandations qui en découlent sont exposées dans la publication récente du Bulletin Épidémiologique Hebdomadaire (BEH) [16].

D’une manière générale, la proportion moyenne "d’évitabilité" de 54 % sur toute la période, est très similaire à celle qui est observée dans les études confidentialites du Royaume-Uni, malgré une expérience beaucoup plus ancienne que la nôtre de l’analyse des morts maternelles [10].

**Soins en services de réanimation**

Parmi les décès maternels étudiés de 1996 à 2002, 340 (soit 95 %) sont survenus en établissements et parmi ceux-ci, 238 femmes (72 %) avaient été soignées en service de réanimation (SR). En réalité, si la majorité de ces femmes a été hospitalisée en SR (200 soit 56 % des décès), d’autres ont été accueillies en unités de surveillance continue (11) ou en unités de soins intensifs [USI] (16) et neuf en unités non précisées. Quinze pour cent des femmes sont arrivées directement en SR-USI, les autres ont été transférées, le plus souvent (9/10) en interne, et 1/10 en provenance d’un autre établissement.

Les femmes décédées accueillies en SR-USI se distinguent peu des autres, puisque leurs caractéristiques socio-démographiques (âge, parité, catégorie socioprofessionnelle, ou nationalité) leur surveillance prénatale (nombre de visites prénatales, hospitalisation au cours de la grossesse) et leur maternité d’accouchement sont similaires.

En revanche, parmi les femmes admises en SR-USI, 15 % seulement étaient en cours de grossesse, contre 57 % qui avaient déjà accouché, depuis moins de deux heures après l’accouchement en général, mais quatre avaient été admises plus de 42 jours après.

Le motif le plus fréquent d’admission en SR-USI est lié aux causes obstétricales indirectes : 77 décès sur 238 (soit 32 %) dont la plupart étaient liés aux cardiopathies ou aux accidents vasculaires cérébraux. Les HPP représentent 20 % et les complications de l’hypertension 17 % ; cette répartition diffère sensiblement de celle des morts maternelles qui ne sont pas passées en SR-USI Fig. 2.

Dans 167 cas sur 238 (soit 70 %), le score avait été calculé ; la répartition était la suivante : indice de gravité simplifié (IGS) < 25 18 %, IGS ≥ 50 41 %, 25 < IGS < 49 le reste. Cinquante pour cent des femmes étaient déjà en coma stade 3 ou 4, et 11 % étaient mourantes.

Les examens et actes pratiqués figurent au Tableau 3. La durée de séjour a été en moyenne de six jours, mais la moitié des femmes sont restées moins de 24 heures, 37 % de deux à dix jours, 7 % de 11 à 20 jours et 5 % plus de 20 jours.

**Cas particulier des hémorragies...**

L’étude des morts maternelles a permis de révéler plusieurs problèmes de prise en charge, concernant notamment l’HPP. Le fait que cette cause soit beaucoup plus présente que dans les pays comparables et qu’en outre, lors des premières expertises, 80 % des décès aient été jugés évitables par le comité, nous a conduit assez rapidement à étudier cette pathologie de manière plus approfondie en faisant l’hypothèse qu’il existait un lien avec l’organisation des soins. Deux études ont abouti à des résultats utiles pour guider la réflexion sur les pratiques professionnelles : d’une part, nous avons montré que l’absence d’anesthésiste-réanimateur 24 heures/24, dans la structure, multipliait par trois le risque de prise en charge non optimale, ce qui était le cas de 38 % des hémorragies sévères étudiées dans cette enquête [17] ; d’autre part, dans le cadre du projet européen EUPHRATES, nous avons observé que :

- la prévention, par la réalisation systématique de la délivrance dirigée à la troisième phase de l’accouchement, n’était que rarement pratiquée par les équipes obstétricales hexagonales ;
- le traitement de l’hémorragie constituée manquait d’efficacité pour plusieurs raisons : estimation imprécise de la gravité, retard à l’application des thérapeutiques recommandées par les professionnels avertis [18].

Ces observations, complétées d’études épidémiologiques, ont été suivies par la publication, en décembre 2004, de règles de pratiques cliniques, élaborées par le Collège des gynécologues-obstétriciens, à la demande conjointe de l’Anaes et de la DGS, pour la prise en charge des HPP [19].

D’autres études sont en cours : l’une sur l’évaluation d’une stratégie coordonnée de prise en charge au niveau
d’un réseau régional de soins périnatals (étude SPHERE du Réseau Bas Normand) ; deux autres sont des essais d’intervention sur l’intérêt de la mesure systématique de la perte sanguine par un sac de recueil après la naissance du bébé, et sur une intervention multifacette (projet PITHAGORE-6) pour l’appropriation effective par les équipes obstétricales des règles de pratique clinique, prouvées par ailleurs [20, 21].

Tout cela devrait logiquement conduire à des changements de comportement. La fréquence des HPP sévères ainsi que la mortalité maternelle qui en résulte devraient diminuer à partir des années 2005 – 2006.

Conclusion : un modèle pour l’urgence obstétricale

D’autres causes de mort maternelle, celles dont 50 à 70 % des décès sont considérés « évitables », pourraient bénéficer de recherches sur la relation entre mortalité maternelle, organisation et qualité des soins. Il y a tout lieu de penser que des progrès sont encore réalisables, spécialement en amont de l’arrivée en service de SR-USI. Pour y travailler de façon efficace, il faudrait prévenir le transfert SR-USI en recourant aux pratiques cliniques reconnues (preuves scientifiques), et par ailleurs en révisant la politique du « toujours plus de césarienne ». Il faudrait, sans doute, avancer en temps utile le transfert, grâce à une meilleure estimation de la menace sur le pronostic vital maternel. Car, on l’a vu, la plupart des femmes transférées parviennent dans un état gravissime en SR-USI. C’est donc en amont qu’il faudrait intervenir : avant que la complication maternelle ne devienne sévère. Or, les études sur la morbidité maternelle sévère sont encore rares, bien que quelques auteurs aient appelé depuis plusieurs années à les mettre en œuvre [22].

Une étude épidémiologique (cas témoins à base populationnelle) réalisée sur toutes les femmes en état gravidopuerpèral admises en SR-USI, dans trois régions françaises avait constitué une première tentative en 1998 [23]. La fréquence de l’admission en SR-USI avait été estimée à 330 pour 100 000 naissances. Ce taux tombe au milieu de la
fourchette que l’on trouve dans une revue de la littérature récente [24]. Nos études avaient permis de montrer qu’il existait une relation entre les caractéristiques des materni-
tés d’accouchement et le degré de gravité des femmes lorsqu’elles étaient prises en charge en SR USI [25]. Cela suggère l’existence de facteurs de risque du décès maternel liés à l’organisation des soins, à côté des facteurs individuels évoqués précédemment.

Il serait très intéressant de reprendre cette démarche dix ans après, d’analyser si des évolutions se produisent et lesquelles, puisque la création de salles de réveil locali-
sées ou les modifications de la tarification des actes de réa-
mination ou de soins intensifs sont des changements récents dont l’impact n’est pas connu.

Remerciements

Aux médecins certificateurs, aux assesseurs qui font le travail de recherche des dossiers, aux experts qui analysent les cas.

Références

Can excess maternal mortality among women of foreign nationality be explained by suboptimal obstetric care?

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Accepted 20 June 2008.

Objectives To test the hypothesis that the risk of postpartum maternal death in France remains significantly higher for women of foreign nationality after individual characteristics are taken into account and to examine whether the quality of care received by the women who died differs according to nationality.

Design A national case–control study.

Setting Metropolitan France.

Population A total of 267 women who died of maternal death from 1996 to 2001 as cases and a representative sample (n = 13,186) of women who gave birth in 1998 as controls.

Methods Crude and adjusted odd ratios were calculated with multivariate logistic regression, and the quality of care for cases was compared according to nationality with chi-square tests or Fisher’s exact tests.

Main outcome measures Odd ratio for postpartum maternal death associated with nationality and quality of care.

Results After taking individual characteristics into account, the risk of postpartum maternal death was twice as high for foreign women. The odds ratio was 5.5 (95% CI: 3.3–9.0) for women from sub-Saharan Africa and 3.3 (95% CI: 1.7–6.5) for those from Asia, North and South America. There was no significant excess risk of postpartum maternal death for the other European and North Africa women. The risk of dying from hypertensive disorder or infection was four times higher for foreign women. Among women who died, care was more often considered not optimal for foreign women (78 versus 57%).

Conclusions The excess risk of postpartum maternal death persisted for foreign women after individual characteristics were taken into account and was especially important for some nationalities and for some causes of death, primarily hypertensive disorders. These results point to an immediate need to pay special attention to early enrolment in prenatal care, screening and prenatal management of hypertension, especially in women of sub-Saharan African nationality.

Keywords Maternal mortality, nationality, quality of care.

Introduction

Immigrant women are often at risk of poor pregnancy outcomes.1–4 However, these results differ according to the geographical origin of immigrants and some groups of immigrant women have unexpectedly favourable birth outcomes.5–8 Although several studies have examined the perinatal health of the children of immigrant women, the mother’s health has been studied less.

Maternal mortality is always a dramatic event. This rare event remains the principal indicator of maternal health, a marker simultaneously of the quality of and access to care.

Maternal mortality rates within a given country differ according to the geographical origin of the women living there. These differences are nonetheless studied from diverse perspectives according to country: some look at the mother’s country of birth, others her nationality and others her racial or ethnic category. From 1995 to 2000, immigrants in the Netherlands had a risk of death after childbirth three times higher than women born there.9 In 2000–2002, black women in the UK had a maternal mortality rate three times higher than did the white women.10

The reasons for this excess maternal mortality remain unclear. Whereas few European studies have looked at this
subject,11,12 many studies carried out in the USA have attempted to explain the excess of mortality of the African-American women,13-17 but they used racial categories specific to the US context. More generally, racial or ethnic category does not cover the notion of migration that we have prioritised.

In France, the only variable available is the current nationality of the mother. For 2000–2002, the French national cause-of-death statistics show a maternal mortality rate of 6.8 per 100 000 livebirths in women of French nationality compared with 14.9 in women of non-European nationality. A worrisome observation is that recent trends in the level of maternal mortality seem more favourable to French women than to those of non-European nationality: between 1990–1994 and 2000–2002, the maternal mortality rate among French women dropped significantly and substantially (by 35%), while in women of non-European nationality, the reduction was slight (9%) and not significant.18

To our knowledge, few studies have examined the factors that might explain this difference. Nonetheless, it would be particularly informative to study the reasons for this persistent excess mortality of foreign women in a model of healthcare organisation based on the principle of universal access to care.

Schematically, two categories of explanatory factors can be considered: the individual characteristics of women and factors related to healthcare services. With a focus on prevention, it seems important to identify the potential factors associated with medical care because they are more amenable to change. This study was conducted from such a perspective. The excess maternal mortality in foreign women is an issue that concerns an increasing number of western countries and very few studies have examined the factors related to healthcare services.

The first aim of the present study was to test the hypothesis that the risk of postpartum maternal death remains significantly higher for women of non-French nationality, after taking individual characteristics into account. Second, we sought to determine if the quality of care received by the women who died differed according to nationality.

Methods

Women who died were selected from the national confidential enquiry into maternal deaths, conducted in France since 1996. The general objective of this permanent survey is to analyse in depth all maternal deaths in France. Its methodology was detailed in the last report of the National Expert Committee on Maternal Mortality.18 The Expert Committee makes a unanimous determination about the cause of death, its preventability (certainly, perhaps, or cannot be determined) and the reasons for preventability (one or more of these reasons: delay in diagnosis, failure to diagnose, inappropriate or inadequate treatment, treatment error or patient negligence) and the global quality of medical and obstetric care (not optimal, optimal and cannot be determined). In this study, postpartum maternal deaths included all maternal deaths that were associated with a still or livebirth, up to 365 days after delivery.

In all, the survey identified 323 maternal deaths during the period 1996–2001 in metropolitan France. The 51 that involved women who did not give birth (death during pregnancy or after an abortion) were excluded from the analysis, for consistency with the definition of the controls. The nationality of five of the women was unknown. The study population of women who died during the postpartum period therefore included 267 deaths.

The control subjects came from the 1998 national perinatal survey, a national representative sample of births in France. National perinatal surveys are repeated cross-sectional studies covering all births occurring during 1 week in France of children born at a gestational age of 22 weeks or more or weighing at least 500 g. The information is collected from the obstetric files and from an interview of the mother during the postpartum period. The precise methodology of the 1998 survey was described in the survey report.19 Briefly, the survey involved a nationally representative sample of all births (i.e. both livebirths and stillbirths) occurring in France during a 1-week period. Two sources of information were used (1) face-to-face interviews of women after childbirth, to obtain data on sociodemographic characteristics and prenatal care and (2) medical records, to obtain data on labour and delivery and the infant’s condition at birth. During the interview, both the questions and the response choices were read aloud to the women surveyed. No women were excluded because they did not speak French. In all, the 1998 survey included 13 477 women who gave birth. Nationality was not recorded for 291 women. The control sample for this study therefore included 13 186 women.

The variable of interest was the women’s current nationality. It was recorded from the vital records for the maternal deaths and provided by the women themselves for the national perinatal survey. The classification was first in two classes: French versus foreign, and then in five classes: French, other European, North African, sub-Saharan African and other (North and South America and Asia). This classification is that used in the national perinatal survey.

Other variables collected and studied in this study were: mother’s age (less than 25 years, 25–34, 35 and older), parity (nulliparas, 1–3, 4 and more), work status (in or not in the labour force), marital status (married/unmarried) and hospitalisation during pregnancy (yes/no).

First, to test the hypothesis of an excess risk of postpartum maternal death for the women of foreign nationality, we used a logistic multivariate regression analysis. Because of missing values for some variables, the logistic regression included 230 cases and 12 578 controls. The following variables were studied as possible confounding factors: age, parity, work
status, marital status and hospitalisation during pregnancy. Variables were selected on the basis of univariate analysis of risk factors. Interactions between these variables and nationality were systematically tested. First, crude and adjusted odds ratios for postpartum maternal death in foreign women were calculated. Secondly, crude and adjusted odds ratios for cause-specific postpartum maternal death in foreign women were calculated. The analyses were performed with STATA 9 SE (StataCorp., College Station, TX, USA).

The second part of the analysis was restricted to women who died. In this group, we compared quality of care received, preventability of death and reasons for preventability, according to nationality. The distributions of frequency were compared with chi-square tests, or, when appropriate, Fisher’s exact tests.

**Results**

Table 1 presents the characteristics of case and control women. The distribution of nationalities differed significantly between them: there were more women of foreign nationality among the cases than the controls (20.6 versus 10.5%). Sub-Saharan Africa nationalities and ‘other nationalities’ were both represented more often among the women who died. Women who died were significantly older, more often multiparous, not working and hospitalised during pregnancy.

Foreign women had a significantly greater risk of postpartum maternal death than French women. The crude odds ratio for postpartum maternal death for foreign women was 2.5 (95% CI: 1.8–3.5). After taking confounders into account, the adjusted odds ratio was 2.0 (95% CI: 1.4–2.8) (Table 2). No first order interaction with nationality was significant. The excess risk of postpartum maternal death after adjustment for age was highest for the women from sub-Saharan Africa and for the ‘other nationalities’. There was no significant excess risk of postpartum maternal death for the other European and North Africa women.

Causes of postpartum maternal death also differed significantly for French and foreign women ($P = 0.05$). Among French women, haemorrhage was the most important direct cause of maternal mortality (24% of all deaths) (Table 3). In foreign women, hypertensive disorders were as important, accounting for 24% of maternal deaths. After adjustment for age, the risk of dying from hypertensive disorders was four times higher in foreign women (Table 4). Of 23 deaths from hypertensive disorders among French women, 11 were due to eclampsia, 7 to pre-eclampsia, 4 to haemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome and 1 to complicated pre-existing hypertension. Of 13 deaths from this cause in foreign women, 6 were due to eclampsia, 5 to pre-eclampsia and 2 to HELLP syndrome.

The age-adjusted risk of death from infection was four times higher in foreign than in French women (Table 4). Of the eight deaths of French women due to infection, four were caused by puerperal sepsicaemia, two by chorioamnionitis and two by streptococcal infections after cesarean deliveries. The four infection-related deaths of foreign women were all due to puerperal sepsicaemia, including two after home deliveries.

After adjustment for age, the risk of dying from haemorrhage was twice as high in foreign women (Table 4). Of the 50 deaths of French women from haemorrhage, 34 were due to postpartum haemorrhage, 8 to uterine rupture, 4 to placental abruption and 4 to placenta praevia. Of the 13 deaths of foreign women from haemorrhage, 4 were due to postpartum haemorrhage, 4 to uterine rupture, 3 to placenta praevia. Of the 13 deaths from this cause in foreign women, 13 were due to placenta praevia. The causes of haemorrhage differed significantly between the French and foreign women ($P = 0.01$): uterine rupture was more frequent among foreign women.

After adjustment for age, the risk of death from an indirect cause was twice higher among foreign women (Table 4).

**Table 1. Characteristics of cases and controls**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Controls</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationality</td>
<td>267</td>
<td>13 186</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>French</td>
<td>79.4</td>
<td>89.5</td>
<td></td>
</tr>
<tr>
<td>Other European</td>
<td>3.8</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>North Africa</td>
<td>4.1</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>8.2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Other*</td>
<td>4.5</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>267</td>
<td>13 165</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>&lt;25</td>
<td>7.5</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>25–34</td>
<td>53.9</td>
<td>67.6</td>
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</tr>
<tr>
<td>35+</td>
<td>38.6</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td>252</td>
<td>13 107</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nulliparas</td>
<td>28.2</td>
<td>43.0</td>
<td></td>
</tr>
<tr>
<td>1–3</td>
<td>59.1</td>
<td>53.7</td>
<td></td>
</tr>
<tr>
<td>4+</td>
<td>12.7</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Work status</td>
<td>253</td>
<td>12 754</td>
<td>0.010</td>
</tr>
<tr>
<td>Yes</td>
<td>60.5</td>
<td>68.1</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>39.5</td>
<td>31.9</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>265</td>
<td>13 084</td>
<td>0.069</td>
</tr>
<tr>
<td>Yes</td>
<td>63.0</td>
<td>57.4</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>37.0</td>
<td>42.6</td>
<td></td>
</tr>
<tr>
<td>Hospitalisation during pregnancy</td>
<td>250</td>
<td>13 080</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>37.6</td>
<td>21.5</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62.4</td>
<td>78.5</td>
<td></td>
</tr>
</tbody>
</table>

*Other nationality* includes Asian, North and South American and Oceanian nationalities. The women who died were of the following nationalities: Sri Lankan, Haitian, Laotian, Vietnamese, Iraqi, Pakistani, Philippine and Brazilian.
Of the 54 French women who died of indirect causes, more than half (33) died from complications of the circulatory system, 5 of a haematological disease, 5 of puerperal psychosis, 4 of cancer, 3 of a complication of the respiratory system, 1 of disseminated lupus erythematosus, 1 of an oesophageal varix rupture, 1 of paroxysmal nocturnal haemoglobinuria and 1 of thrombotic microangiopathy. Among the 14 foreign women who died of indirect causes, 6 died from complications of the circulatory system, 3 from sickle-cell anaemia, 1 from a complication of the respiratory system, 1 of meningitis aggravated by cardiac failure, another of Ehler-Danlos syndrome, 1 of cancer and the last of an unspecified indirect obstetric cause.

In women of sub-Saharan Africa and ‘other’ nationalities, the excess risk of postpartum maternal death was the most important for deaths due to hypertensive disorders and infections (Table 5).

Among women who died of postpartum maternal death, care was more often considered not optimal for foreign women: 78% of the foreign women who died had received non-optimal care compared with 57% of the French women, as assessed by the national expert committee (Table 6). When we stratified by category of cause of death, there was a trend towards a lower quality of care received by women who died was less often optimal for foreign compared with French women.

Considering maternal deaths from all causes, women from sub-Saharan Africa had received non-optimal care more often than French women (21/22 women compared with 120/212 in French women, \( P = 0.002 \)). This difference was not found for the other nationality subgroups.

‘Inadequate treatment’ (mentioned alone) or ‘failure to diagnose’ accounted more often for the preventability of death in foreign women than in French women. The patient’s negligence was mentioned in 3.2% of cases of foreign women (compared with 14.9% of the French women). Nonetheless, there was no significant difference in the distribution of reasons for preventability according to nationality.

**Discussion**

Our results show that, after taking individual characteristics into account, the excess risk of postpartum maternal death for women of foreign—compared with French—nationality persists. This excess risk is especially important for some nationalities (sub-Saharan Africa, Asia, North and South America) and for some causes of death (hypertensive disorders and infections). In these same subgroups of nationality and of cause of death, quality of care received by women who died was less often optimal for foreign compared with French women.

The existence of an overall excess risk of postpartum maternal death for women of foreign nationalities is consistent with other European studies. These are, however, relatively few and fairly old. An analysis of maternal deaths between 1970 and 1985 in the UK according to country of birth showed an increased risk of death for women born outside England or Wales. This risk was quintupled for the women from West Africa and the West Indies for the principal causes of death. A study of maternal deaths in West Germany from 1980 to 1996 also showed a risk of death twice higher from haemorrhage

<table>
<thead>
<tr>
<th>Nationality</th>
<th>Cases, n (%)</th>
<th>Controls, n (%)</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>French</td>
<td>180 (78.3)</td>
<td>11 335 (90.1)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Foreign</td>
<td>50 (21.7)</td>
<td>1243 (9.9)</td>
<td>2.53 (1.84–3.48)</td>
<td>2.00 (1.42–2.80)*</td>
</tr>
<tr>
<td>Other European</td>
<td>10 (4.3)</td>
<td>381 (3.0)</td>
<td>1.65 (0.87–3.15)</td>
<td>1.64 (0.86–3.14)**</td>
</tr>
<tr>
<td>North Africa</td>
<td>11 (4.8)</td>
<td>490 (3.9)</td>
<td>1.41 (0.76–2.62)</td>
<td>1.20 (0.65–2.23)**</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>19 (8.3)</td>
<td>200 (1.6)</td>
<td>5.98 (3.65–9.79)</td>
<td>5.45 (3.29–9.00)**</td>
</tr>
<tr>
<td>Other</td>
<td>10 (4.4)</td>
<td>172 (1.4)</td>
<td>3.66 (1.90–7.04)</td>
<td>3.34 (1.72–6.47)**</td>
</tr>
</tbody>
</table>

*Adjusted for maternal age, parity, work status, marital status and hospitalisation during pregnancy.
**Adjusted for maternal age.

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>French, n (%)</th>
<th>Foreign, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemorrhage</td>
<td>50 (24)</td>
<td>13 (24)</td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>23 (11)</td>
<td>13 (24)</td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>30 (14)</td>
<td>4 (7)</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>24 (11)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Infection</td>
<td>8 (4)</td>
<td>4 (7)</td>
</tr>
<tr>
<td>Other direct</td>
<td>23 (11)</td>
<td>6 (11)</td>
</tr>
<tr>
<td>Indirect causes</td>
<td>54 (26)</td>
<td>14 (26)</td>
</tr>
<tr>
<td>All causes</td>
<td>212</td>
<td>55</td>
</tr>
</tbody>
</table>
and from hypertensive disorders in women whose nationality was not German. Data for both studies came from the birth and death certificates of the vital records registry. Classification by cause of death in vital statistics, however, can be imprecise for rare causes of deaths in the industrialised countries.

Inversely, the data on which our study is based come from recent detailed national studies: the information about the controls is detailed on the characteristics of the women, the pregnancy and the delivery. For the cases, the information is very specific about management (e.g. hospitalisation notes and surgical and autopsy reports). The meticulous reconstruction of the patient’s history obtained through the confidential enquiry allowed the clinical experts to make a reliable assessment on the underlying cause of death and on its relation to pregnancy. Moreover, the other European studies considered only two confounding factors when examining the relationship between nationality and maternal mortality: age and marital status. Here, we also took into account parity, mother’s health status (through the variable ‘hospitalisation during pregnancy’) and work status. Finally, in the present study, we were able to study the management provided by the healthcare system through the experts’ judgement about quality of care.

One limitation of this study is the likely under-identification of maternal deaths. In the French confidential enquiry, 20% of possible maternal deaths were not investigated. However, these unstudied deaths include some occurring during pregnancy or after an abortion—by definition not included in our study—and non-maternal deaths, although the respective contribution of these categories cannot be estimated. In consequence, the percentage of unstudied postpartum maternal deaths is expected to be low. Nonetheless, this under-identification would introduce a bias in this study only if the unstudied deaths were distributed differently according to nationality, and they were not. Similarly, there was no difference in the distribution by nationality of the 37 deaths excluded from the multivariate analysis because of missing data.

Nationality was characterised from different sources for cases and controls: it was recorded from the vitals records for the cases and provided by the women for the controls.

### Table 4. Crude and adjusted odds ratios for postpartum maternal death by cause, associated with nationality

<table>
<thead>
<tr>
<th>Causes of death</th>
<th>Cases</th>
<th>Controls</th>
<th>OR (95% CI)</th>
<th>OR adjusted for age (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>French</td>
<td>Foreign</td>
<td>French</td>
<td>Foreign</td>
</tr>
<tr>
<td>Total (all causes)</td>
<td>212</td>
<td>55</td>
<td>11 788</td>
<td>1377</td>
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<tr>
<td></td>
<td>2.22 (1.64–3.00)</td>
<td>2.04 (1.51–2.77)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>50</td>
<td>13</td>
<td>2.23 (1.21–4.11)</td>
<td>1.91 (1.03–3.55)</td>
</tr>
<tr>
<td></td>
<td>4.84 (2.45–9.57)</td>
<td>4.58 (2.31–9.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>23</td>
<td>13</td>
<td>1.14 (0.40–3.24)</td>
<td>1.02 (0.36–2.91)</td>
</tr>
<tr>
<td></td>
<td>4.58 (2.31–9.08)</td>
<td>4.58 (2.31–9.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>30</td>
<td>4</td>
<td>2.23 (0.91–5.49)</td>
<td>2.13 (0.86–5.25)</td>
</tr>
<tr>
<td></td>
<td>2.22 (1.23–4.01)</td>
<td>2.08 (1.15–3.77)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NA, non applicable.**

### Table 5. Crude and adjusted odds ratios for postpartum maternal death by cause, associated with nationality sub-Saharan Africa and other

<table>
<thead>
<tr>
<th>Causes of death</th>
<th>Cases</th>
<th>Controls</th>
<th>OR (95% CI)</th>
<th>OR adjusted for age (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>French</td>
<td>Sub-Saharan Africa and other</td>
<td>French</td>
<td>Sub-Saharan Africa and other</td>
</tr>
<tr>
<td>Total (all causes)</td>
<td>212</td>
<td>34</td>
<td>11 788</td>
<td>441</td>
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<tr>
<td></td>
<td>4.81 (2.35–9.85)</td>
<td>4.11 (1.99–8.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>50</td>
<td>9</td>
<td>8.14 (3.47–19.06)</td>
<td>7.62 (3.24–17.93)</td>
</tr>
<tr>
<td></td>
<td>2.67 (0.81–8.79)</td>
<td>2.42 (0.73–7.98)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertensive disorders</td>
<td>23</td>
<td>7</td>
<td>10.02 (2.65–37.91)</td>
<td>9.39 (2.47–35.70)</td>
</tr>
<tr>
<td></td>
<td>4.65 (1.60–13.50)</td>
<td>4.40 (1.51–12.81)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>30</td>
<td>3</td>
<td>3.47 (1.57–7.66)</td>
<td>3.26 (1.47–7.22)</td>
</tr>
<tr>
<td></td>
<td>2.24 (1.23–4.01)</td>
<td>2.08 (1.15–3.77)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NA, non applicable.**
This may have introduced a differential classification bias if non-French controls tended to under-declare their actual nationality. However, it is unlikely that such a bias explained the excess risk observed in foreign women, given the strength of the relation found.

In the control population, one major reason for missing data for the variables obtained from the interview of the mother was women who did not speak French. As these women are more likely to be of foreign nationality, this may have introduced a selection bias in the control sample. However, they accounted for only 3.8% of the foreign women in the national perinatal survey. It is therefore unlikely that their non-inclusion in the control sample resulted in a substantial overestimation of the risk of postpartum maternal death for foreign women. Even if the hypothesis of maximal bias was performed, it does not explain the differences found.

Another limitation of our study is that we lack detailed information about the women’s socio-economic status and educational level. We took work status into account but it is only an indirect indicator of socio-economic status. It is therefore possible that the differences in socio-economic status and educational level explain the excess risk of maternal mortality in foreign women.

We found that the risk of postpartum maternal death was highest for women from sub-Saharan Africa and from ‘the rest of the world’ (Asia, North and South America). These nationalities are part of the most recent waves of immigration and may represent populations at higher risk in terms of access to care. There was no excess risk of postpartum maternal death for women of other European and North African nationalities. Immigration of persons of European and North African nationalities is less recent and their knowledge and use of the healthcare system may be better. The issue of language barrier may also be less prevalent among women of European and North African nationalities than among women of other regions of the world. Poor communication between women and caregivers may result in inadequate care because of undiagnosed early symptoms or poor compliance with treatments.

This excess risk of postpartum maternal death among foreign women concerns essentially two causes: hypertensive disorders and infections. Both types of disease require good interaction between the healthcare system and patients for correct treatment. Of the four maternal deaths due to infection in foreign women, two involved women with home deliveries: one was a preterm delivery of a mother with hypertension and the other involved a pregnancy hidden from family and friends. This suggests that the interaction between the healthcare system and foreigners is not optimal. The fact that the risk of maternal death due to amniotic fluid embolism was not increased in foreign women can be interpreted in the same way. If the global excess risk of maternal mortality in foreign women is due to differences in care provided, it can be expected that this excess risk will not be found for causes of death on which the efficacy of care is poor, such as amniotic fluid embolism.

The risk of dying from hypertensive disorders was four times higher for the foreign women. The prevalence of hypertension itself during pregnancy differs according to nationality: in France, pregnant women from sub-Saharan Africa have both hypertension and hypertension with proteinuria more often than French women (unpublished data, 2003 national perinatal survey). In the USA, some studies show that black women have more hypertension in pregnancy. A nationwide study of all hospital births from 1988 to 1992 found that the prevalence of hypertension before pregnancy was 2.5 times higher in African-American women. But the prevalence of pregnancy-related hypertension was identical in both groups.

Regardless of the prevalence of hypertension, however, appropriate care throughout the pregnancy can prevent these complications, at least in part. We have noted that, in the 1998 national perinatal survey, women from sub-Saharan Africa and from the rest of the world began prenatal care later than French women and had more often a pregnancy without prenatal care. The reasons that may explain this delay entry into the healthcare system could not be studied here. The maternal factors known in the literature to be associated with late onset of prenatal care include young age, low

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educational level, unwanted or unplanned pregnancy and high parity. Social difficulties may explain this delay in part. It has been shown that both lack of legal immigration status and recent arrival in France are risk factors for inadequate prenatal care. Unfortunately, we were not able to control for prenatal care in our analysis because of the high rate of missing data for this variable in the confidential enquiry into maternal deaths. Lack of medical care during pregnancy can promote the onset of severe complications. This is particularly true for hypertensive complications and may explain why the excess risk for postpartum maternal death in foreign women is so marked for the hypertensive disorders. This cause of death differs from other causes by the importance that routine prenatal care can play in its prevention. In a study in Belgium, Haelterman et al. showed that after adjustment for socio-economic conditions, the association between 'ethnicity' and pre-eclampsia disappeared. They also found that previous residence in a foreign country is an important risk factor for pre-eclampsia, even after adjustment for medical and social factors: these conclusions point towards the existence of an effect of recent migration on the hypertensive disorders during pregnancy.

In this study, we found that the proportion of non-optimal care in women who died was greater among foreign than French women. The confidential enquiries into maternal deaths in the Netherlands found similar results, especially as to hypertensive disorders: immigrant women more often received insufficient treatment for serious hypertensive disorders. In a recent Norwegian study auditing perinatal deaths, erroneous interpretation of severe risk factors as signs of eclampsia were over-represented in nonwestern women. A similar Swedish study found a greater frequency of suboptimal perinatal care for immigrants from East Africa than for native Swedes.

The more frequent suboptimal care found in this study among foreign women may occur during the prenatal period. Poor availability of translations and of culturally competent services may constitute an obstacle to a contributive prenatal visit. The severity of the patient’s condition may also be underestimated at the moment of the complication due to communication problems: women may have difficulties to explain clinical signs such as severe epigastric pain, nausea, headaches or phosphenes, and the severity of their condition may thus be underestimated. The assessment of the patient’s condition during the clinical interview determines management: for some serious hypertensive disorders, such as HELLP syndrome, clinical symptoms appear more predictive than laboratory tests. Failure or inability to report these symptoms may therefore delay the administration of appropriate treatment.

Among preventable maternal deaths, negligence of the patient had more often contributed to the death among French than among foreign women, according to the experts' assessment. This finding may be interpreted as a differential propensity to refuse care or medical advice, and/or to express this choice.

**Conclusion**

This study shows that an excess risk of postpartum maternal death persists for foreign women after taking individual characteristics into account, especially for hypertensive disorders, and that this increased mortality risk is associated with a poorer quality of care as compared to French women. Additional studies are needed to elucidate the obstacles to optimal management of these women. In a practical perspective, these results point to an immediate need to pay special attention to early enrolment in prenatal care and the screening and prenatal management of hypertension, especially in women of sub-Saharan Africa nationality.

**Contribution to authorship**

M.P. conducted the analysis and drafted the article. C.D-T. had the original idea for this study. M-H.B-C. has coordinated the confidential national survey on maternal deaths in France since 1996. M.P. drafted the article in collaboration with C.D-T. and M-H.B-C., who both actively participated in developing it.

**Details of ethics approval**

The national confidential enquiry into maternal deaths and the national perinatal survey were approved by the Commission Nationale Informatique et Libertés (National Data Protection Authority).

**Financial support**

The national confidential enquiry into maternal deaths is funded in part by the Institute for Health Surveillance (InVS) and by INSERM.

The 1998 national perinatal survey was funded in part by the General Health Directorate (Ministry of Health).

**Acknowledgements**

We thank the medical assessors of the national confidential enquiry into maternal deaths who collected all the information about maternal deaths; the members of the National Expert Committee on Maternal Mortality; the coordinators of the national perinatal survey of Epidemiological research unit on perinatal health and women's health (INSERM U149) and the Directorate of Research, Studies, Evaluation and Statistics (Ministry of Health).
References


The seventh report of the confidential enquiries into maternal deaths in the United Kingdom: Comparison with French data

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Reçu le 26 mars 2008 ; accepté le 5 novembre 2008
Disponible sur Internet le 19 décembre 2008

Résumé


Résultats. – Le nombre de décès maternels tend à augmenter et le nombre de décès indirects est supérieur au nombre de décès directs. Les étiologies et leur rang respectif sont maintenant très différents de la situation française. L’obésité, l’âge maternel croissant, le diabète et le tabagisme deviennent des facteurs favorisants importants. Au Royaume-Uni, les cardiopathies sont les causes dominantes des étiologies indirectes et la moitié environ des cas est liée à une pathologie ischémique tandis qu’en France les décès d’origine cardiaque sont rares. La maladie thromboembolique reste la cause dominante des étiologies des morts directes, alors que l’hémorragie a nettement regressive contrairement à la France où l’hémorragie reste préoccupante. Les causes infectieuses sont au second rang (avec la prééclampsie) au Royaume-Uni alors qu’elles ne représentent qu’une cause rare en France. Dans les deux rapports, les soins non optimaux restent fréquents pour les causes directes. Les décès attribuables à l’anesthésie sont très rares aujourd’hui (n = 6), mais dans de nombreux cas britanniques, l’anesthésie a contribué au décès par des soins non optimaux (n = 31). Le rapport britannique souligne, plus encore qu’en France, le rôle important des personnels insuffisamment formés et notamment des internes non supervisés.

Conclusion. – Le Royaume-Uni se distingue par le renouvellement de sa réflexion sur les stratégies qui intègrent les conceptions modernes sur la sécurité des soins. L’analyse systémique, les registres de pathologies, les indicateurs de suivi représentent notamment des approches passionnantes qu’il faut également mettre en œuvre en France.

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Abstract
Objectives. – To describe the main results and recommendations from the seventh report on confidential enquiry into maternal death in the United Kingdom (UK) (2003–2005).

Methods. – Comparison with the most recent French data (1999–2001).

Results. – Maternal mortality tends to increase and indirect causes are more common than direct causes. Causes of deaths and their respective ranking are strikingly different with what is observed in France. This can probably be ascribed to the increasing role of obesity, maternal age, tobacco use and diabetes in the UK. Cardiac disease now ranks first among indirect causes and is linked in half of cases to ischaemic heart disease. This contrasts with the French situation where cardiac death remains rare. Thromboembolic disease remains the main cause of direct deaths while the role of haemorrhage has decreased. This also contrasts with the French situation where haemorrhage remains of concern. Sepsis is now the

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second cause in the UK (at the same level than preeclampsia), while it is a rare cause in France. In both French and UK reports, substandard care remains of concern in many cases of direct deaths. Anaesthesia is now a rare cause of death \((n = 6)\) although the UK report emphasizes that in a large number of cases, anaesthesia has contributed to death because of substandard care \((n = 31)\). In many cases, the report highlights the deleterious role of unsupervised residents.

Conclusion. – The United Kingdom report integrates modern strategies that might improve patient safety, including systems failure analysis, incident reporting and registries. Systematic auditing (with proposition of auditable standards) might also prove important in facilitating implementation of the top ten recommendations. All these strategies might also be implemented in France and hopefully might prove to be also beneficial here.

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Mots clés : Anesthésie ; Obstétrique ; Mort ; Enquête confidentielle

Keywords: Anaesthesia; Obstetrics; Death; Confidential enquiry

1. Introduction

La publication au début de l’année 2008 de ce nouveau rapport [1] est encore un événement de portée internationale compte tenu de la qualité du travail sous-jacent (incluant la méthode de recueil des cas permettant de réduire la sous déclaration et la qualité des analyses collaboratives menées par les experts nationaux et régionaux). Bien que la mortalité maternelle soit plus faible qu’au moment de l’initiation de cette enquête au début des années 1950, le taux global a maintenant tendance à augmenter depuis une vingtaine d’années (entre sept et 14 pour 100 000 actuellement selon le mode de calcul et la prise en compte de la sous déclaration). L’évolution des causes est devenue évidente, avec notamment un rôle favorisant de l’obésité, de l’immigration et de la pauvreté. La hausse actuelle du nombre de décès est liée, malgré les améliorations fortes du système, à une aggravation des situations maternelles (obésité, pathologies complexes sous-jacentes, origine ethnique et facteurs socioéconomiques). Cela est reflété par le fait que les morts indirectes (pathologies sous-jacentes préexistantes à – et décompensées par – la grossesse telles que cardiopathies ou pathologies psychiatriques) sont plus nombreuses que les morts directes (Tableau 1).

Les premiers enseignements, dont plusieurs sont à mettre en parallèle de la situation française et les rapports du Comité national d’experts sur la mortalité maternelle [2,3], sont nombreux. Nous rappellerons pour chaque situation clinique pertinente pour les anesthésistes-réanimateurs les principaux résultats de cette enquête auxquels feront suite des commentaires spécifiques.

2. Seniorisation des soins

La réflexion la plus importante de ce rapport est le rôle majeur joué par les médecins en formation dans les décès : méconnaissance des pathologies, retard au diagnostic des complications en phase d’installation (hémorragie par exemple), retard de prise en charge ou insuffisance de compétence devant une complication grave. Il semble admis au Royaume-Uni que les internes sont actuellement moins bien formés ou plus lentement qu’auparavant, peut-être en raison de la diminution du temps de travail [4]. Cela a conduit à un travail de fond sur la formation, notamment
en prévision des situations difficiles (exercices de simulation et évaluation des compétences au cours de la formation). Cependant, le problème souligné dans ce rapport de façon répétitive est le fait que les gardes restent assurées au Royaume-Uni par des internes et non par des médecins spécialistes (« seniors »), ces derniers restant à leur domicile en astreinte. Depuis le rapport Steg sur les urgences au début des années 1990 [5], la tendance à senioriser les gardes s’est accrue et est maintenant la règle en France. Au Royaume-Uni, cette solution, pourtant évidente, n’est toujours pas envisagée (du moins dans le rapport) probablement parce qu’elle remettrait trop en cause le lobby médical représenté par les consultants. Il est intéressant de noter qu’aux États-Unis également, la réflexion évolue vers une prise de conscience des faiblesses des médecins en formation [6] et donc du rôle de support que devraient jouer les médecins diplômés. Bien qu’intuitivement le rôle des médecins en formation soit un facteur important, on remarquera que dans les rapports français [2,3], les prises en charge non optimales et la déception restent très fréquents, suggérant qu’en France la seniorisation ne règle pas tout et que d’autres problèmes importants restent à traiter.

Les rapporteurs insistent beaucoup sur un early warning score qui permettrait de détecter précocement une situation en train de s’aggraver et un modèle (incluant la fréquence cardiaque, la pression artérielle systolique, la fréquence respiratoire, l’état neurologique et la SpO2) est proposé à titre d’exemple. Cette idée est certes intéressante mais la littérature sur le sujet est déjà relativement abondante (essentiellement dans les services d’hospitalisation générale) et jusqu’ici pas vraiment concluante [7]. On rapprochera de cette volonté de détecter précocement les signes de gravité, la recommandation française d’avoir un hémostoglobinomètre à disposition dans toutes les maternités et de rechercher une anémie au moindre doute. Il est intéressant de constater qu’en France, cela est officiellement obligatoire depuis le texte réglementaire datant de 2000 qui impose la présence d’un tel appareil dans toutes les maternités. De plus, la mise en évidence en France par l’enquête nationale Sfar–Inserm de décès par non transfusion ou par retard à la transfusion [8], suivie de la recommandation d’emploi d’une mesure répétée du taux d’hémoglobine (Hb) au lit du malade ou au bloc opératoire vont dans le même sens. Ainsi donc, plutôt que la mise en place d’un score aux qualités prédictives discutables, on retiendra qu’il faut se donner les moyens de détecter précocement une hémorragie du post-partum et d’en appréhender la gravité.

3. Cardiopathies

Les cardiopathies représentent à elles seules la cause principale de mortalité maternelle au Royaume-Uni dans ce triennum (47 cas), mais l’origine des cardiopathies a profondément évolué. La moitié environ des cas est liée à une cardiopathie ischémique (infarctus du myocarde, n = 12) ou à une dissection aortique (n = 9) secondaire à une hypertension ou à un syndrome de Marfan. Deux cas seulement de décès par rétrécissement mitral rhumatismal ont été notés (auquel il faut ajouter quelques rares cas de pathologies valvulaires congénitales). On retrouve donc ici encore l’influence de l’obésité, du diabète, de l’âge et du tabagisme dans l’accroissement du risque ischémique. Un décalage certain existe entre les modes de vie de part et d’autre de la Manche puisque le rapport français ne décrit qu’un nombre faible de décès par cardiopathie et leurs étiologies restent traditionnelles.

4. Maladie thromboembolique

Elle reste la première cause de décès maternel direct depuis plusieurs triennums. Le problème des femmes obèses est souligné au Royaume-Uni, mal apprécié et la littérature dans ce domaine est encore imprécise (ajustement des doses d’anticoagulants par exemple) [9]. Fort heureusement, la situation en France, bien que préoccupante par l’augmentation du taux d’obésité [10], reste en deçà de celle rencontrée au Royaume-Uni.

Les recommandations sur la thromboprophylaxie en cours de grossesse, décrites dans ce rapport, prennent position sur au moins deux points discutés jusqu’ici :

- la prophylaxie doit être débutée tôt dans la grossesse lorsqu’elle est nécessaire (alors que dans les recommandations françaises, persiste encore la possibilité de ne débuter le traitement qu’au troisième trimestre [11]) ;
- les AVK ne sont pas recommandés en cours de grossesse. Cette position ferme s’oppose aux recommandations américaines qui suggèrent la possibilité de l’emploi des AVK au second trimestre [12], tandis que certains auteurs estiment que le risque thrombotique pourrait être mieux contrôlé avec les AVK au second trimestre [13].

En présence d’un seul facteur de risque « mineur » (exemple : âge supérieur à 35 ans, parité supérieure à 4, travail long, varices, prééclampsie...), une thromboprophylaxie doit être débutée avec une héparine sous-cutanée ou des bas antithromboses (BAT). Cette recommandation est en désaccord avec celle de la Sfar qui considère qu’au moins trois de ces facteurs mineurs doivent être associés pour faire passer de la catégorie « risque faible » à « risque modéré ». Bien que toutes les recommandations publiées soient avant tout des avis d’experts, donc fondées sur un très faible niveau de preuve, on peut s’étonner de cette classification britannique des facteurs de risque qui positionne la césarienne en urgence comme « à risque mineur » et au même niveau qu’un âge supérieur à 35 ans. Certes, le choix laissé au prescripteur d’utiliser une héparine sous-cutanée ou des BAT permet de retrouver des pratiques plus habituelles en France puisqu’il est possible de prescrire plutôt des BAT à une femme de plus de 35 ans et une héparine après césarienne. Cependant, il eût été plus logique de séparer les niveaux de risque « mineur » et « modéré » par l’emploi de moyens mécaniques dans un cas et d’une prophylaxie pharmacologique dans l’autre.

5. Hémorragies obstétricales

Il est important pour les équipes françaises de s’intéresser aux stratégies employées au Royaume-Uni sur ce thème. Le
nombre de décès par hémorragie est, en effet, environ la moitié de celui observé en France, où l’hémorragie reste la première cause de décès maternel. Même si une amélioration est possiblement observable entre les deux triennums français disponibles (1996–98 : n = 42 versus 1999–2001 : n = 30) [3], cette tendance n’est pas retrouvée lorsque les données sont agrégées de façon différente (Tableau 1).

Too little, too late est cependant l’expression qui décrit le mieux le problème de l’hémorragie et cette expression a de plus une bonne valeur mnémotechnique. Le retard au diagnostic et au traitement de l’hémorragie a aussi été mis en évidence en France. D’autres commentaires des experts du comité britannique sont importants. La « césarienne n’est pas une procédure sans risque » à la fois à court terme (61 % des décès sont enregistrés au décours de césariennes, même si ce chiffre ne préjuge pas d’un lien causal constant avec la césarienne elle-même) et à long terme car l’utérus devient « cicatriciel » avec un risque accru de placenta prævia et accreta. Cette remarque est également valable pour les experts français du Cnemm [14]. Pour les patientes ayant un antécédent de césarienne, le rapport britannique indique clairement que la localisation anténatale du placenta doit être systématiquement précisée et le moindre doute sur l’existence d’un placenta accreta ou percreta doit être levé par la réalisation d’une échographie, voire d’une IRM. Les patientes avec un placenta prævia doivent être prises en charge dans des structures permettant une réanimation maternelle et ayant un accès immédiat à des produits sanguins labiles. La mesure répétée du taux d’Hb au lit du malade est soulignée. L’emploi de PFC, dans un rapport PFC/CGR proche ou égal à un, est également souligné, en accord avec les études récentes [15,16]. L’intérêt de la méthylergométrine, très peu utilisée en France, est souligné par les experts de ce rapport, en excluant les femmes hypertendues chez lesquelles le produit est contre-indiqué.

6. Prééclampsie

La mise en route du traitement antihypertenseur dès que la PAS s’élève au-dessus de 160 mmHg est élevée au rang de recommandation forte, la valeur seuil ayant été définie dans une étude nord-américaine [17], afin d’éviter la survenue d’hémorragie intracrânienne. De même, la prophylaxie d’une poussée hypertensive lors de la laryngoscopie chez les femmes prééclamptiques est rappelée. Il est intéressant de noter que l’emploi en France de la nicardipine [18], voire de l’urapidil [19], par voie intraveineuse, produits qui ne semblent pas disponibles au Royaume-Uni permet un contrôle quasi-instantané de la pression artérielle lorsque celle-ci s’élève de façon très importante ou qu’une prise en charge urgente est requise.

7. Infections

Dans le rapport 2003–2005, le nombre de cas de décès par pathologie infectieuse est plus élevé (n = 18 versus sept) et le rang de classement (deuxième versus cinquième) qu’en France. Cependant, les soins ont été aussi souvent qu’en France considérés comme non optimaux (71 % des cas dans les deux enquêtes). Le retard au diagnostic et au traitement est aussi souligné dans les deux études, ce qui pourrait donner du corps au concept de score de dépistage précoce, mais ici encore, il apparaît que le rôle des médecins en formation est au moins aussi crucial. On remarquera que l’urgence à l’instauration d’un traitement antibiotique dans les situations obstétricales est de même nature que pour les autres situations infectieuses graves, avec un lien entre le délai de début du traitement et le risque de décès [20]. Les germes de la flore génitale (bacilles Gram négatif, streptocoques) sont sensibles à une antibiothérapie à large spectre initiale et une bithérapie immédiate est souhaitable lorsque des signes de gravité s’installent. Le streptocoque A mérite une mention particulière : responsable de huit décès sur 18 au Royaume-Uni (soit 44 %) et de deux décès sur sept en France (29 %), notamment en raison du lien qui existe entre l’infection à ce germe et les règles d’hygiène au sein de la maternité, en particulier le port du masque en salle d’accouchement.

8. Rôle de l’anesthésie

Concernant les décès d’origine anesthésique, le nombre de décès n’est plus en diminution. Après le triennum 1994–1996 où seulement un décès de cause anesthésique directe avait été enregistré, on a assisté à une réascension aux taux antérieurs (trois à six décès par triennum).

Les six cas du rapport actuel sont les suivants :

- un bronchospasme mortel à l’extubation au décours d’une grossesse extra-utérine, géré par un interne avec formation insuffisante et sans aide ;
- une forte dose de fentanyl administrée immédiatement avant extubation avec détresse respiratoire postopératoire (anesthésie en cours de grossesse) gérée par un interne seul ;
- à l’occasion d’une hémorragie en postpartum, passage intraveineux de bupivacaine à partir d’une poche préparée pour perfusion continue péridurale (confusion avec une perfusion d’ocytocine) ;
- la méconnaissance d’un hémorragia secondaire à une double tentative de pose de cathéter par voie sous-clavière avec absence d’utilisation de l’échographie [21], même si les experts britanniques reconnaissent que dans le cas précis, l’emploi de l’échographie n’aurait pas modifié l’évolution ;
- des troubles électrolytiques non détectés chez une patiente ayant une néphropathie opérée à distance de l’accouchement ;
- une patiente obèse et asthmatique avec détresse respiratoire postcésarienne mal prise en charge (sur le plan du monitorage et de la thérapeutique).

Ici encore, le problème récurrent est l’absence de senior (consultant) et on ne trouve dans le rapport que peu de discussion sur les problèmes anesthésiques propres dits (doses, agents d’anesthésie, techniques d’ALR notamment), laissant suggérer que ces aspects sont maîtrisés aujourd’hui. C’est davantage l’insuffisance de compétence et l’expérience pour gérer une complication qui apparaît en cause. Il faut aussi souligner que l’anesthésie-réanimation est aussi impliquée dans 31 autres décès du fait d’une prise en charge imparfaite (éclampsie, hémorragie, obésité).
On notera l’absence de décès par syndrome de Mendelson. Cela ne préjuge pas de la survenue lors des triennums ultérieurs comme cela s’est déjà produit précédemment. En France, cette étiologie reste préoccupante ainsi que l’a montré l’enquête nationale sur la mortalité anesthésique [8]. Bien que les cas aient été enregistrés dans des circonstances non obstétricales, les pratiques relevées étaient souvent éloignées des recommandations habituelles sur la prise en charge des patients avec « estomac plein ».

L’un des décès britanniques a été secondaire à l’administration d’anesthésie locale par voie intraveineuse en raison d’une erreur humaine. Les facteurs favorisants de l’erreur humaine sont discutés dans le paragraphe suivant. En raison de l’efficacité de l’administration de solution lipidique, il est maintenant recommandé que tous les sites où sont réalisées des anesthésies locorégionales soient pourvus de ces solutions lipidiques et d’un protocole d’administration et que des informations soient largement diffusées à tous les personnels pour que leur emploi soit immédiat en cas d’accident toxique après injection d’anesthésique local [22].

9. Facteurs systémiques


10. Morbidité grave

Au cours des dix dernières années, la plupart des auteurs avaient considéré que l’enregistrement de la morbidité grave (ou du taux d’admission en réanimation des femmes enceintes ou en postpartum) était un marqueur subrogé (intermédiaire) pertinent de la qualité des soins [27,28]. Beaucoup pensaient que ce marqueur était plus intéressant à enregistrer que la mortalité car : (1) les pathologies responsables de mortalité et de morbidité grave étaient similaires et évoluaient en parallèle, l’un reflétant donc l’autre ; (2) les nombres de cas de morbidité grave, plus élevés, faciliteraient l’analyse et les statistiques. De façon intéressante, dans le rapport actuel, l’expérience écossaise d’analyse de la morbidité grave est rapportée. Contrairement à ce que l’on pensait jusqu’ici, mortalité et morbidité ne semblent plus évoluer en parallèle. La première hypothèse pour expliquer cette séparation pourrait être un problème de définition trop large de la morbidité grave. Celle-ci correspond à une liste de 14 causes incluant hémorragie, thromboembolie, prééclampsie, œdème du poumon, sepsis grave, anesthésie, à laquelle pourraient, en revanche, échapper certaines situations à risque élevé. Cette hypothèse est peu probable car le taux global enregistré ici (0,5/1000) correspond typiquement au taux d’admissions des femmes enceintes en réanimation [29,30] et la définition semble donc couvrir assez bien le risque grave. La seconde hypothèse est liée au fait que toutes les patientes ne sont pas admises en réanimation actuellement car se sont développées les unités de soins intensifs obstétricaux (USIO) [31] qui permettent de maintenir les femmes avec peu (ou pas) de défaillance(s) d’organe dans un environnement obstétrical plus favorable à la prise en charge des pathologies maternelles. Le troisième facteur pourrait être la sous déclaration des cas de morbidité grave (on ne déclarerait que ce qui est sans risque pour l’équipe, notamment médicojudiciaire). Cette idée pourrait être en accord avec le fait que le taux de soins non optimaux est très faible (3 %), chiffre bien différent des chiffres observés pour la mortalité où les soins non optimaux sont retrouvés dans 50 à 100 % des cas. Cependant, cette discordance pourrait bien aussi traduire la réalité car on peut penser que bon nombre de situations critiques se terminent bien actuellement, ayant été bien prises en charge. Il ne resterait alors dans le registre des décès que les cas avec soins non optimaux ou ceux pour lesquels la qualité de soins ne détermine pas de façon importante le risque de décès (exemple : l’embolie amniotique). Cette dernière catégorie semble cependant peu probable car l’hémorragie du post-partum, souvent associée à des soins non optimaux, est la première cause de morbidité dans le registre écossais.

11. Système de surveillance et retour d’expérience

En complément de la déclaration volontaire des cas de morbidité grave en Écosse, on notera avec intérêt le développement d’un système de surveillance et de déclaration des pathologies maternelles en cours de grossesse et en postpartum : ces registres, dont au moins l’un d’entre eux est géré par l’Obstetric Anaesthetists’ Association (OAA) [32], permettent de relever un nombre important de pathologies rares et de tirer des informations sur la présentation de ces pathologies et leur prise en charge qui ne seraient jamais obtenues par l’expérience d’un seul centre, même sur une durée prolongée. Le caractère volontaire de la déclaration peut cependant limiter la qualité du registre [33].

12. Indicateurs de suivi

Un point nouveau de grande importance est la suggestion, pour chaque recommandation, d’indicateurs de mise en œuvre, avec même pour certains un objectif chiffré exigeant (« cible à 100 % »). Ces indicateurs pourraient, au moins en partie, être repris dans le système de certification des établissements français.

13. Conclusion

Les données de ce rapport mettent en avant des situations cliniques et des organisations bien différentes de celles retrouvées en France. Par certains aspects, la situation française semble
plus favorable, en raison soit d’une meilleure situation socioculturelle (obésité) soit d’une meilleure organisation des soins (rôle prédominant des médecins diplômés). Malgré les faiblesses du système britannique, on se souviendra que la mortalité maternelle au Royaume-Uni est d’amplitude similaire à celle de la France. Le Royaume-Uni a déjà démontré sa forte capacité à améliorer la prise en charge des causes évitables de décès (hémorragie) et se distingue par le renouvellement de sa réflexion sur les stratégies qui peuvent être proposées et qui intègrent les conceptions modernes sur la sécurité des soins. L’analyse systémique, les registres de pathologies, les indicateurs de suivi représentent notamment des approches passionnantes qu’il faut également mettre en œuvre en France. La diffusion large des résultats de cette enquête (et ceux des rapports français), ainsi que la définition des cibles prioritaires d’action, sont de nature à réduire encore la mortalité évitable. La complémentarité de ces enquêtes nationales, plus encore que leur simple comparaison est source d’amélioration de la qualité des soins.

**Références**


The objective of the National Confidential survey on Maternal Deaths is to collect detailed information on all maternal deaths occurring in France, in order to analyze their epidemiology and the quality of care provided. The current report covers the 2001 to 2006 years.

During this period, 463 maternal deaths were identified, i.e. a ratio of 9.6 maternal deaths per 100,000 live births. The risk of maternal death increases with maternal age, from the age of 30, and even more after the age of 35 – 3 times higher for women aged 35-39, and 6 times higher for women aged 40 and above. Foreign women also are at greater risk of maternal mortality, in particular those from sub-Saharan Africa. Geographical disparities in maternal mortality exist. Compared to other regions, the maternal mortality ratio is 30% higher in the Ile-de-France region, and 3 times higher in the French overseas regions.

The majority of maternal deaths were due to direct obstetrical causes (73%), the main causes being haemorrhage (25%), amniotic fluid embolism (12%), complications of hypertension (10%), and venous thromboembolism (10%).

Half of maternal deaths were considered avoidable by the National Experts Committee. The causes of death that were most often considered avoidable were haemorrhage (86%) and sepsis (90%).

Each group of causes of death (haemorrhage, amniotic fluid embolism, venous thromboembolism, complications of hypertension, complications of anaesthesia, indirect obstetrical causes) is discussed in a specific section including the main characteristics of women, a detailed description of several cases, and recommendations on how the quality of care may be improved.

**Mots clés:** maternal mortality, avoidable deaths, quality of care, France

Suggested citation: