



Report on
Maternal Deaths
in Australia

1991-93

NHMRC

National Health and Medical Research Council

Report on

**Maternal Deaths
in Australia**

1991-93

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Report of the Maternal Mortality Working Party

NHMRC

National Health and Medical Research Council

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PREFACE

In the 1991–93 triennium there were 84 deaths (27 direct, 21 indirect and 36 incidental). The overall maternal mortality rate was 10.9 per 100,000 confinements and was the lowest on record. *More importantly, the maternal mortality rates for direct and indirect deaths were 3.5 and 2.7 per 100,000 confinements respectively. These figures compare favourably with those of 5.5 and 4.3 per 100,000 confinements for direct and indirect deaths respectively published in the report on confidential Enquiries into Maternal Deaths in the United Kingdom for the triennium 1991–93.*¹ In Australia in the 1991–93 triennium, the incidental maternal mortality rate was 4.7 per 100,000 confinements, a rate that has not fallen over the past seven triennia; because of the reduction in direct and indirect deaths the incidental maternal deaths now comprise the largest group (Table 5). This explains the increased emphasis on discussion of deaths from suicide, self-administrated overdose and/or coexistent psychiatric disorder in this report (see Chapter 11).

It is noteworthy that the total maternal mortality rate was appreciably less than the average female death rate from all causes for the age groups 15–49 years (0.11 versus 0.55 per 100,000 Chapter 1, Tables 10 and 11). However, as in eight of the nine previous triennia, the *death rates for women aged 35 years and over were well above the overall rate*, and in 1991–93 the rates were treble that in the three age groups below 30 years of age (Chapter 1, Table 10).

Important Findings and Recommendations

Many maternal deaths have several complications and so appear in several chapters of this report (of the 84 deaths, 41 were considered in one chapter, 30 in two, 11 in three and two in four; the 84 deaths provided 142 cases for discussion in Chapters 2–12, but Tables 1–3 each death has been attributed to a single (main) cause as decided by the relevant State Maternal Mortality Committee.

1. In this triennium, an avoidable factor was considered to be present in seven of the 27 direct obstetric deaths, two of the 21 indirect deaths and three of the 36 incidental deaths.
2. Aboriginal women accounted for 10.7 per cent of the 84 maternal deaths and an avoidable factor was judged to be present in only one. *The relative risk of maternal mortality in this triennium for Indigenous women versus non-Indigenous women was 4.12 (95 per cent CI 2.07-8.23) (Tables 12 and 13).*
3. There was no direct maternal death resulting from abortion (Chapter 2).

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4. Preeclampsia/eclampsia (pregnancy induced hypertension) was associated with nine deaths and was classified as the primary cause of death in five (Table 1). At least three of these women developed intravascular coagulopathy. The Maternal Mortality Working Party wishes to emphasise to readers that the International Collaborative Eclampsia Trial indicates that ***magnesium sulphate is the drug of choice for the treatment of eclampsia*** (Chapter 3). Women with severe preeclampsia also require careful management, sometimes in an intensive care unit, and prompt delivery. Early consultation with a referral centre for management of persisting postpartum medical problems is recommended.
 5. ***Cardiovascular disease*** was a major contributing cause in 12 deaths and the main cause in five (Chapter 4, Table 2). The leading causes were the same as in the last triennium and were cardiomyopathy (3), myocardial infarction (2) and myocarditis (2). These cases serve to emphasise the importance of an adequate cardiovascular examination during pregnancy and appropriate investigation of any episode of dyspnoea.
 6. ***There were 16 maternal deaths associated with infection and in eight this was the main cause of death*** (one direct death, Table 1; four indirect, Table 2, and three incidental, Table 3). ***The increase in the number of maternal deaths related to septicaemia illustrates the importance of vigorous treatment of infections during pregnancy.*** Avoidable factors were considered to be present in three of these patients (Chapter 6).
 7. ***Haemorrhage was a major cause of death in 15 cases*** (Table 16); four were associated with placenta praevia, three with ectopic pregnancy and two with placental abruption. ***Caesarean section was performed in ten of the 15 cases and disseminated intravascular coagulopathy occurred in six of the 15 cases*** (Chapter 7). Many of these cases illustrate that expert resuscitative facilities can be needed urgently and unexpectedly in pregnancy complications that necessitate Caesarean section because of conditions such as placenta praevia.

Intramyometrial injection of prostaglandin F2 alpha is often lifesaving when postpartum haemorrhage is associated with uterine atony.
 8. ***Caesarean section or its necessary anaesthetic was associated with 33 maternal deaths.*** In 17 women the death was related to the Caesarean section or the administration of the anaesthetic. There were nine women who would probably have died from existing obstetric or other complications and the other seven women were dead or moribund before Caesarean section (Chapter 8).

-
9. In three of the eight cases in which *pulmonary thromboembolism* was diagnosed the women died suddenly without warning signs. Known predisposing factors included Caesarean section (4), obesity (3), anaemia (2) and pelvic inflammatory disease (Chapter 9). In the 1964–66 triennium there were 44 maternal deaths from thromboembolism. The reduction in deaths from this cause is likely to be the result of better obstetric care including avoidance of maternal exhaustion by prevention of prolonged labour and pain, adequate resuscitation when haemorrhage occurs, and use of all available methods to establish the diagnosis of deep venous thrombosis and thromboembolism with appropriate use of anticoagulation therapy.
 10. *Amniotic fluid embolism* presented with cardiorespiratory shock in labour in three of the five cases and in the other two, the women collapsed during Caesarean section and both developed blood coagulation failure. This awesome complication may result in death despite expert resuscitation efforts.
 11. During the past 30 years there has been progressive reduction in direct and indirect maternal deaths from all causes (Table 5), but in this triennium ten of the 84 deaths were associated with *suicide, self-administered overdose and/or psychiatric disease*. This is the largest number of such deaths since the 1970–72 triennium (Chapter 11). Antenatal and postnatal depression require early recognition and specialised psychiatric support. Similarly women with narcotic drug addiction need additional care during and after pregnancy (Chapter 11).
 12. The final chapter in this report discusses the miscellaneous deaths which accounted for 28 of the 84 deaths; these include homicide (4), traffic and other injuries (11) and neoplasms (5). Although only two of these 28 deaths were judged to have avoidable factors, it is clear that a range of medical diseases can suddenly pose critical complications during pregnancy whether the diagnosis was previously unknown, or well known but under inadequate control (Chapter 12).

Further improvements in the maternal mortality rate and/or the maintenance of the present excellent results in Australia, require study of maternal morbidity (ie the deaths prevented), as well as heeding the clinical lessons in those deaths that did occur:

The clinical details of the maternal deaths presented in this report illustrate that all midwifery units should have access and protocols for transport to intensive care facilities for critically ill women during pregnancy or after delivery.

Note

1. *Report on Confidential Enquiries into Maternal Deaths in the United Kingdom, 1991–93.* Department of Health, Welsh Office, Scottish Office Department of Health, Department of Health and Social Services, Northern Ireland.

DEFINITIONS

Maternal mortality

Maternal mortality as defined by the World Health Organisation (WHO) is the death of a woman during pregnancy, childbirth or in the 42 days of the puerperium, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management. This definition includes deaths from abortion and ectopic pregnancy, but excludes deaths from incidental causes. Also excluded are deaths from assisted reproduction technologies where pregnancy has not occurred. *In this, as in all previous reports on maternal deaths in Australia, incidental deaths are included, as are deaths occurring more than 42 days after termination of the pregnancy, when their origin and illness related to the pregnancy.*

Maternal deaths are classified into three groups:

1. *Direct maternal deaths* (Table 1) are those 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—they are complications of the pregnancy itself (for example, eclampsia, amniotic fluid embolism, rupture of the uterus, postpartum haemorrhage).
2. *Indirect obstetric deaths* (Table 2) are those resulting from preexisting disease or disease that developed during pregnancy and was not due to direct obstetric causes, but which may have been aggravated by the physiological effects of pregnancy (for example, heart disease, diabetes, renal disease).
3. *Incidental deaths* (Table 3) are those due to conditions occurring during pregnancy, where the pregnancy is unlikely to have contributed significantly to the death, although it is sometimes possible to postulate a distant association (for example, road accidents, malignancies and suicide). It is often difficult for the expert committees to decide whether a death is an indirect or an incidental death. For example, death from a self-administered overdose could be an accident or a suicide, and may or may not have been due to some effect on the woman of the pregnant state.

SUMMARY

In 1991–93, of a total of 84 maternal deaths, there were 27 attributable to pregnancy and childbirth and 57 associated with pregnancy and childbirth. Of the latter, 21 were classified as indirect and 36 as incidental deaths (Figure 1 and Tables 1–3). In the previous triennium, the respective numbers of maternal deaths were 37 direct, 33 indirect and 26 incidental, making a total of 96. The total death rate was 10.9 per 100,000 total pregnancies (Table 5). ***This result is the lowest recorded in any triennium and is creditable in comparison with those of all other developed countries.***

During the 30 years covered by our ten triennial reports, the number of maternal deaths has reduced progressively by 70 per cent from 275 to 84. However, incidental deaths have not decreased (Figure 1) and now, numerically, are the most important category of maternal deaths. Accordingly this report contains a separate chapter on suicide, self-administered overdose and/or psychiatric disorders, which in this triennium accounted for ten of the 84 deaths (11.9 per cent).

International comparisons of mortality rates are important and to be accurate, should use the same definitions and criteria for inclusion. Ascertainment is a problem with maternal deaths, especially with incidental deaths, where the woman may not be known to be pregnant. Data from coronial enquiries and the autopsy rate in a particular community are therefore important considerations. For example, a report on pregnancy-related mortality in the United States, 1987–90, stated that more than half of such deaths are probably still unreported.¹ Likewise retrospective maternal mortality case ascertainment in West Virginia, 1985–89, found ‘the case ascertainment through this study improved maternal death detection by 100 per cent over official statistics’.²

For this report case ascertainment by the various States and Territories was validated by comparison with information available to the Australian Institute of Health and Welfare. It is noteworthy that this audit gathered only one additional case to the 1991–93 total of 84. Table A provides comparable data from Australia and the United Kingdom (UK) for the last four triennia and shows that incidental deaths (labelled ‘fortuitous’ in the UK reports) are more commonly identified in Australia. A recent study of 293 deaths in currently or recently pregnant women showed that 115 deaths (39 per cent) were attributable to injury; these 115 deaths included homicide (63 per cent), suicide (13 per cent), motor vehicle crashes (12 per cent) and drug overdoses (7 per cent).³ The expert committee agrees with the conclusions of this study that homicide and other injuries are major contributors to maternal mortality and should be (but rarely are) included routinely in maternal mortality surveillance systems. Prenatal and postpartum clinic visits represent an ideal time to implement interventions to prevent injuries among pregnant women.³

Pregnancy complications such as preeclampsia and thromboembolism can cause rapid deterioration and death; warning signs and symptoms should be heeded by patient and medical practitioner, and immediate hospitalisation and appropriate treatment effected. Women with high-risk pregnancies should be managed in hospitals with the required facilities. ***In the 1991–93 triennium avoidable factors were considered to be present in seven of the 27 (25.9 per cent) direct maternal deaths, two of the 21 indirect deaths (9.5 per cent) and three of the 36 (8.3 per cent) incidental deaths.***

Tables 1–3 (Chapter 1) show the causes of death as classified by the expert committees. Chapters 2–12 consider the complications present in the 84 deaths individually, with each patient reported in only one chapter in 41 cases, in two chapters in 30, in four chapters in 11 and in four chapters in two cases. The clinical summaries in each chapter provide relevant details that should assist practitioners in the management of women with these complications.

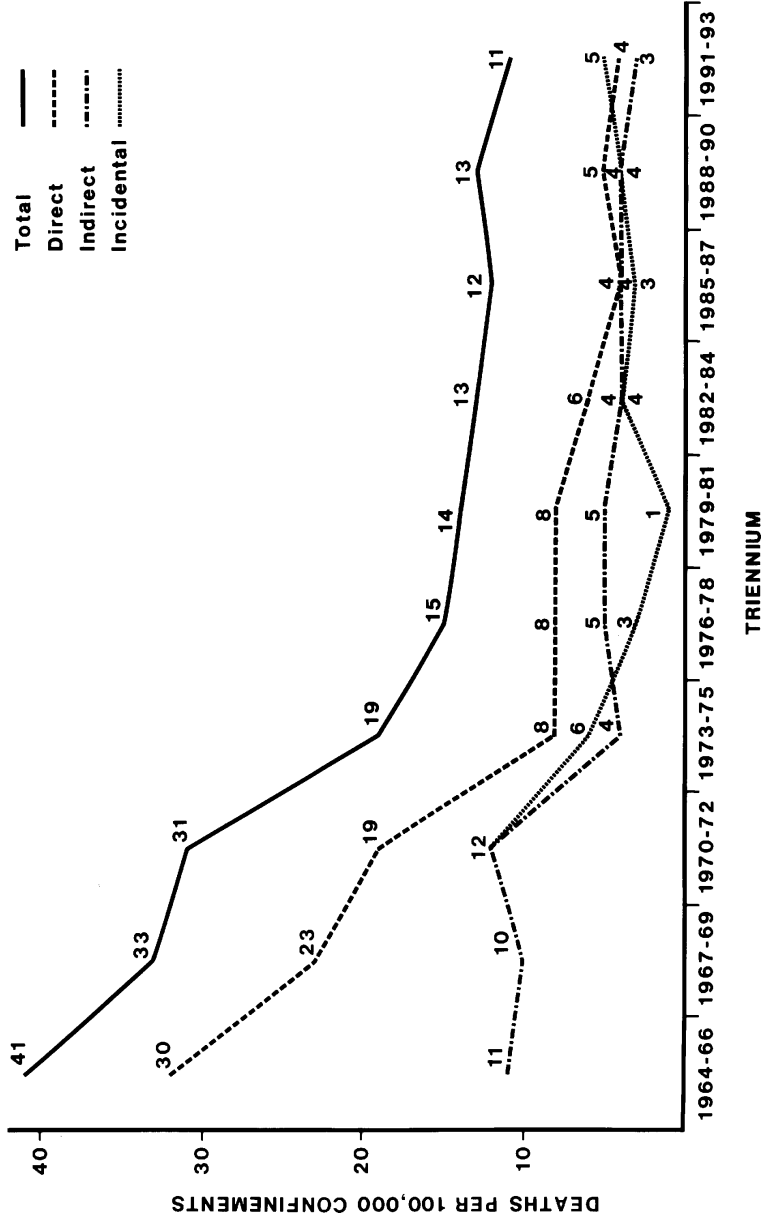
It is noteworthy that the number of direct maternal deaths at 27 (see Figure 1 and Table 1) was the lowest on record, the previous lowest number being 32 in the 1985–87 triennium. Pulmonary embolism (5), amniotic fluid embolism (5) and preeclampsia (5) were the leading primary causes of direct maternal deaths.

It is also noteworthy that the number of indirect maternal deaths at 21 was the lowest on record (see Figure 1 and Table 2), the previous lowest number being 25 in the 1982–84 triennium. Cardiovascular disease (8) dominated the indirect maternal deaths as in the 1988–90 triennium with cardiomyopathy being the main contributor. Other important causes were cerebrovascular disease (4), infections (4) and suicide (2). It should be noted that cases of suicide also appear in the incidental deaths (Table 3), having been thus classified by the various State committees.

The increasing importance of incidental maternal deaths is explained in detail in Chapter 1. The leading causes were motor vehicle accidents (10), cardiovascular disease (5) and neoplasms (5). Deaths from suicide, self-administered overdose (uncertainty whether accident or suicide) and psychiatric disorders are an important group and are considered together in Chapter 11.

Australia, like many other countries, has minority groups with relatively high maternal mortality rates. In this triennium Aboriginal or part-Aboriginal women accounted for nine of the 84 maternal deaths (Table 12) and 16 others occurred in women not born in Australia.

Figure 1 Maternal mortality in Australia 1964-93



Over the 30 years that these reports have been published, the total numbers of maternal deaths (direct, indirect and incidental) have been as follows:

In 1964–66 the total was 275 in 667,649 confinements

In 1967–69 the total was 237 in 713,064 confinements

In 1970–72 the total was 244 in 790,818 confinements

In 1973–75 the total was 137 in 726,690 confinements

In 1976–78 the total was 106 in 678,098 confinements

In 1979–81 the total was 98 in 682,880 confinements

In 1982–84 the total was 94 in 713,985 confinements

In 1985–87 the total was 86 in 726,642 confinements

In 1988–90 the total was 96 in 754,468 confinements

In 1991–93 the total was 84 in 769,253 confinements

The maternal mortality rate (pregnancy and puerperium – 0.11 per 1,000 confinements, Table 5), including deaths from indirect and incidental causes, was appreciably less than the average female death rate from all causes for the age groups 15–49 years (0.55 per 1,000); ***that is the death rate was approximately five times greater in the general population than in women during pregnancy and the puerperium.*** This calculation involves the assumption that each pregnancy represents a year at risk of a maternal death.

For most women in Australia at this time, pregnancy and giving birth do not involve a high likelihood of death. Improved health status and reproductive patterns, together with access to appropriate general and specialised health care has greatly reduced the incidence of maternal mortality in this century. The incidence of deaths determined to be avoidable by factors related to medical care is now very low. The scope of national examination of the health of childbearing women should now be extended to include morbidity associated with pregnancy and childbirth.

However, despite overall general improvements, it is important to note that life-threatening complications can occur, sometimes unpredictably. Seeking to avoid loss of women's lives in childbearing, and minimising damage to their health, remain issues of critical importance for obstetric and midwifery practice in Australia. Against this background, the higher loss of life among Aboriginal childbearing women should be of increasing concern to the Australian community, and demands attention as a priority from all relevant agencies.

Table A Distribution of maternal deaths by triennium, Australia and United Kingdom, 1982–93

Australia*							
Triennium	Direct		Indirect		Incidental		Total
	No.	%	No.	%	No.	%	
1982–84	42	44.7	25	26.6	27	28.7	94
1985–87	32	37.2	30	34.9	24	27.9	86
1988–90	37	38.5	33	34.4	26	27.1	96
1991–93	26	31.0	22	26.2	36	42.9	84

United Kingdom**							
Triennium	Direct		Indirect		Incidental		Total
	No.	%	No.	%	No.	%	
1982–84	138	56.8	71	29.2	34	14.0	243
1985–87	139	55.8	84	33.7	26	10.4	249
1988–90	145	52.4	93	33.6	39	14.1	277
1991–93	128	46.7	100	36.5	46	16.8	274

* *Reports on Maternal Deaths in Australia, 1982–84, 1985–87 and 1988–90.* Australian Government Publishing Service, Canberra.

** *Reports on Confidential Enquiries into Maternal Deaths in the United Kingdom, 1982–84, 1985–87, 1988–90 and 1991–93.* Department of Health, Welsh Office, Scottish Office Home and Health Department, Department of Health and Social Services, Northern Ireland.

Notes

1. Berg CJ, Atrash HK, Koonin LM, Tucker M. (1996) 'Pregnancy-Related Mortality in the United States, 1987–1990'. *Obstet Gynecol* 88: 161–67.
2. Dye TD, Gordon H, Held B, Tolliver NJ, Holmes AP. (1992) Retrospective maternal mortality case ascertainment in West Virginia, 1985 to 1989. *Am J Obstet Gynecol* 167: 72–76.
3. Dannenberg AL, Carter DM, Lawson HW, Ashton DM, Dorfman SE, Graham EH. (1995) Homicide and other injuries as causes of maternal death in New York City, 1987 through 1991. *Am J Obstet Gynecol* 172: 1557–64.

CHAPTER 1

INTRODUCTION

This is the tenth triennial report on maternal deaths in Australia. It covers the years 1991, 1992 and 1993. Confidential information on each maternal death is collected and considered by a maternal mortality committee in each State and Territory which, after seeking further information if required, assesses the case history and determines the cause of death and whether a primary avoidable factor is present. This report collates the decisions made available by all State and Territory committees.

As well as summarising details of the maternal deaths occurring in 1991–93, this report also presents limited data on the deaths from previous triennia, showing the substantial declines in maternal death rates that have occurred since the first report, which covered the triennium 1964–66.

In this report, the figures are based on the causes of death as assigned by the State and Territory Maternal Mortality Committees (see Appendix for the titles and composition of these committees). There were 84 deaths in the triennium—27 direct, 21 indirect and 36 incidental (Tables 1–3). It is possible that some of the variation in the proportions of deaths classified as direct, indirect or incidental may be attributable to classification procedures. Consequently, it is important that deaths classified as incidental be included to produce a proper overview of deaths occurring related to pregnancy.

Assessment of avoidable factors

One of the chief features of the State investigations is the determination and assessment of any avoidable factors in the circumstances of a maternal death, that is, of some departure from the accepted standard of satisfactory care which may have played a part in the death. It is not suggested that, in cases in which avoidable factors are considered present, death could certainly have been prevented, but the presence of an avoidable factor is regarded as an indication that the risk of death could have been lessened. When an avoidable factor is found, it is further classified as to whether it should be ascribed to a medical practitioner, the medical care facilities or to the patient. Due cognisance is taken of the area where the death occurred, the facilities that were available and the status of the medical attendant.

In this triennium, an avoidable factor was considered to be possibly or certainly present in seven of the 27 direct obstetric deaths, two of the 21 indirect deaths and three of the 36 incidental deaths; of the 12 deaths judged to have or possibly have an avoidable factor by the State committees, the factor was mainly the responsibility of the medical practitioner in nine and mainly of the woman herself and/or her companions/family in three.

Cause of death

The causes of death in each category, direct, indirect and incidental, are listed in Tables 1–3. In many deaths, a number of contributing conditions were identifiable. Chapters 2–12 consider the deaths grouped according to the leading causes of death as presented in the nine previous reports, with the exception of Chapter 11 where deaths from suicide, self-administered overdose, and/or psychiatric disease are considered separately rather than being included in the ‘miscellaneous’ deaths as in previous reports, because of their increased importance.

Note that the conditions described in these chapters are considered separately, with the details of individual women reappearing in several chapters: of the total 84 deaths this triennium, 41 were considered in only one chapter, 30 were considered in two chapters, 11 in three chapters and two in four separate chapters. Therefore, the 84 deaths provided 142 cases for discussion.

Maternal mortality rate

The most appropriate denominator for estimating maternal mortality rates is the number of women at risk, that is, the number of pregnant or recently pregnant women. However, this figure is not accurately known, the unknown component being the number of pregnancies ending before 22 weeks’ gestation. The WHO defines maternal mortality rate as the number of maternal deaths (multiplied by 1,000), related to the number of livebirths, as this denominator is available in most countries. In Australia, reliable data are available on the number of pregnancies resulting in a livebirth and those resulting in a stillbirth. In this report, (except in Table 10), the maternal mortality rates have been calculated as:

$$\frac{\text{Number of maternal deaths} \times 100,000}{\text{Total number of pregnancies} \\ \text{(livebirths and stillbirths)}}$$

In Table 10, the maternal mortality rate is shown per 1,000 births (livebirths plus stillbirths), since this convention is also widely used.

A *stillbirth* is defined as a stillborn infant weighing at least 500g, or if the weight is not known, born after at least 22 weeks’ gestation.

A *livebirth* is defined as a liveborn infant weighing at least 500g, or if the weight is not known, born after at least 22 weeks’ gestation.

STATISTICS

Maternal mortality rates

The changes in the maternal mortality rate over the ten triennia covered by the National Health and Medical Research Council (NHMRC) reports are shown in Table 4 (direct maternal deaths only). The changes in the rates of direct, indirect and incidental deaths over the ten triennia are also shown in Table 5.

The direct maternal mortality rate in 1991–93 at 3.5 per 100,000 pregnancies was the lowest recorded in any triennium to date. There has been a progressive reduction in direct maternal deaths since these reports began in the 1964–66 triennium.

In the 1991–93 triennium the total number of deaths was 84, which is the lowest recorded in any triennium, the death rate being 10.9 per 100,000 pregnancies (Table 5). It should also be noted that the indirect maternal mortality rate fell to the lowest figure recorded (2.7 per 100,000 pregnancies), but the incidental maternal mortality rate increased to 4.7 per 100,000 pregnancies, and for the first time comprised the largest group. This is why Chapter 11 has been introduced to draw attention to the important group of deaths from suicide, self-administered overdose and psychiatric disease, which jointly contributed ten of the 84 deaths.

Other statistics

For the present triennium, the age and parity distributions of direct, indirect and incidental deaths are shown in Tables 6–8. Tables 9–12 show other statistical information usually provided in a report of this nature.

1. Table 9 shows the distribution of all confinements according to maternal age and parity.
2. Table 10 shows the age distribution of the maternal deaths, and the age-specific death rates. As in all previous triennia, except the 1985–87 triennium, *the death rates for women aged 35 years and over were well above the overall rate, and in 1991–93 the rates in these groups were approximately treble that in the three age groups below 30 years of age.* It is also of interest that in 1991–93 the total maternal death rates were higher in the age groups 35–39 and 40 years and over (0.27 and 0.34 per 1,000 births) in comparison with the 1988–90 triennium where these rates were 0.23 and 0.22 respectively, although the total mortality rate fell from 0.13 to 0.11 per 1,000 births in the 1991–93 triennium.

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3. Table 11 shows the average annual female death rates from all causes according to age group. *Tables 10 and 11 illustrate the considerably reduced risk of death from any cause for women pregnant and during the puerperium in comparison with women of the same age groups in the general population.*

Aboriginal maternal deaths

The race of the mother is still not recorded in all the death reports. In the 1991–93 triennium, race was reported in 78 of the 84 deaths (92.3 per cent), compared with 90.6 per cent in 1988–90 and 84 per cent in the 1985–87 triennium. Table 12 summarises identified Aboriginal maternal deaths. No information is available for identifying Aboriginal maternal deaths before 1970. In the 1991–93 triennium, the deaths of nine Aboriginal or part-Aboriginal women accounted for 10.7 per cent of the 84 maternal deaths, and an avoidable factor was judged to have been present in only one case, a direct death; there were one direct, four indirect and four incidental deaths. The one direct Aboriginal maternal death is by far the lowest number recorded (Table 12). In previous triennia, the proportion of maternal deaths from all causes in Aboriginal and Torres Strait Islander women were 7.4 per cent (1970–72), 4.4 per cent (1973–75), 8.5 per cent (1976–78), 15.3 per cent (1979–81), 8.5 per cent (1982–84), 15.1 per cent (1985–87) and 14.6 per cent (1988–90).

The report from the National Perinatal Statistics Unit, *Indigenous Mothers and their Babies, Australia, 1991–93* contains the numbers of births identified as being to Indigenous women in this triennium. This enables the comparisons of maternal mortality rates in non-Indigenous and Indigenous women shown in Table 13 to be made. These differences should be interpreted with caution because when numerators are very small and the denominators are large, small variations (and chance fluctuations) in the numbers of cases may render the rates somewhat unstable. Nevertheless, the relative risk of maternal mortality in this triennium for Indigenous women versus non-Indigenous women was 4.12 (95 per cent CI 2.07–8.23).

Maternal deaths in immigrants

The country of birth is not routinely recorded in the case notes of maternal deaths. In 1991–93, this information was available in 70 of the 84 deaths (83.3 per cent). It seems that the country of birth is mostly stated when the woman is known to have been born overseas as was recorded in 16 women.

The countries of birth of these women were Philippines (3), United Kingdom (2), Croatia (2), Burma (1), Tonga (1), Iceland (1), Vietnam (1), Sri Lanka (1), China (1), Thailand (1), Cambodia (1) and Noumea (1).

Nine of the 16 deaths occurring in women born outside Australia were classified as direct, two as indirect and five as incidental.

Table 1 Primary causes of direct maternal deaths, 1991–93

Cause of death	Number
Pulmonary embolism	5
Amniotic fluid embolism	5
Preeclampsia, pregnancy induced hypertension, haemolysis, elevated liver enzymes, and a low platelet count (HELLP syndrome)	5
Ectopic pregnancy	3
Primary postpartum haemorrhage at Caesarean delivery	2
Secondary postpartum haemorrhage	1
Placenta praevia	1
Abruptio placentae	1
Acute fatty liver of pregnancy	1
Systemic lupus erythematosus	1
Acute chorioamnionitis	1
Regional analgesia complication	1
Total	27

Note: Each death has been attributed to a single cause as decided by the relevant State and Territory Maternal Mortality Committee. In a significant number multiple factors were present.

Table 2 Primary causes of indirect maternal deaths, 1991–93

Cause of death	Number
<i>Cardiovascular disease</i>	8
Cardiomyopathy	3
Acute heart failure	1
Cardiac arrhythmia	1
Primary pulmonary hypertension	1
Dissecting aortic aneurysm	1
Prosthetic valve endocarditis	1
<i>Cerebrovascular disease</i>	4
Cerebral thrombosis	2
Cerebral haemorrhage	2
<i>Infection</i>	4
Pulmonary tuberculosis	1
Streptococcal pneumonia	1
Bowel infection	1
Septicaemia	1
<i>Suicide</i>	2
Postpartum depression	1
Schizophrenia	1
<i>Miscellaneous</i>	3
Anaphylaxis suxamethonium	1
Malignant pyrexia syndrome	1
Asthma, epilepsy	1
<i>Total</i>	21

Note: Each death has been attributed to a single cause as decided by the relevant State or Territory Maternal Mortality Committees. In a significant number multiple factors were present.

Table 3 Primary causes of incidental maternal deaths, 1991–93

Cause of death	Number
<i>Injury</i>	21
Motor vehicle injury	10
Driver of vehicle	4
Passenger	3
Not known if driver	2
Other*	1
Homicide	4
Self administered overdose**	3
Suicide	3
Psychiatric disease	1
Drug addiction	1
Diabetes mellitus	1
Fire, carbon monoxide poisoning	1
<i>Cardiovascular</i>	5
Pulmonary embolus	2
Myocardial infarction	1
Myocarditis	1
Cerebral haemorrhage	1
<i>Neoplasm</i>	5
Bowel	2
Melanoma	1
Astrocytoma	1
Acute leukaemia	1
<i>Infection</i>	3
Group A haemolytic streptococcus septicaemia	1
Staphylococcal pneumonia, septicaemia	1
Viral pneumonitis	1
<i>Sudden collapse</i>	2
Urogenital intercourse associated	1
In shower near term, mild preeclampsia	1
Total	36

Note: Each death has been attributed to a single cause as decided by the relevant State or Territory Maternal Mortality Committees. In a significant number multiple factors were present.

* = woman crushed by a semitrailer crashing into her home (see Chapter 12).

** = undetermined whether accident or suicide.

Table 4 Maternal mortality rates by triennium (direct maternal deaths only) per 100,000 confinements (livebirths and stillbirths)

Triennium	Total confinements	Maternal deaths	Maternal mortality rate
1964–66	667,649	202	30.3
1967–69	713,064	166	23.3
1970–72	790,818	150	19.0
1973–75	726,690	60	8.3
1976–78	678,098	52	7.7
1979–81	682,880	54	7.9
1982–84	713,985	42	5.9
1985–87	726,642	32	4.4
1988–90	754,468	37	4.9
1991–93	769,253	27	3.5

Source: ABS, State and Territory Maternal Mortality Committees.

Table 5 Direct, indirect and incidental maternal mortality rates by triennium

Triennium	Total	Direct	Indirect	Incidental
1964–66	41.2	30.3		10.9
1967–69	33.2	23.3		10.0
1970–72	30.8	19.0		11.8
1973–75	18.9	8.3	4.4	6.2
1976–78	15.6	7.7	5.1	2.8
1979–81	14.4	7.9	5.0	1.5
1982–84	13.2	5.9	3.5	3.5
1985–87	11.8	4.4	4.1	3.3
1988–90	12.7	4.9	4.4	3.4
1991–93	10.9	3.5	2.7	4.7

Note: Rates are maternal deaths per 100,000 total confinements. In the first three triennia indirect and incidental deaths were not separated.

Source: State and Territory Maternal Mortality Committees.

Table 6 Direct maternal deaths by age and parity,* 1991–93

Age (years)	Parity							Total
	0	1	2	3	4–8	9+	Not stated	
Under 20	–	–	–	–	–	–	–	–
20–24	–	2	–	–	–	–	–	2
25–29	3	2	1	2	1	–	–	9
30–34	2	1	2	–	1	–	–	6
35–39	1	4	1	–	1	–	–	7
40 and over	–	2	1	–	–	–	–	3
Total	6	11	5	2	3	–	–	27

* Exclusive of final pregnancy.

Source: State and Territory Maternal Mortality Committees.

Table 7 Indirect maternal deaths by age and parity,* 1991–93

Age (years)	Parity							Total
	0	1	2	3	4–8	9+	Not stated	
Under 20	2	1	–	–	–	–	–	3
20–24	1	1	–	–	–	–	–	2
25–29	2	2	1	–	–	–	–	5
30–34	2	3	1	–	–	–	1	7
35–39	–	1	1	–	1	–	–	3
40 and over	–	–	–	–	–	1	–	1
Total	7	8	3	–	1	1	1	21

* Exclusive of final pregnancy.

Source: State and Territory Maternal Mortality Committees.

Table 8 Incidental maternal deaths by age and parity,* 1991–93

Age (years)	Parity						Not stated	Total
	0	1	2	3	4–8	9+		
Under 20	1	1	–	–	–	–	2	4
20-24	2	1	–	–	–	–	–	3
25-29	5	3	3	1	1	–	3	16
30-34	–	–	1	–	1	–	1	3
35-39	1	3	3	2	1	–	–	10
40 and over	–	–	–	–	–	–	–	–
Total	9	8	7	3	3	–	6	36

* Exclusive of final pregnancy.

Source: State and Territory Maternal Mortality Committees.

Table 9 Distribution of confinements by maternal age and parity, 1991–93

Parity	Age of mother (years)						Not stated	All Ages
	0–19	20–24	25–29	30–34	35–39	40+		
0	31,014	75,687	96,989	52,519	13,300	1,895	212	271,616
1	5,970	43,535	83,808	70,161	20,362	2,672	173	226,681
2	741	13,702	37,411	45,216	16,643	2,207	77	115,997
3	62	3,370	12,037	17,548	8,861	1,629	32	43,539
4 and over	14	944	5,058	9,056	6,841	2,082	13	24,008
Not stated	5,140	17,392	30,411	24,150	8,391	1,390	538	87,412
All parities	42,941	154,630	265,714	218,650	74,398	11,875	1,045	769,253

Note: Parity data for New South Wales for 1991 were not available and this is the explanation for the great majority of the 'not stated'.

Source: Australian Institute of Health and Welfare National Perinatal Statistics Unit.

Table 10 Maternal death rates (direct, indirect and incidental deaths) by age group, 1991–93

Parity	Age at death (years)							Total
	Under 20	20–24	25–29	30–34	35–39	40+	Not stated	
Number of direct deaths	–	2	9	6	7	3	–	27
Rate per 1,000 births (Table 9)	0	0.01	0.03	0.03	0.09	0.25	–	0.04
Number of indirect deaths	3	2	5	7	3	1	–	21
Rate per 1,000 births	0.07	0.01	0.02	0.03	0.04	0.08	–	0.03
Number of incidental deaths	4	3	16	3	10	–	–	36
Rate per 1,000 births	0.09	0.02	0.06	0.01	0.13	0	–	0.05
Total number	7	7	3	16	20	4	–	84
Rate per 1,000 births	0.16	0.05	0.11	0.07	0.27	0.34	–	0.11

Source: Australian Institute of Health and Welfare.

Table 11 Average annual female death rates* from all causes, by specified age groups, by triennium

Triennium	Age group (years)						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1964-66	0.55	0.63	0.71	1.00	1.61	2.30	3.89
1967-69	0.55	0.57	0.66	0.88	1.41	2.32	3.67
1970-72	0.59	0.59	0.65	0.90	1.42	2.21	3.60
1973-75	0.53	0.51	0.55	0.76	1.27	2.04	3.41
1976-78	0.51	0.52	0.51	0.72	1.12	1.86	3.00
1979-81	0.45	0.53	0.49	0.62	0.92	1.54	2.63
1982-84	0.39	0.47	0.50	0.55	0.85	1.39	2.34
1985-87	0.42	0.52	0.50	0.57	0.80	1.30	2.20
1988-90	0.39	0.48	0.46	0.57	0.78	1.22	2.03
1991-93	0.35	0.43	0.43	0.55	0.77	1.10	1.80

* Deaths per 1,000 of the estimated female population for each age group.

Source: Australian Institute of Health and Welfare.

Table 12 Direct maternal deaths by Aboriginality, by triennium

Triennium	Aboriginal maternal deaths		Non-Aboriginal maternal deaths	
	Direct	Total	Direct	Total
1970–72	13	18	137	226
1973–75	5	6	55	131
1976–78	5	9	47	97
1979–81	6	15	48	83
1982–84	5	8	37	86
1985–87	4	13	28	75
1988–90	11	14	26	82
1991–93	1	9	26	75

Table 13 Maternal mortality rates for Indigenous and non-Indigenous women

Births	Deaths	Maternal	Mortality rates per 100,000 births
Indigenous	21,750	9	41.38
Non-Indigenous	747,503	75	10.03
Total	769,253	84	10.91

CHAPTER 2

ABORTION AND MISCARRIAGE

The two deaths associated with miscarriage were classified as incidental deaths by the relevant State maternal mortality committees.

Clinical summaries:

1. A woman was admitted to hospital with a seven-day history of bleeding at about 14 weeks' gestation following an ***overdose of dextropropoxyphene, alcohol and salicylate***. She developed ***disseminated intravascular coagulopathy*** and died from multiple organ failure in spite of dilatation and curettage and extensive resuscitative efforts (Case also included in Chapter 11).
2. A 32-year-old para 1, had a ***brain tumour*** diagnosed when treated for first trimester spontaneous miscarriage. She became drowsy and collapsed 24 hours after curettage and died four days later. Autopsy revealed raised intracranial pressure complicating a grade two ***astrocytoma*** as the cause of death.

Comment

This is the second triennial report in which there was no direct maternal death classified as resulting from abortion.

CHAPTER 3

PREECLAMPSIA/ECLAMPSIA (PREGNANCY-INDUCED HYPERTENSION)

There were nine deaths in this category compared with 13 deaths in the previous triennium. The distinction between direct and indirect deaths is sometimes a difficult judgement, therefore the decision of the State committees in assigning the classification is respected. As there is increasing concern about the contribution of obesity to maternal mortality and morbidity, weights are reported where available.

Clinical summaries:

1. A 26 year old para 1, became unwell two weeks prior to admission for elective repeat Caesarean section. On admission, the patient was found to have **severe preeclampsia** and drowsiness. An elective Caesarean section was performed, followed by postoperative **eclampsia**, treated with phenytoin, subsequent **coagulopathy**, cardiac arrest and unsuccessful resuscitation. Autopsy showed **acute fatty liver of pregnancy**. Classified as a **direct** maternal death (Case also included in Chapters 7 and 8).
2. A 23 year old primigravida, weight 101 kg, who showed signs of mild preeclampsia at 36 weeks was found dead in the shower two weeks later. Autopsy failed to reveal the cause of death. No underlying factors were identified. Preeclampsia was considered to be an unlikely cause of death. Classified as an **incidental** maternal death (Case also included in Chapter 12).
3. A 26 year old para 4, weight 85 kg, was seen at 37 weeks with preeclampsia. She was readmitted ten days later with **severe preeclampsia**. Urgent Caesarean section was performed, with **postoperative laryngospasm** following extubation. She died despite tracheostomy and resuscitation. Autopsy showed no anatomical abnormality. Classified as a **direct** maternal death (Case also included in Chapter 8).
4. A 33 year old primigravida, weight 60 kg, had an uneventful pregnancy to 32 weeks' gestation, when found semiconscious. Acute **fulminating preeclampsia** was diagnosed and treated with phenytoin and hydralazine prior to Caesarean section. She had post-operative **coagulopathy** with return to operating theatre for uterine artery ligation. Cardiac arrest followed. Post-mortem showed **subarachnoid haemorrhage** secondary to pre-eclampsia and coagulopathy. Classified as a **direct** maternal death (Case also included in Chapter 8).

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5. A 34 year old para 1, weight 87.2 kg, had *labile hypertension* at 39 weeks. Elective Caesarean section was performed with no intra- or post-operative problems. She was discharged on day five but was readmitted 24 hours later with *hemiparesis*. Cardiac arrest followed nine days later. No postmortem was performed and the cause of death was thought to be *pulmonary embolism*. Preeclampsia probably was not implicated. Classified as an *indirect* maternal death (Case also included in Chapters 8 and 9).
 6. A 36 year old para 1, weight 65 kg, had an uneventful pregnancy to 26 weeks' gestation when she presented with *haemoptysis. Pneumonia* was diagnosed at 27 weeks with moderate *preeclampsia*. This was followed by acute respiratory failure and severe *anaemia*. Cardiac arrest followed *blood transfusion*. Post-mortem showed viral pneumonitis and a fatty liver. Classified as an *incidental* death (Case also included in Chapters 6 and 8).
 7. A 29 year old para 0, weight 55 kg, had an uneventful pregnancy until 32 weeks' gestation. She was admitted with severe *preeclampsia* and treated with nifedipine and phenytoin. She developed *disseminated intravascular coagulopathy*. Following Caesarean section, cardiorespiratory arrest occurred despite expert resuscitation. Classified as a *direct* maternal death (Case also included in Chapter 8).
 8. A 30 year old para 0, weight 87 kg, had an uneventful pregnancy to 30 weeks. She developed moderate/severe *preeclampsia*. Caesarean section performed at 32 weeks was followed by *acute renal failure*, respiratory distress syndrome, *septicaemia* and liver infarction. She was transferred to a referral centre where she underwent partial hepatectomy. Cardiac arrest followed. Autopsy showed multiple organ failure secondary to haemolysis, elevated liver enzymes, and a low platelet count (HELLP syndrome). Classified as a *direct* maternal death (Case also considered in Chapters 6 and 8).
 9. A 27 year old para 0, developed severe *preeclampsia* at 21 weeks' gestation. She was treated with atenolol, magnesium sulphate and heparin in a teaching hospital. Three days later, she developed profound neurological deterioration and CT scan showed *subdural haematoma* and cerebral oedema. She was transferred to intensive care at another hospital. Craniotomy and evacuation of subdural haematoma was performed, followed by Caesarean section. Ventilatory support was withdrawn following diagnosis of 'brain death'. Classified as a *direct* maternal death (Case also included in Chapter 8).

Comment

Evidence from the International Collaborative Eclampsia Trial¹ indicates that *magnesium sulphate* is the drug of choice for the treatment of eclampsia, to be preferred over phenytoin and diazepam. Phenytoin probably should no longer be used for seizure prophylaxis, either.

In the review of these cases, the State committees made several comments including the recommendation of prompt delivery of women with severe preeclampsia and early consultation with a referral centre for management of persisting postpartum medical problems.

Note

1. **The Eclampsia Trial Collaborative Group.** (1995) 'Which anticonvulsant for women with eclampsia? Evidence from the Collaborative Eclampsia Trial'. *The Lancet* 345: 1455–63.

CHAPTER 4

CARDIOVASCULAR DISEASE

Cardiovascular disease continued to be a significant cause of maternal death in the triennium 1991–93. Twelve maternal deaths occurred in which cardiovascular disease was the sole or major contributing cause. There were three more deaths than in the last triennium. The major causes of death were similar to the last triennium and were: cardiomyopathy (3), myocardial infarction (2), myocarditis (2). There was one case of pulmonary hypertension, two of valvular disease, one of a dissecting aortic aneurysm and in one patient sudden death from cardiac arrhythmia occurred at 17 weeks' gestation (Table 14). On three occasions the maternal death occurred following delivery.

Cardiomyopathy

Clinical summaries:

1. A 29 year old para 1, who had required treatment for *ventricular tachycardia* in her first pregnancy died suddenly at 17 weeks' gestation. Autopsy examination showed evidence of *cardiomyopathy*. The cause of death was considered to be *cardiac arrhythmia* secondary to cardiomyopathy.
2. A 38 year old para 7, was admitted to hospital in spontaneous labour at 38 weeks' gestation. An assisted breech delivery was performed without difficulty. On the third post-partum day she appeared dyspnoeic on effort. Her haemoglobin value was 9.8 g/dL. A loud systolic murmur was heard at the left sternal edge and an X-ray examination showed cardiomegaly. She developed cardiac failure and as her condition did not improve she was advised to be transferred to an intensive care unit. Unfortunately she refused. Her condition seemed to improve but on the fourteenth day post-partum she developed acute shortness of breath and chest pain with an increase in her cardiac failure. In spite of active management she did not respond. The autopsy diagnosis was *postpartum cardiomyopathy*.
3. A 43 year old para 10, collapsed at home at 40 weeks' gestation. The antenatal period had been uneventful and she had been well. Whilst at home she was given CPR by ambulance staff but by the time she arrived at the hospital she was cyanosed with fixed dilated pupils. Resuscitation was continued in order to deliver the baby by Caesarean section. A stillborn infant was delivered. Autopsy showed *pregnancy-related congestive cardiomyopathy* and *Hashimoto thyroiditis* (Case also included in Chapter 8).

Myocardial infarction

Clinical summaries:

1. A 29 year old para 0, was admitted to hospital at 32 weeks' gestation with a history of fever, abdominal pain, loin pain and malaise. The following day, a diagnosis of ***acute myelocytic leukaemia*** was made. Labour was induced and Caesarean section was necessary for fetal distress which occurred two hours later. The mother was transferred to the intensive care unit post-operatively. Shortly after tachycardia developed and subsequently cardiac arrest occurred. Resuscitation was unsuccessful. Autopsy showed ***myocardial infarction secondary to acute leukaemia*** (Case also included in Chapters 8 and 12).
2. A 31 year old para 4, died three weeks after an elective Caesarean section under epidural anaesthesia at 38 weeks' gestation. She was known to be a heavy drinker and smoker. The cardiac arrest followed an episode of acute chest pain. During the pregnancy she had complained of some chest pain and was referred for investigation but no cardiovascular disease was diagnosed. The autopsy showed an ***acute anteroseptal myocardial infarction with an old posterior left ventricular infarction***. There was extensive coronary atherosclerosis (Case also included in Chapter 8).

Mitral and aortic valvular disease

Clinical summaries:

1. A 28 year old para 1, had an established diagnosis of ***aortic incompetence with left ventricular hypertrophy***. There was a history of ***resection of subvalvular aortic stenosis***. She had been assessed by the cardiac physicians and had regular review throughout pregnancy. She was offered admission to hospital at 35 weeks' gestation but she was unable to attend. At 36 weeks' gestation she unexpectedly died suddenly at home. Autopsy showed acute heart failure secondary to ***congenital aortic stenosis***.
2. A 35 year old woman had a long history of ***rheumatic heart disease*** and had had both the ***mitral and aortic valves replaced***. Her past obstetric history was of two full term pregnancies and one ectopic pregnancy. An ultrasound examination showed a grade 4 ***placenta praevia*** at 25 weeks' gestation. She was hospitalised at 29 weeks for observation and anticoagulation. It was intended that she would remain in hospital until delivery and that anticoagulation would continue. An antepartum haemorrhage occurred at 32 weeks' gestation and delivery by Caesarean section was necessary at 33 weeks' gestation. An infant was delivered in a satisfactory condition.

The mother developed *septicaemia* with staphylococcus aureus secondary to an infected IV cannula site. She developed *endocarditis* and despite resuscitation died 17 days after delivery. Death was attributed to *staphylococcal septicaemia* secondary to an infected IV cannula site and *endocarditis* of artificial heart valves (Case also included in Chapters 6, 7 and 8).

3. A 25 year old para 2, had an established diagnosis of *mitral valve prolapse* and had attended for regular cardiac review. She was in her third pregnancy having had two normal deliveries and was a regular attender for antenatal care. She had a normal delivery at term and was discharged home after six days. Five weeks after delivery she developed *ventricular tachycardia* progressing to *ventricular fibrillation*. An initial satisfactory response occurred with defibrillation and resuscitation but this response was not maintained. Cause of death was considered to be *cardiac arrhythmia associated with a floppy mitral valve*.

Pulmonary hypertension

Clinical summary:

1. A 19 year old para 1, was known to suffer from *anaemia* and *malnutrition* and had had a past history of haemoptysis and shortness of breath. She presented at 15 weeks' gestation with a *cough and pleuritic chest pain* and was given antibiotics. She continued to have a cough and pleuritic chest pain and she was admitted to hospital at 26 weeks' gestation. Soon after spontaneous rupture of the membranes occurred, labour became established and her consciousness gradually deteriorated. A stillborn baby was delivered with forceps and the mother died soon afterwards. The autopsy diagnosis was *pulmonary hypertension secondary to recurrent pulmonary microembolism*.

Myocarditis

Clinical summaries:

1. A 28 year old para 1, on whom a Caesarean section was performed previously, was found dead in her home at 37 weeks' gestation. A post-mortem Caesarean section was performed and a stillborn baby was delivered. There was evidence of *severe concealed placental abruption*. An autopsy showed evidence of *nonspecific myocarditis*. While the myocarditis may have been a contributing factor the cause of death is more likely to have been due to the severe placental abruption (Case also included in Chapter 7).

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2. A 19 year old primigravida, was admitted to hospital at 38 weeks' gestation following collapse at home. Resuscitation was commenced and continued until transfer to hospital where an emergency Caesarean section was performed and a stillborn infant was delivered. Resuscitation of the mother was unsuccessful and she died soon afterwards. The antenatal period had been uneventful until 27 weeks' gestation when a small *antepartum haemorrhage* occurred. Fetal growth was found to be somewhat restricted at 35 weeks' gestation. Autopsy microscopic examination showed evidence of *myocarditis* (Case also included in Chapter 8).

Dissecting aortic aneurysm

Clinical summary:

1. A 32 year old para 1, was admitted to hospital at 32 weeks' gestation complaining of chest pain, nausea and vomiting. *Urinary infection* was diagnosed and treated. The antenatal period had been previously uneventful. Examination had excluded a pulmonary embolism and major cardiovascular pathology. She was found dead the next morning. Autopsy showed a 2 cm tear in the aorta typical of a *ruptured dissecting aneurysm* (Case also included in Chapter 6).

Comment

Primary pulmonary hypertension was less common in this triennium and there was a preponderance of maternal deaths from cardiomyopathy and valvular disease. These serve to emphasise the importance of an adequate cardiovascular examination during pregnancy and to consider any episode of dyspnoea seriously and to investigate it appropriately.

Table 14 Type of cardiovascular disease and cause of death

Type of disease	Age of patient (years)	Cause of death	Time of death	Contributing factor
Cardiomyopathy	29	Cardiac arrhythmia	17 weeks' gestation	–
Cardiomyopathy	38	Cardiac failure	2 weeks' postpartum	–
Cardiomyopathy	43	Cardiac failure	40 weeks' gestation	Pregnancy-related
Myocardial infarction	29	Staphylococcal septicaemia	32 weeks' gestation	Acute leukaemia
Myocardial infarction	31	Myocardial infarction	3 weeks' post-Caesarean section	Heavy smoking and alcohol intake
Aortic stenosis	28	Acute cardiac failure	36 weeks' gestation	Aortic stenosis
Prosthetic valve endocarditis	35	Staphylococcal septicaemia	33 weeks' gestation	Aortic and mitral valve replacements
Cardiac arrhythmia	25	Cardiac arrhythmia	5 weeks' postpartum	Floppy mitral valve
Pulmonary hypertension	19	Pulmonary oedema	26 weeks' gestation	Anaemia, malnutrition
Myocarditis	28	Placental abruption	37 weeks' gestation	–
Myocarditis	19	Myocarditis	38 weeks' gestation	–
Dissecting aortic aneurysm	32	Ruptured aorta	32 weeks' gestation	–

CHAPTER 5

NON-HYPERTENSIVE INTRACRANIAL HAEMORRHAGE

There were three cases in this category.

Clinical summaries:

1. A 40 year old gravida 4, para 1, had recurrent abdominal pain in early pregnancy. Ultrasound scans were performed at eight, ten and 11 weeks' gestation. The last scan raised the possibility of an extrauterine pregnancy. A further scan at 32 weeks showed a major degree of ***placenta praevia***. Caesarean section was performed at 37 weeks at which time the extrauterine pregnancy was identified. There was massive intraoperative haemorrhage and the woman was subsequently transferred to a referral centre. A CT scan revealed massive left ***cerebral haemorrhage***. Resuscitation was unsuccessful. Classified as a ***direct*** maternal death (Case also included in Chapter 7).
2. A 22 year old para 1, weight 64 kg, was known to have ***angiomatous malformation of the corpus callosum***. She presented at 34 weeks with ***twins***, with headache and neck stiffness following a minor motor vehicle accident. She was treated with analgesia and physiotherapy without benefit. Symptoms progressed. Ultrasound revealed ***intraventricular haemorrhage***. Angiography showed a recurrence of the arteriovenous malformation. Six days after admission, massive intraventricular haemorrhage occurred. Caesarean section was performed. The babies were born alive. There was rapid maternal deterioration with death three days after delivery. Classified as an ***indirect*** maternal death (Case also included in Chapter 8).
3. A 29 year old gravida 1, para 0, weight 77 kg, with no history of prior problems collapsed with convulsions at 25 weeks' gestation. A CT scan revealed an extensive ***intracerebral haemorrhage***. She died within 24 hours of admission. No autopsy was performed. Classified as an ***incidental*** maternal death.

CHAPTER 6

INFECTIONS

There were 16 maternal deaths associated with infection during the triennium 1991–93, one fewer than in the previous triennium (Table 15). Of these deaths, infection was the major cause of death in 14 patients, and in two cases, infection was present but not considered to be the primary cause of death.

As in the last triennium pneumonia was the most frequent cause of death from infection and this again demonstrates the importance of treating respiratory illness during pregnancy with caution.

There was a remarkable increase in the number of deaths related to septicaemia. This reflects the importance of vigorously treating any primary site of infection during pregnancy.

Avoidable factors were considered to be present in three of the patients. In two of these patients, treatment had been delayed and in the third the patient failed to seek medical advice.

Pneumonia

There were four deaths where pneumonia was considered to be the primary cause of death.

Clinical summaries:

1. A 32 year old para 4, was admitted to hospital at 30 weeks' gestation with preterm labour. She had been a poor antenatal attender having been seen only once at 19 weeks' gestation. Labour was rapid and vaginal delivery occurred of a male infant, birthweight 1,415 g. The patient discharged herself seven days after delivery. Three weeks later she was found dead at home apparently having had a respiratory illness, lost weight and had a haemoptysis. There was pneumonia of the right lung and the thoracic cavity contained a **large empyema**. Some pulmonary arteries contained fibrin (Case also included in Chapter 9).
2. An 18 year old required an emergency Caesarean section in her first pregnancy because of fetal distress. Her past history included **asthma** and she was a known **heavy smoker**. The Caesarean section was apparently uneventful. However, her respiratory function deteriorated soon after the operation and a chest X-ray on the first day postoperatively showed **bilateral pneumonia**. She was transferred to an intensive care unit at a Base Hospital where bronchoscopy showed oedematous airways and cultures grew streptococcus pneumonia. Despite intensive management there was progressive deterioration in her pulmonary function. This was further

complicated by the occurrence of *cholecystitis* which required laparotomy on the eighth day after Caesarean section. Autopsy confirmed the presence of bronchopneumonia (Case also included in Chapter 8).

3. A 36 year old para 1, was seen with a history of *haemoptysis* at 26 weeks' gestation. The pregnancy had previously been uneventful. The patient declined admission to hospital for treatment. Three days after first presenting she was admitted to hospital with severe dyspnoea and peripheral oedema. The blood pressure was 180/108 on admission to hospital. She was treated with antibiotics and bronchodilators but despite this the dyspnoea increased. She was found to be *anaemic* (haemoglobin value 7.0 g/dL) and a blood transfusion was commenced. On the day following admission to hospital cardiac arrest occurred and resuscitation was unsuccessful. An emergency Caesarean section delivered a stillborn baby. The cause of death was considered to be *viral pneumonia* (Case also included in Chapters 3 and 8).
4. A previously healthy 28 year old para 1, was admitted to hospital at 11 weeks' gestation with *staphylococcal pneumonia*. She subsequently developed *septicaemia* and multiple organ failure and despite intensive care treatment she died from respiratory failure nine days after admission.

Pneumonia secondary to other conditions

Clinical summary:

1. A 30 year old para 0, was admitted to hospital at 30 weeks' gestation because of *hypertension*. The pregnancy had been previously uneventful. One week later despite hypotensive treatment she developed proteinuric hypertension with generalised oedema. Caesarean section was necessary for fetal distress. Thirty-six hours following delivery she developed acute renal failure and *adult respiratory distress syndrome* leading to respiratory failure. Infarction of the right lobe of the liver and pseudomonas sepsis developed. Two weeks after delivery she was transferred to a tertiary hospital where partial hepatectomy was performed. Hypotension developed during the procedure and this was followed by cardiac arrest. Autopsy confirmed the presence of *bronchopneumonia and massive hepatic necrosis*. The cause of death was *multiple organ failure secondary to HELLP syndrome* (Case also included in Chapters 3 and 8).

Sepsis following Caesarean section

There were three cases in this group. In one of these patients the cause of death was adult respiratory distress and in another amniotic fluid embolism.

Clinical summaries:

1. A 30 year old para 2, weight 106 kg, had had an uneventful pregnancy until 37 weeks' gestation when she was admitted to hospital with vomiting and epigastric pain. Her past history included a hiatus hernia repair with fundoplication. Because of her elevated blood pressure and headache a diagnosis of ***preeclampsia*** was considered. However, a chest X-ray showed the presence of stomach and bowel in the patient's chest. A ***Caesarean section*** was performed and a live baby was delivered. At the time of Caesarean section the incarcerated intrathoracic stomach was reduced and the hiatus hernia closed. In addition ***fundoplication and gastroenterostomy*** were performed. The patient was tachycardic and febrile postoperatively and 24 hours later her respiratory function deteriorated and she required ventilation. She was found to have ***septicaemia***, the cause of which was uncertain. An exploratory laparotomy did not identify any intraabdominal site for the sepsis. She died nine days after delivery from respiratory failure secondary to sepsis of unknown origin (Case also included in Chapter 8).
2. A 41 year old para 1, had a Grade 4 ***placenta praevia*** associated with ***gestational diabetes, polyhydramnios*** and ***iron deficiency anaemia***. She was admitted to hospital at 33 weeks' gestation and at 35 weeks' gestation Caesarean section was performed for fetal hypoxia. A live infant was delivered. She became hypotensive postoperatively although the estimated blood loss was less than 1,000 ml. She was transferred to intensive care and required resuscitation but both renal and liver function deteriorated. There was evidence of fulminating ***septic shock*** and she died eight days after delivery. Autopsy revealed evidence of ***amniotic fluid embolism*** and multiple thrombi in small vessels consistent with a diagnosis of disseminated intravascular coagulopathy (Case also included in Chapters 7, 8 and 10).
3. A 25 year old para 2, who had had two previous Caesarean sections was delivered in her third pregnancy by elective Caesarean section. Tubal ligation was also performed. The operation and postoperative period were uneventful. Thirty-four days after delivery she was admitted to hospital with ***vaginal bleeding*** and ***curettage*** of the uterine cavity was performed. There were no retained products of conception and she was treated with antibiotics and a blood transfusion. Sixty-one days following delivery she presented again with heavy vaginal bleeding and was given the oral contraceptive pill. Four days

later there was a recurrence of heavy vaginal bleeding and at this time her haemoglobin value was found to be 6.0 g/dL. Curettage of the uterine cavity was again performed but the bleeding continued and she was transferred to an intensive care unit. **Subtotal hysterectomy** was necessary but 24 hours after the operation there was a **haemoperitoneum** and a further laparotomy with ligation of the right uterine artery was performed. She developed septicaemia and her condition deteriorated and she died 15 weeks after delivery. The **septicaemia** did not appear to be related to the Caesarean section and had developed much later in the puerperium perhaps at the time of the first curettage of the uterus (Case also included in Chapters 7 and 8).

Pulmonary embolism

In this group there were two cases of pulmonary embolism. Both were the primary cause of death and each was associated with infection.

Clinical summaries:

1. A 36 year old para 1, had a normal vaginal delivery at 32 weeks' gestation after a spontaneous onset of labour. She had a long history of psychiatric disturbance and had previously been treated for manic depression. She developed **postnatal depression** a week after delivery and was admitted to hospital for treatment. In addition she was found to have **pelvic inflammatory disease**. Appropriate treatment for both disorders was commenced. Two days following admission to hospital cardiac arrest occurred and despite resuscitation she did not recover. Autopsy revealed **pulmonary embolism**, postpartum pelvic vein thrombosis and pelvic inflammatory disease (Case also included in Chapters 9 and 11).
2. A 32 year old para 2, weight 128 kg, underwent elective repeat Caesarean section at 38 weeks' gestation. Her past history included two previous Caesarean sections. The estimated blood loss at the Caesarean section was 1,000 ml. The immediate postoperative period was complicated by **anaemia and endometritis**. She refused a blood transfusion. Antibiotic regimens were continued and further investigation by ultrasound showed a **pelvic haematoma**. Because of her postoperative immobility prophylactic heparin was commenced on the tenth day postoperatively. There had been initial improvement in her symptoms and signs but on the thirteenth day following delivery she was found dead in hospital. Autopsy confirmed that death had occurred from a **pulmonary embolus** and there was a right parametrial **pelvic haematoma** in continuity with full thickness necrosis of the uterine wound (Case also included in Chapters 8 and 9).

Comment

There were a number of contributing factors to this patient's pulmonary embolus, including her obesity (weight 128 kg), the Caesarean section and the anaemia which was secondary to her procedure and made worse by the pelvic haematoma. This patient demonstrates the need to ensure that haemostasis is complete once the uterine wound has been closed following Caesarean section.

Septicaemia

There were four deaths from septicaemia, three more than in the previous triennium.

Clinical summaries:

1. A 30 year old gravida 3, para 1, had a past obstetric history of a previous termination of pregnancy followed by a spontaneous abortion at 18 weeks' gestation and a stillbirth at 21 weeks' gestation. In this her fourth pregnancy she presented early for antenatal care, it was considered that the cervical os was incompetent and a ***cervical suture*** inserted at 16 weeks' gestation. The pregnancy was uneventful until 23 weeks' gestation when she was admitted to hospital with vomiting, malaise and backache. Spontaneous labour developed during which her level of consciousness deteriorated. Investigations suggested the presence of ***septicaemia*** and the cervical suture was removed and gentamicin and cefoxitin were given intravenously. A stillborn infant was delivered. Despite intensive treatment, ***disseminated intravascular coagulation*** and ***adult respiratory distress syndrome*** developed. She died five hours after delivery. Autopsy confirmed the presence of ***chorioamnionitis*** and the blood culture taken prior to death showed E. coli.

Comment

The direct cause of death was E. coli septicaemia from the acute chorioamnionitis and villitis. It is unusual to see intrauterine infection in the presence of intact membranes. The cervical suture may have been a contributing factor.

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2. A 17 year old primigravida, had a spontaneous vaginal delivery at term. The pregnancy had been uneventful. The immediate postpartum period was uncomplicated and she was discharged on the fifth day. Eleven days later she presented to hospital with a 24 hour history of **fever, vomiting, diarrhoea and abdominal pain**. She was found to be shocked, tachycardic and hypotensive. In addition, she was cyanosed and febrile. The uterus was exquisitely tender and she had a **purulent vaginal discharge**. Investigations indicated endometritis and her condition continued to deteriorate. **Curettage** of the uterine cavity was performed on the day after admission. There were no signs of improvement and **abdominal hysterectomy** was performed. Histopathology showed severe endometritis together with toxic necrosis of the muscle of the uterus. Blood cultures had been positive for staphylococcus aureus. Her condition deteriorated and renal failure occurred following which she died five days after the second admission to hospital. The cause of death was initially considered to be **overwhelming sepsis** secondary to severe endometritis. Autopsy revealed massive intracerebral haemorrhage caused by disseminated intravascular coagulation caused by **postpartum haemolytic syndrome** (Case also included in Chapter 12).
 3. A 27 year old woman of unknown parity complained of vomiting, diarrhoea and abdominal pain at 36 weeks' gestation. The antenatal history was unavailable. Soon after her symptoms occurred she was found unconscious at home. Resuscitation was commenced and she was transferred to hospital. Emergency Caesarean section was performed and a stillborn macerated infant was delivered. Resuscitation was unsuccessful. A swab from the placenta grew streptococcus pyogenes. Cause of death was **septicaemia** due to **Group A haemolytic streptococcus** (Case also included in Chapter 8).
 4. A 35 year old patient had a long history of **rheumatic heart disease** and had had both the mitral and aortic valve replaced. Her past obstetric history was of two previous full-term pregnancies and one ectopic pregnancy. An ultrasound examination showed a Grade 4 **placenta praevia** at 25 weeks' gestation. She was hospitalised at 29 weeks' gestation for observation and anticoagulation. It was intended that she would remain in hospital until delivery and that anticoagulation would continue. An **anteperium haemorrhage** occurred at 32 weeks' gestation and delivery by Caesarean section was necessary at 33 weeks' gestation. The infant, birthweight 2,500 g, was born in satisfactory condition. She developed staphylococcus aureus septicaemia secondary to an infected IV cannula site and subsequently **endocarditis** occurred. Despite resuscitation she died 17 days postdelivery. Death was attributed to **staphylococcal septicaemia** secondary to an infected IV cannula site (Case also included in Chapters 4, 7 and 8).

Pulmonary tuberculosis

1. A 37 year old para 1, had arrived in Australia 12 years previously. There was a family history of active tuberculosis. She was admitted to hospital at 38 weeks' gestation with signs of *asthma* and then developed *haemoptysis*. Investigation confirmed *pulmonary tuberculosis* and she was delivered at 39 weeks' gestation in order to commence antituberculosis treatment. Three days after delivery she had a massive haemoptysis and cardiac arrest occurred. Resuscitation was unsuccessful and death was due to pulmonary tuberculosis.

Miscellaneous

1. A 32 year old para 1, was admitted to hospital at 32 weeks' gestation with chest pain, nausea and vomiting. A mid-stream specimen of urine grew *chlamydia* on culture. She recovered quickly and was discharged after four days. The following day she was admitted to hospital again with chest pain, nausea and vomiting and she was found dead the next morning from a *ruptured dissecting aneurysm* confirmed at autopsy. There was no infective process and it is unlikely that the urinary tract infection was a contributory cause (Case also included in Chapter 4).

Table 15 Causes of death from infection

Type of infection	Number of deaths			
	1982–84	1985–87	1988–90	1991–93
Sepsis associated with abortion	–	3	–	–
Sepsis following caesarean section	5	–	–	3
Pneumonia	2	5	5	4
Pneumonia secondary to other disease	–	–	3	–
Pneumonia associated with preclampsia	–	–	4	–
Pneumonia associated with hypertension	–	–	–	1
Pulmonary embolus secondary to sepsis	–	–	–	2
Pulmonary tuberculosis	–	–	–	1
Septicaemia	1	4	1	4
Meningitis	1	1	–	–
Adult respiratory distress syndrome	–	–	2	–
Acute pyelonephritis	–	2	–	–
Acute myocarditis	1	–	–	–
Pelvic infection, caval thrombosis	–	–	1	–
Bowel obstruction and septicaemia	–	–	1	–
Miscellaneous	–	–	–	1
Total	10	15	17	16

CHAPTER 7

HAEMORRHAGE

There were 15 cases in which haemorrhage was a major cause of death (Table 16), the numbers in the previous five triennia being 23, 22, 21, 16 and 12 respectively. Four of the 15 cases were associated with placenta praevia, three with ectopic pregnancy and two with placental abruption. It is noteworthy that *Caesarean section* was performed in ten of the 15 cases and that *disseminated intravascular coagulopathy* was a complication in six cases.

Ectopic pregnancy

Clinical summaries:

1. A 40 year old gravida 4, para 1, had recurrent abdominal pain in early pregnancy. Ultrasound scans were performed at eight, ten and 11 weeks' gestation. The last scan raised the possibility of an extrauterine pregnancy. A further scan at 32 weeks' showed a major degree of *placenta praevia*. Caesarean section was performed at 37 weeks at which time the *extrauterine pregnancy* was identified. There was massive intraoperative haemorrhage and the woman was subsequently transferred to a referral centre. A CT scan revealed massive left *cerebral haemorrhage*. Resuscitation was unsuccessful (Case also included in Chapter 5).
2. A 25 year old para 3, collapsed at home after a four-day history of *abdominal pain*. She was resuscitated and laparotomy revealed a *ruptured right ectopic pregnancy*. Postoperatively she was declared brain dead and she died the next day.
3. A 36 year old para 1, developed *abdominal pain* and vomiting the day before death, two weeks after a miscarriage. She had developed *diarrhoea* and discussed this with her local doctor by telephone. The same day she died at home. Autopsy revealed a *haemoperitoneum* and *ruptured left fallopian tube*.

Comment

These cases illustrate that ruptured tubal pregnancy can cause death from haemorrhage where the only warning was preceding abdominal pain. Case 1 illustrates the well-known difficulties that can be encountered with advanced abdominal pregnancy.

Amniotic fluid embolism

Clinical summaries:

1. A 35 year old para 1, had an uneventful pregnancy and labour was induced four days postterm. When the cervix reached 6–7 cm dilatation a small ***anteartum haemorrhage*** occurred. Fetal scalp blood analysis at this time revealed marked fetal acidosis. Therefore, an emergency ***Caesarean section*** was performed. During the operation there was difficulty with haemostasis which ultimately led to an abdominal ***subtotal hysterectomy*** being performed. During the operative procedure the patient became shocked and it became impossible to maintain cardiac output. The patient died intraoperatively. At autopsy all lobes of the lungs showed the presence of fetal squames, squamous casts and meconium within small branches of the pulmonary artery and within pulmonary capillaries. The findings were consistent with ***amniotic fluid embolism and disseminated intravascular coagulation*** (Case also included in Chapters 8 and 10).
2. A 33 year old para 2, laboured spontaneously at home at 41 weeks' gestation in the care of an independent midwife. Labour progressed well until ***the woman complained of faintness, vomited and became confused and distressed***. She had ***fresh vaginal bleeding*** and there was fetal bradycardia. She was referred to a Base Hospital within 45 minutes and delivered a stillborn infant soon afterwards. She developed severe ***postpartum haemorrhage and disseminated intravascular coagulopathy***. General anaesthesia was given for removal of the placenta; 18 hours after delivery laparotomy was performed because of persistent bleeding. A full thickness ***uterine tear*** on the posterolateral wall was identified and ***subtotal hysterectomy*** was performed. Cardiac arrest occurred two days later during another laparotomy performed because of further haemorrhage. Autopsy revealed evidence of ***amniotic fluid embolism*** fetal material in pulmonary arterioles (Case also included in Chapter 10).
3. A 41 year old para 1, with a grade 4 ***placenta praevia***, gestational diabetes, polyhydramnios and iron deficiency anaemia was admitted to hospital at 33 weeks' gestation. Two weeks after admission she reported absent fetal movements and fetal cardiotocography indicated decreased fetoplacental reserve. Accordingly, a Caesarean section was performed under general anaesthesia. A live infant was delivered by ***internal version and breech extraction*** through the lower uterine segment incision as the fetal lie was transverse. The patient became hypotensive after the uterine incision had been repaired although blood loss was estimated at less than one litre. In the

intensive care unit a coagulation screen showed *coagulopathy*. The patient received massive resuscitation over the next 48 hours, but renal and liver function deteriorated progressively and there was increasing respiratory difficulty. She died eight days after delivery. At autopsy there was evidence of disseminated intravascular coagulation and early diffuse pulmonary alveolar damage. In addition, there was evidence of amniotic fluid within the pulmonary vasculature. Thus, the pathologist concluded that the cause of death was *disseminated intravascular coagulation following amniotic fluid embolism* (Case also included in Chapters 6, 8 and 10).

Comment

These cases are discussed in Chapter 10. It is noteworthy that the condition can occur during Caesarean section and result in uncontrollable haemorrhage.

Placenta praevia

Clinical summaries:

1. A 39 year old para 8, with a past history including two Caesarean sections was admitted to hospital with vaginal bleeding. She did not consider that she was pregnant. Her haemoglobin value was 8.1 g/dL. A heavy episode of vaginal bleeding resulted in shock; resuscitation was commenced and examination under anaesthesia performed. The uterus was found to be the size of a 24 week pregnancy with heavy bleeding through the cervix and a *central placenta praevia*. *The fetus presented by the breech and was delivered immediately through the placenta which was then removed manually*. After delivery, severe bleeding continued, and *abdominal hysterectomy* was performed during which cardiac arrest occurred. Resuscitation was performed, but *disseminated intravascular coagulopathy* occurred. The woman died two days after delivery, in spite of considerable resuscitative efforts and two further laparotomies.
2. A 39 year old primigravida, was found to be anaemic at 22 weeks' gestation. Iron supplements were prescribed. At 34 weeks' gestation she was found to have persisting *anaemia* and a grade 3 *placenta praevia*. Parenteral iron was administered. At 38 weeks' gestation an elective Caesarean section was performed because of the placenta praevia. Three hours after delivery, the blood pressure was found to be 70/50. Intravenous therapy was commenced. Soon afterwards, a large vaginal haemorrhage occurred accompanied by haemorrhage from the Caesarean section wound. Further intravenous fluids were administered along with intravenous Syntocinon. However, bleeding

continued and a *hysterectomy* was carried out. A provisional diagnosis of *disseminated intravascular coagulation* was made. For religious reasons the woman had refused administration of blood products. Subsequently, the patient developed cardiac failure and was admitted to the intensive care unit and mechanically ventilated. A short time afterwards she died. Death was attributed to multiple organ failure, secondary to the HELLP syndrome accompanied by disseminated intravascular coagulation (Case also included in Chapter 8).

3. A 35 year old had a long history of *rheumatic heart disease* and had had both the mitral and aortic valves replaced. Her past obstetric history was of two previous full term pregnancies and one ectopic pregnancy. An ultrasound examination showed a grade 4 *placenta praevia* at 25 weeks' gestation. She was hospitalised at 29 weeks' gestation for observation and anticoagulation. It was intended that she would remain in hospital until delivery and that anticoagulation would continue. An *antepartum haemorrhage* occurred at 32 weeks' gestation and delivery by *Caesarean section* was necessary at 33 weeks' gestation. The infant, birth weight 2,500 g, was born in satisfactory condition. The mother developed staphylococcus aureus septicaemia secondary to an infected IV cannula site and subsequently *endocarditis* occurred. Despite resuscitation she died 17 days postdelivery. Death was attributed to *staphylococcal septicaemia* secondary to an infected IV cannula site (Case also included in Chapters 4 and 8).

Comment

The difficulties encountered in Case 1 may have been lessened had abdominal delivery been performed. In Case 2, placenta praevia was the complication that set in train the sequence of problems resulting in the woman's death. In Case 3, sepsis rather than the placenta praevia was the cause of death.

Placental abruption

Clinical summaries:

1. A 28 year old para 1, who had Caesarean section performed previously was found dead in her home at 37 weeks' gestation. A postmortem Caesarean section was performed and a stillborn baby was delivered. There was evidence of *severe concealed placental abruption*. An autopsy showed evidence of *non-specific myocarditis*. While the myocarditis may have been a contributing factor the cause of death is more likely to have been due to the severe placental abruption (Case also included in Chapter 4).

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2. A 31 year old para 1, had a Caesarean section at 37 weeks' gestation because of **placental abruption**. She had postoperative **pyrexia** and **anaemia** (**haemoglobin value 9.5 g/dL**). Ten days after discharge home she developed **right ulnar artery embolism** associated with **subclavian artery thrombosis**. In spite of heparinisation, **embolism to the right cerebral artery** resulted in cerebral infarction and death 17 days after delivery. Autopsy revealed the right innominate artery as the probable source of the emboli (Case also included in Chapters 8 and 12).

Comment

In Case 1, severe placental abruption was the probable cause of death although myocarditis was found at autopsy. In Case 2, anaemia may have been associated with the subsequent bizarre thromboembolic complications that occurred.

Deaths Related to Caesarean section

(i) Primary postpartum haemorrhage

1. A 29 year old para 0, weight 105 kg, had prostaglandin induction at 41 weeks' gestation. **Caesarean section** was performed for failure to progress. The infant's birth weight was 4,310 g. An **intrapartum haemorrhage** of 2,000 mL occurred due to **uterine atony**; this responded to oxytocic therapy. Her postoperative haemoglobin value was 8.0 g/dL. The mother went home nine days after delivery, taking iron tablets. She developed thigh pain 14 days postpartum but reportedly did not seek attention at that time. She collapsed at home on the sixteenth postpartum day. On admission she was **anaemic** (**haemoglobin value 6.3 g/dL**) and received a blood transfusion and cardiopulmonary embolectomy during which procedure she died. Autopsy revealed **massive pulmonary embolism**, lung infarctions and **deep vein thrombosis** in the left leg (Case also included in Chapters 8 and 9).
2. A 30 year old primigravida, was admitted to a suburban district hospital at 30 weeks' gestation with mild **hypertension** and oedema. After two days in hospital she was discharged on the antihypertensive drug, oxprenolol, 40 mg twice daily. The next day, she was readmitted to hospital again for two days for further bed rest because of mildly elevated blood pressure. For the second time she was discharged from hospital only to be readmitted again after two days with blood pressure of 128/88, proteinuria 3+ and generalised oedema. A **Caesarean section** was performed three days later. Some 36 hours after delivery the patient developed **acute renal failure** and the **adult respiratory distress syndrome**. She also developed Pseudomonas sepsis and an infarcted right lobe of the liver. At this stage, she was transferred to a major

teaching hospital where a *partial hepatectomy* was performed. Hypotension developed intraoperatively followed by cardiac arrest and the patient died in the immediate postoperative period. Postmortem examination revealed evidence of *acute bronchopneumonia* and hyaline membrane disease with *disseminated intravascular coagulation*. There was *900–1,000 mL of blood-stained ascites* and a *large blood clot in the abdominal wall* around the recent surgical incision. Cholestasis and inflammation of the liver along with *massive hepatic necrosis* of the right lobe of the liver were also present (Case also included in Chapters 3 and 8).

3. A 23 year old had induction of labour at 39 weeks' gestation because of spontaneous preterm rupture of membranes. The progress of labour was poor and a *Caesarean section* was performed. Two hours after the operation a large *postpartum haemorrhage* occurred and hypovolaemic shock resulted. Resuscitation was commenced and the patient was transferred to a base hospital where laparotomy revealed a haemoperitoneum and, therefore, *hysterectomy* was performed. The patient remained hypotensive and died 18 hours after delivery. The intraperitoneal bleeding was thought to have originated from incomplete closure of the uterine wound after the Caesarean section (Case also included in Chapter 8).

(ii) Secondary postpartum haemorrhage

4. A 25 year old para 2, who had had two previous Caesarean sections was delivered in her third pregnancy by elective Caesarean section. Tubal ligation was also performed. The operation and postoperative period were uneventful. Thirty-four days after delivery she was admitted to hospital with *vaginal bleeding* and *curettage* of the uterine cavity was performed. There were no retained products of conception and she was treated with antibiotics and a blood transfusion. Sixty-one days following delivery she presented again with heavy vaginal bleeding and was given the oral contraceptive pill. Four days later there was a recurrence of heavy vaginal bleeding and at this time her haemoglobin value was found to be 6.0 g/dL. Curettage of the uterine cavity was again performed but the bleeding continued and she was transferred to an intensive care unit. *Subtotal hysterectomy* was necessary but 24 hours after the operation there was a *haemoperitoneum* and a further laparotomy with ligation of the right uterine artery was performed. She developed septicaemia and her condition deteriorated and she died 15 weeks after delivery. The *septicaemia* did not appear to be related to the Caesarean section and had developed much later in the puerperium perhaps at the time of the first curettage of the uterus (Case also included in Chapters 6 and 8).

Comment

In Case 1, anaemia resulting from intrapartum haemorrhage may have contributed to deep venous thrombosis and pulmonary thromboembolism. In Case 2, acute renal failure and hepatic necrosis were the important complications, whereas Case 3 illustrates that postpartum haemorrhage at Caesarean section can rapidly result in shock. The intramyometrial injection of prostaglandin F₂ alpha (given in 1 mg aliquots at intervals of five to ten minutes to a maximum dose of 5 mg) is often life saving in this circumstance when the cause of haemorrhage is uterine atony.

Table 16 Deaths associated with haemorrhage

Category	Number of cases	Significant contributing factors present
Ectopic pregnancy	3	Advanced abdominal pregnancy (1)
Amniotic fluid embolism	3	Blood coagulation failure (3) Placenta praevia (1) Uterine rupture (1)
Placenta praevia	3	Coagulation failure (2) Difficult vaginal delivery (1) Septicaemia (1)
Placental abruption	2	Myocarditis (1) Cerebral infarction (1)
Related to Caesarean section		
(i) Primary postpartum haemorrhage	3	Pulmonary thromboembolism (1) Cholestasis and hepatic necrosis (1) Blood coagulation failure (1)
(ii) Secondary postpartum haemorrhage	1	Septicaemia (1)

CHAPTER 8

DEATHS ASSOCIATED WITH ANAESTHESIA OR CAESAREAN SECTION

There were 33 deaths related to anaesthesia or Caesarean section. As in previous reports they can conveniently be grouped into three separate categories:

1. Those women whose death was solely related to the Caesarean section or to administration of an anaesthetic (17 cases).
2. Those women who probably would have died from existing obstetric or other complications whether the Caesarean section had been done or not (nine cases).
3. Those women in whom the Caesarean section was performed in the hope of salvaging the fetus in a recently dead or moribund mother (seven cases).

Category 1: Deaths associated solely with anaesthesia or Caesarean section (Table 17)

Administration of an anaesthetic (3 deaths)

1. A 36 year old multigravida, had an uneventful antenatal period until 38 weeks' gestation when induction of labour was arranged because of aching in both lower limbs and intermittent headaches. Artificial rupture of the membranes was followed by good labour and when the cervix had reached 6 cm dilatation, caudal block analgesia was performed by the attending obstetrician. The anaesthetic agent used was bupivacaine hydrochloride which was given in two separate doses such that a total of 38 mL of 0.375 per cent solution of bupivacaine hydrochloride was administered altogether. Soon after the second injection of *bupivacaine* the patient had the first of three convulsions. Breathing ceased and cardiopulmonary resuscitation was commenced. A specialist anaesthetist was called along with a paediatrician. The infant was delivered with the assistance of obstetric forceps and required resuscitation. Maternal cardiopulmonary resuscitation failed.
2. A 26 year old multigravida, had an urgent Caesarean section performed for *acute preeclampsia* in a provincial town. Endotracheal intubation during induction of anaesthesia was difficult and after completion of the Caesarean section, laryngospasm occurred after extubation. The patient died despite tracheostomy and vigorous resuscitation attempts. It was thought that the difficulty with intubation may have been due to oedema of the glottis and larynx associated with her severe preeclampsia reflected in a blood pressure of 170/110, proteinuria 4+, and generalised oedema (Case also included in Chapter 3).

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3. A 31 year old in her fifth pregnancy, during the antenatal period, had an early upper respiratory tract infection treated with antibiotics and throughout pregnancy received treatment for *asthma*. Labour occurred spontaneously at 41 weeks' gestation. After 14 hours in labour, deep transverse arrest of the fetal head was diagnosed, an attempt at forceps delivery failed, and the patient was prepared for Caesarean section. *Anaphylactic shock* occurred on induction of anaesthesia with thiopentone and suxamethonium. The patient was unable to be ventilated and death followed bronchospasm, vasodilatation, circulatory failure and cardiac arrest. At autopsy, periorbital and conjunctival oedema along with oedema of the face, lips and larynx was noted. The lungs were congested and the pericardial sac contained a small amount of straw-coloured fluid. The pleural and peritoneal cavities contained blood stained fluid. Immunochemical investigation showed high levels of suxamethonium IgE antibodies and mast cell tryptase. It was concluded that the cause of death was an *anaphylactic reaction to suxamethonium* (Case also included in Chapter 12).

Postpartum haemorrhage (2 deaths)

4. A 25 year old multigravida, had an uneventful elective Caesarean section performed along with tubal ligation in a provincial base hospital. The reason for the Caesarean section was that she had had two previous Caesarean sections. After a normal convalescence she was discharged from the base hospital only to return 34 days later with heavy bleeding per vaginam. Uterine *curettage* was performed but no products of conception were obtained. She received a blood transfusion and antibiotics intravenously and was discharged from hospital. Sixty-one days after the Caesarean section she returned again to the base hospital with heavy vaginal bleeding and was seen by the principal house officer in the Casualty Department. She was sent home with instructions to take an oral contraceptive pill. On the sixty-fifth day postpartum the patient presented again to the hospital with heavy vaginal bleeding. This time she was seen by a consultant gynaecologist and a second uterine curettage was performed. However, she continued to bleed and was transferred to the intensive care unit where a *coagulopathy* was diagnosed. Resuscitation was undertaken and the next day a *subtotal hysterectomy* was performed. Twenty-four hours later the patient developed a haemoperitoneum and a laparotomy was performed at which the right uterine artery was ligated. Subsequently, there was no evidence of further bleeding but she developed *septicaemia* and irreversible shock and died on the 104th day after her Caesarean section. At autopsy secondary postpartum haemorrhage and the shock syndrome were thought to be the cause of death (Case also included in Chapters 6 and 7).

5. A 23 year old woman had induction of labour at 39 weeks' gestation because of spontaneous preterm rupture of membranes. The progress of labour was poor and a Caesarean section was performed. Two hours after the operation a large *postpartum haemorrhage* occurred and hypovolaemic shock resulted. Resuscitation was commenced and the patient was transferred to a base hospital where laparotomy revealed a haemoperitoneum and, therefore, *hysterectomy* was performed. The patient remained hypotensive and died 18 hours after delivery. The intraperitoneal bleeding was thought to have originated from incomplete closure of the uterine wound after the Caesarean section (Case also included in Chapter 7).

6,7,8 and 9.

Four women died of pulmonary embolism following Caesarean section. In three of these patients, pulmonary embolism occurred ten to 16 days after the Caesarean section had been performed. In the remaining patient, massive pulmonary embolism and cardiac arrest occurred two and a half hours after the Caesarean section (These cases are considered in more detail in Chapter 9).

Amniotic fluid embolism (primary cause of death in two patients)

10. A 41 year old multigravida, with a grade 4 *placenta praevia*, gestational diabetes, polyhydramnios and iron deficiency anaemia was admitted to hospital at 33 weeks' gestation. Two weeks after admission she reported absent fetal movements and fetal cardiotocography indicated decreased fetoplacental reserve. Accordingly, a Caesarean section was performed under general anaesthesia. A live infant was delivered by internal version and breech extraction through the lower uterine segment incision as the fetal lie was transverse. The patient became hypotensive after the uterine incision had been repaired although blood loss was estimated at less than one litre. In the intensive care unit a coagulation screen showed *coagulopathy*. The patient received massive resuscitation over the next 48 hours but renal and liver function deteriorated progressively and there was increasing respiratory difficulty. She died eight days after delivery. At autopsy there was evidence of disseminated intravascular coagulation and early diffuse pulmonary alveolar damage. In addition there was evidence of amniotic fluid within the pulmonary vasculature. Thus, the pathologist concluded that the cause of death was *disseminated intravascular coagulation following amniotic fluid embolism* (Case also included in Chapters 6, 7 and 10).

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11. A 35 year old multigravida, had an uneventful pregnancy and labour was induced four days post-term. When the cervix reached 6–7 cm dilatation a small *antepartum haemorrhage* occurred. Fetal scalp blood analysis at this time revealed marked fetal acidosis. Therefore, an emergency Caesarean section was performed. During the operation there was difficulty with haemostasis which ultimately led to an abdominal *subtotal hysterectomy* being performed. During the operative procedure the patient became shocked and it became impossible to maintain cardiac output. The patient died intraoperatively. At autopsy, all lobes of the lungs showed the presence of fetal squames, squamous casts and meconium within small branches of the pulmonary artery and within pulmonary capillaries. The findings were consistent with *amniotic fluid embolism and disseminated intravascular coagulation* (Case also included in Chapters 7 and 10).

Cerebral haemorrhage (2 deaths)

12. A 27 year old primigravida, developed *severe preeclampsia* (hypertension, proteinuria and generalised oedema) at 21 weeks' gestation. She was admitted to a teaching hospital and treated with atenolol, magnesium sulphate and heparin. Three days later profound neurological deterioration occurred and a CT scan of the head revealed a *subdural haematoma* and cerebral oedema. The patient was transferred to the intensive care unit at another hospital where craniotomy and evacuation of a subdural haematoma were performed. A Caesarean section was performed after the craniotomy, but the woman remained 'brain dead'. Ventilatory support was withdrawn three days later. At autopsy, the cause of death was found to be cerebral oedema and subdural haemorrhage associated with preeclampsia (Case also included in Chapter 3).
13. A 33 year old primigravida, had an uneventful pregnancy until 32 weeks' gestation when she had sudden onset of epigastric pain and vomiting and was found semiconscious in the bathroom of her home. She was admitted to hospital and found to have acute and *fulminating pregnancy-induced hypertension*. After administration of an anticonvulsant and an antihypertensive, Caesarean section was performed. Thereafter, she was admitted to the intensive care unit for management of hypotension, oliguria and *coagulopathy*. She received massive blood product transfusion and was taken back to the operating theatre for continued bleeding. At laparotomy, the uterine arteries were ligated. The following day, a CT scan of the head showed a large left *intracerebral haemorrhage*. Cardiac arrhythmia preceded death on the following day. At autopsy, the left cerebral hemisphere was softened with subarachnoid blood over the surface. In addition, blood clot

was emerging from a rupture of the left frontal lobe of the brain. The cause of death was attributed to cerebral haemorrhage associated with pregnancy induced hypertension (Case also included in Chapter 3).

Disseminated intravascular coagulation and uncontrollable bleeding (2 deaths)

14. A 29 year old primigravida, was admitted to hospital at 32 weeks' gestation with *severe preeclampsia* (hypertension and massive proteinuria). Twelve hours after admission to hospital Caesarean section was performed. Immediately after the operation she became hypotensive, dyspnoeic and finally had a cardiac arrest five hours after the Caesarean section. Resuscitation was unsuccessful. At autopsy the lungs were congested with platelet thrombi and intraalveolar haemorrhage. There was no evidence of amniotic fluid embolism. The liver showed severe centrilobular necrosis. No fibrin thrombi were identified. The pathologist was of the opinion that the cause of death was *disseminated intravascular coagulation* due to preeclampsia (Case also included in Chapter 3).
15. A 39 year old primigravida, was found to be anaemic at 22 weeks' gestation. Iron supplements were prescribed. At 34 weeks' gestation, she was found to have persisting *anaemia* and a grade 3 *placenta praevia*. Parenteral iron was administered. At 38 weeks' gestation, an elective Caesarean section was performed because of the placenta praevia. Three hours after delivery, the blood pressure was found to be 70/50. Intravenous therapy was commenced. Soon afterwards, a large vaginal haemorrhage occurred accompanied by haemorrhage from the Caesarean section wound. Further intravenous fluids were administered along with intravenous Syntocinon. However, bleeding continued and a *hysterectomy* was carried out. A provisional diagnosis of *disseminated intravascular coagulation* was made. Subsequently, the patient developed cardiac failure and was admitted to the intensive care unit and mechanically ventilated. A short time afterwards she died. Death was attributed to multiple organ failure, secondary to the HELLP syndrome accompanied by disseminated intravascular coagulation (Case also included in Chapter 7).

Acute renal failure (1 death)

16. A 30 year old primigravida, was admitted to a suburban district hospital at 30 weeks' gestation with mild *hypertension* and oedema. After two days in hospital she was discharged on the antihypertensive drug, oxprenolol, 40 mg twice daily. The next day, she was readmitted to hospital again for two days for further bed rest, because of mildly elevated blood pressure. For the second time she was discharged from hospital only to be readmitted again after two days with blood pressure of 128/88, proteinuria 3+ and generalised oedema. A Caesarean section was performed three days later. Some 36 hours after delivery the patient developed *acute renal failure* and the *adult respiratory distress syndrome*. She also developed Pseudomonas sepsis and an infarcted right lobe of the liver. At this stage, she was transferred to a major teaching hospital where a partial hepatectomy was performed. Hypotension developed intraoperatively followed by cardiac arrest and the patient died in the immediate postoperative period. Postmortem examination revealed evidence of *acute bronchopneumonia* and hyaline membrane disease with *disseminated intravascular coagulation*. Cholestasis and inflammation of the liver along with *massive hepatic necrosis* of the right lobe of the liver were also present (Case also included in Chapters 3 and 7).

Acute fatty liver of pregnancy (1 death)

17. A 26 year old secundigravida, was admitted to a provincial base hospital at 37 weeks' gestation with a blood pressure of 140/105, moderate proteinuria and gross oedema. A diagnosis of *severe preeclampsia* was made and an elective Caesarean section was performed. Postoperatively, the patient was noted to be hypotensive with low serum albumen, *coagulopathy*, raised bilirubin and *raised liver enzymes*. She was transferred to the intensive care unit where she was managed with intravenous fluids and blood products. She then sustained a grande mal seizure which was treated with intravenous phenytoin. Finally, a dopamine infusion was given because of increasing hypotension. Thereafter, cardiac asystole occurred and all attempts at resuscitation were unsuccessful. Postmortem examination revealed acute *fatty liver of pregnancy* associated with disseminated intravascular coagulation (Case also included in Chapters 3 and 7).

Category 2: Deaths inevitable whether Caesarean section or not (Table 18)

Caesarean section was carried out in a group of women who were not at the time moribund but would almost certainly have died from their illness whether Caesarean section had been performed or not. There were nine women in this group and all died of diseases incidental to pregnancy.

1. A 31 year old multiparous woman from a provincial town had an elective repeat Caesarean section performed at 38 weeks' gestation in her fifth pregnancy. Tubal ligation was performed at the same time. The procedure was uneventful and, after a brief stay in hospital, the patient was allowed to go home. Three weeks after delivery the patient was readmitted to the hospital because of problems with feeding of and caring for the baby. While in hospital on this second occasion, she had a sudden cardiac arrest and died.

Autopsy revealed that she had sustained an acute anteroseptal *myocardial infarct* due to thrombus overlying coronary atherosclerosis in the left anterior descending coronary artery. There was evidence of old posterior left ventricular infarction and triple vessel coronary atherosclerosis (Case also included in Chapter 4).

2. A 29 year old secundigravida, was admitted to a teaching hospital at 32 weeks' gestation with a history of fever, abdominal pain, groin pain and malaise. After investigation, a diagnosis of *acute promyelocytic leukaemia* was made. Labour was induced and after two and a half hours in the first stage of labour the fetus became distressed and a Caesarean section was performed. Blood, platelets and fresh frozen plasma were administered and the mother was transferred to the intensive care unit postoperatively. Shortly after this transfer, a tachycardia developed followed by a bradycardia and cardiac arrest. Resuscitation was unsuccessful. Postmortem examination of the heart revealed recent infarction involving the anterior free wall of the left ventricle and the anterior part of the interventricular septum. In addition, small thromboemboli were found in the main pulmonary artery and in the inferior vena cava. Fibrin was found within glomerular capillaries consistent with *disseminated intravascular coagulation*. Microscopic examination revealed leukaemic blast cells within the blood in all organs and hypercellular bone marrow mostly replaced by blast cells. The primary cause of death was myocardial infarction with acute leukaemia as a contributing factor (Case also included in Chapter 12).

Cerebrovascular accidents (2 deaths)

3. A 22 year old secundigravida, had a past history of an angiomatous malformation near the left side of the cerebral corpus callosum. When 16 years of age and 20 weeks pregnant in her first pregnancy, she presented with seizures, confusion, neck stiffness and intraventricular haemorrhage. The angiomatous malformation was excised following which the remainder of the pregnancy was uneventful. During the present pregnancy, she presented to a metropolitan teaching hospital at 34 weeks' gestation with *twins* and a history of severe bilateral, frontal headaches. Four days previously she had been involved in a minor motor vehicle accident. She was in no distress although she did have some slight neck stiffness and pain. The pain settled with paracetamol but she returned the next day with continuing neck stiffness and frontal headaches. She was admitted to hospital and a neurologist consulted. As the headache worsened, an ultrasound scan of her head was performed which revealed *intraventricular haemorrhage* with no evidence of subarachnoid haemorrhage. Subsequently, a four-vessel angiogram revealed a recurrence of the *arteriovenous malformation* at the same site as the previous excision. Six days after admission there was a sudden deterioration in the patient's mental state and a CT scan showed a large intraventricular haematoma with fresh blood in the third and fourth ventricles and hydrocephalus. A Caesarean section was performed and the twin fetuses were born alive and sent to the special care nursery. During the first postoperative day there was further rapid deterioration of the patient's neurological state and she died on the third day after delivery (Case also included in Chapter 5).
4. A 31 year old multigravida, had a Caesarean section performed at 37 weeks' gestation because of *placental abruption*. Her postoperative course was uneventful except for pyrexia, for which antibiotics were prescribed, and *anaemia*, for which oral iron was given. Ten days after the patient had been discharged home, she developed *thrombosis of the subclavian artery* with embolism of the right ulnar artery. In spite of anticoagulation therapy with heparin, embolism to the right cerebral artery resulted in *cerebral infarction* and maternal death 17 days after delivery. At autopsy, there was embolism of the middle cerebral artery and of the right internal carotid and cerebral arteries. The right innominate artery was thrombosed (Case also included in Chapters 7 and 12).

Extensive respiratory disease (2 deaths)

5. An 18 year old primigravida, who had a past history of mild *asthma* and heavy smoking was admitted to a provincial town hospital at 34–36 weeks' gestation with a recent history of spontaneous rupture of the membranes, diarrhoea and vomiting and failure to gain weight during the previous six weeks of pregnancy. On admission, it was confirmed that the membranes had ruptured. Soon afterwards labour commenced. However, fetal distress developed after nine and a half hours of labour and a straightforward lower segment Caesarean section was performed. Anaesthesia was uneventful. After the operation, respiratory function deteriorated steadily and on the first day after operation a chest X-ray revealed bilateral *pneumonia*. The patient was intubated and transferred to an intensive care unit at the regional base hospital. On admission, a bronchoscopy was done which revealed oedematous airways and mucopurulent aspirations. Cultures grew streptococcus pneumoniae. The patient's lung condition progressively deteriorated and she died eight days after admission to the intensive care unit. Autopsy confirmed the presence of bronchopneumonia and bilateral pneumothoraces (Case also included in Chapter 6).
6. A 30 year old multigravida, had a past history of repair of a hiatus hernia. She smoked 14 cigarettes daily and was reported to have regularly attended for antenatal care. She presented to a provincial town hospital at 37 weeks' gestation with vomiting and epigastric pain. In view of some elevation in the blood pressure and associated headache, a diagnosis of headache secondary to pregnancy induced hypertension was considered. However, a chest X-ray revealed that the patient had stomach and bowel displaced into the chest cavity. A Caesarean section was performed with the delivery of a live female baby. At the same time, reduction of intrathoracic stomach with closure of the hiatus hernia were carried out along with *reduction of an incisional hernia* which had caused small bowel obstruction. A *gastroenterostomy* was also performed. After the operation, the patient was febrile and tachycardic requiring large amounts of intravenous fluids approximately 20 litres over 48 hours. Her respiratory function deteriorated over 24 hours requiring ventilation three days postoperatively and transfer to the intensive care unit of a metropolitan hospital. On arrival she was febrile and tachycardic. A chest X-ray showed pulmonary oedema. She was treated with three types of antibiotics. An exploratory laparotomy the next day failed to find any intraabdominal site of sepsis. She developed bilateral tension pneumothoraces which were drained. She continued to be haemodynamically labile and febrile, requiring ventilatory support up to the time of her death nine days after delivery. At autopsy, findings suggested the adult respiratory

distress syndrome which was confirmed on histological examination of lung tissue. The cause of death was attributed to respiratory failure secondary to the adult respiratory distress syndrome (Case also included in Chapter 6).

Miscellaneous conditions

Of the other three deaths in this group, one was the result of staphylococcal endocarditis, one was due to widespread metastatic melanoma, and the third was caused by the malignant neuroleptic syndrome complicating schizophrenia.

7. A 35 year old multigravida, had a history of long standing *rheumatic heart disease* and *congestive cardiac failure*. Cardiac surgery was performed in 1991 to replace both mitral and aortic valves with prosthetic valves. She was also on digoxin and diuretic therapy. She had two previous vaginal deliveries and an ectopic pregnancy for which left salpingectomy was performed. In the present pregnancy she presented to her local hospital with an unexpected gestation at 25 weeks. Ultrasound examination showed a grade 4 *placenta praevia*. She was transferred to a Level 3 hospital at 29 weeks' gestation and kept in hospital for observation and for stabilisation of her anticoagulation with warfarin. The intention was for her to stay in hospital until delivery. Warfarin was to be continued until 36 weeks' gestation or evidence of antepartum haemorrhage and then heparin was to replace warfarin. Elective Caesarean section was planned for 38 weeks' gestation. The patient had an *antepartum haemorrhage* at 32 weeks' gestation and was heparinised at that stage. At 33 weeks' gestation, she was delivered by Caesarean section because she had developed a septicaemia secondary to an infected canula site. The baby was born alive and weighed 2,500 g. Staphylococcus aureus was identified in the mother's blood and she was treated with antibiotics. However, she developed *septicaemic shock* and was transferred to a hospital with adult intensive care facilities. Persisting fever secondary to endocarditis was diagnosed. Despite initial improvement, the patient subsequently developed *disseminated intravascular coagulation*. Although she received massive life-support measures, cardiac output remained low and she died 17 days after delivery. An autopsy was not performed. Clinically death was attributed to staphylococcal septicaemia secondary to an infected intravenous canula site with endocarditis and disseminated intravascular coagulation (Case also included in Chapters 4, 6 and 7).

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8. A 36 year old multigravida, developed anaemia, oliguria and proteinuria at 32 weeks' gestation. Investigations included a chest X-ray which suggested the diagnosis of *metastatic melanoma*. She was delivered by Caesarean section of a live infant, but thereafter, her condition deteriorated and she died on the sixth postoperative day. At the time of the Caesarean section, multiple abdominal metastases were seen and biopsy of the metastatic tissue confirmed the diagnosis of melanoma (Case also included in Chapter 12).
 9. A 28 year old woman was delivered by Caesarean section for failure to progress in labour. She had been receiving treatment for *schizophrenia*. Twenty-four hours after delivery, she developed dyspnoea and suffered respiratory arrest. Subsequently, during artificial respiration she developed a temperature of 40°C. Lung scan and pulmonary angiography were normal. Laparotomy looking for a septic focus was negative apart from confirming minimal wound sepsis. A muscle biopsy revealed the presence of very small sarcoplasmic concretions similar to those seen in patients with the *neuroleptic malignant syndrome*, which has been reported after the use of potent neuroleptics given in therapeutic doses. The patient had been on injections of fluphenazine decanoate for treatment of her schizophrenia, and had received an injection of this drug 24 hours before being admitted to the intensive care unit some 24 hours after Caesarean section. The coroner concluded that the death resulted from the neuroleptic malignant syndrome or septicaemia or a combination of both (Case also included in Chapter 12).

Category 3: Caesarean section in recently dead or moribund woman (Table 19)

In this category, the Caesarean section can be considered coincidental to the maternal death.

Amniotic fluid embolism (2 deaths)

1. A 35 year old secundigravida, had an uneventful pregnancy and was admitted to a metropolitan hospital at term in early labour. Three hours after admission, a vaginal examination was performed to assess the progress of labour. The membranes ruptured during this examination and the patient collapsed with a cardiac arrest. Immediate resuscitation was unsuccessful and the patient died. The baby was delivered by classical Caesarean section, was hypoxic and in poor condition and died 36 hours later. Autopsy revealed evidence of *amniotic fluid embolism* (Case also included in Chapter 10).

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2. A 29 year old multigravida, had an uneventful antenatal course until she was admitted to hospital at 36 weeks' gestation with a blood pressure of 140/90. An ultrasound scan had revealed a low lying placenta which was clear of the internal cervical os. After three days she was discharged from hospital as her blood pressure had returned to normal and there was no proteinuria or oedema. Subsequently, at term, she presented at a Level 2 hospital with a history suggestive of ruptured membranes. This was confirmed on examination. She was not in labour at this stage. The amniotic fluid was noted to be slightly meconium stained and fetal cardiotocography revealed some decelerations of the fetal heart rate. An oxytocin infusion was commenced on the day of admission and labour progressed well until eight hours later when fetal heart rate decelerations occurred again. The Syntocinon was discontinued and the labour continued satisfactorily. After one hour in the second stage of labour, she had a sudden seizure and, despite vigorous resuscitation, she died. At this time, the fetal heart rate was 68 beats per minute and the baby was delivered by Caesarean section while the mother was being resuscitated but died the next day of profound perinatal asphyxia. Maternal postmortem examination revealed evidence of extensive ***amniotic fluid embolism***
(Case also included in Chapter 10).

Cardiomyopathy (2 deaths)

3. A 43 year old multigravida, in her eleventh pregnancy was under the care of a general practitioner obstetrician. At term, she collapsed at home and was given cardiopulmonary resuscitation by ambulance staff and transferred to a base hospital. On arrival, she was asystolic, cyanosed and had fixed, dilated pupils. Resuscitation was continued and a Caesarean section performed immediately. The infant was stillborn. Autopsy of the mother revealed the presence of ***congestive cardiomyopathy*** which was possibly pregnancy related (Case also included in Chapter 4).
4. A 19 year old primigravida, collapsed at home at 38 weeks' gestation. Cardiopulmonary resuscitation was commenced at home and continued during her transfer to a district hospital. An emergency Caesarean section was performed and a stillborn female infant delivered. The mother was unable to be resuscitated. Postmortem examination revealed ***acute myocarditis***
(Case also included in Chapter 4).

Injuries sustained from motor vehicle accidents (1 death)

5. At 38 weeks' gestation in her third pregnancy, the woman was the driver of a car which was involved in a collision with a passenger train at a level

crossing. She was thrown out of the car and sustained head, chest and abdominal injuries. Despite resuscitative measures in a Level 2 hospital, she died three hours later. A Caesarean section was performed but the baby was stillborn. A postmortem examination of the mother revealed mild subarachnoid and subdural haemorrhages, partial collapse of the lungs from haemothoraces as a result of fractured ribs, and lacerations of the liver and spleen. The cause of death was haemorrhage due to ruptured spleen and laceration of the liver, following a motor vehicle accident (Case also included in Chapter 12).

Septicaemia (1 death)

6. A 27 year old woman complained of vomiting, diarrhoea and abdominal pain at 36 weeks' gestation. Later in the day, she was found unconscious at home. Cardiopulmonary resuscitation was commenced and the patient transferred to a Level 3 teaching hospital. Resuscitation was unsuccessful and the patient died. An emergency Caesarean section resulted in delivery of a stillborn and slightly macerated female infant. Postmortem examination of the mother revealed evidence of *septicaemia* attributed to the *haemolytic streptococcus* (group A). There was no obvious cause for the intrauterine death of the fetus (Case also included in Chapter 6).

Viral pneumonia (1 death)

7. A 36 year old secundigravida, had had an uneventful pregnancy with regular antenatal care until 26 weeks' gestation when she was seen by her local medical officer with a recent history of *haemoptysis*. Crepitations were noted in the left lung. Admission to hospital was advised but the patient declined. Three days later, she was admitted to hospital with dyspnoea, face and ankle swelling, and a blood pressure of 180/108 falling to 124/90 one hour later. She vomited a small amount of blood stained fluid. Twenty-four hours later the dyspnoea increased and there was further haemoptysis. Twelve hours later, oxygen therapy was started, a chest X-ray performed and treatment with flucloxacillin and cephalexin commenced. At this stage, her haemoglobin value was 7.0 g/L. **Blood transfusion** was commenced. Later in the day, a cardiac arrest occurred and resuscitation was unsuccessful. An emergency Caesarean section resulted in delivery of a stillborn baby. Autopsy revealed bilateral pneumonic consolidation of both lungs with interstitial oedema and inflammation associated with diffuse alveolar damage. The cause of death was thought to be due primarily to *viral pneumonitis* (Case also included in Chapters 3 and 6).

Table 17 Deaths related primarily to Caesarean section or anaesthetic

Cause of death	Number of patients
Anaesthetic	3
Postpartum haemorrhage	2
Pulmonary embolism	4
Amniotic fluid embolism	2
Cerebral haemorrhage	2
Disseminated intravascular coagulation	2
Acute renal failure	1
Acute fatty liver	1
Total	17

Table 18 Deaths inevitable whether Caesarean section or not

Cause of death	Number of patients
Myocardial infarction	2
Cerebrovascular accident	2
Respiratory disease	2
Bacterial endocarditis	1
Metastatic melanoma	1
Neuroleptic malignant syndrome	1
Total	9

Table 19 Caesarean section in a recently dead or moribund woman

Cause of death	Number of patients	Perinatal outcome
Amniotic fluid embolism	2	2 neonatal deaths
Cardiomyopathy	2	2 stillbirths
Motor vehicle injury	1	Stillbirth
Septicaemia	1	Stillbirth
Viral pneumonia	1	Stillbirth
Total	7	No surviving infant

CHAPTER 9

PULMONARY THROMBOEMBOLISM

There were eight deaths in which the diagnosis of pulmonary thromboembolism was made. Five of the eight cases were classified as direct maternal deaths with pulmonary embolism being classified as the main cause of death in all of them (Table 1). In two cases (Cases 1 and 2) the deaths were classified as 'incidental' and both had evidence of deep venous thrombosis (Table 3). The remaining case (Case 8) was only one in which autopsy was not performed and the death was classified as 'indirect' (Table 2).

Clinical summaries:

Antenatal

1. A 27 year old para 2, had a ***history of pulmonary embolism*** in her two other pregnancies. She collapsed and died at home. Autopsy revealed extensive pulmonary infarction caused by embolism secondary to right ***common iliac vein thrombosis***. The woman was not known to be pregnant, but autopsy revealed degenerate products of conception within the uterus which was the size of a six-week pregnancy.
2. A 35 year old woman, weight 90 kg, developed extensive ***deep vein thrombosis*** in her left lower limb at seven weeks' gestation. In spite of anticoagulation therapy, she collapsed from a pulmonary embolus and died on the tenth day of hospitalisation.

After vaginal birth

3. A 36 year old para 1, weight 84 kg, had a normal delivery at 32 weeks' gestation after spontaneous onset of labour. She was admitted to a general hospital one week later with ***postnatal depression*** and ***pelvic inflammatory disease***. She had a long history of psychiatric illness. Treatment with antibiotics and appropriate drugs was commenced but cardiac arrest occurred. Autopsy revealed ***pulmonary embolism*** and ***pelvic vein thrombosis*** (Case also included in Chapters 6 and 11).
4. A 32 year old para 4, developed ruptured membranes and delivered vaginally at 30 weeks' gestation after an hour and 20 minutes labour. The mother went home seven days after delivery. She developed a productive cough, lost weight, became weaker and reportedly did not seek medical attention. She was found dead in bed 30 days after delivery. Autopsy revealed ***pulmonary embolism*** and ***pneumonia*** (Case also included in Chapter 6).

After Caesarean section

5. A 41 year old para 2, weight 75 kg, had a routine repeat elective Caesarean section in early labour under general anaesthesia. She had a cardiac arrest two and a half hours after the operation and resuscitative measures were ineffective. Autopsy revealed massive *pulmonary* thromboembolism (Case also included in Chapter 8).
6. A 29 year old para 0, weight 105 kg, had prostaglandin induction at 41 weeks' gestation. Caesarean section was performed for failure to progress. The infant's birthweight was 4,310 g. An *intrapartum haemorrhage* of 2,000 mL occurred due to uterine atony; this responded to oxytocic therapy. Her postoperative haemoglobin value was 8.0 g/dL. The mother went home nine days after delivery, taking iron tablets. She developed thigh pain 14 days postpartum but reportedly did not seek attention at that time. She collapsed at home on the sixteenth postpartum day. On admission, she was *anaemic (haemoglobin value 6.3 g/dL)* and received a blood transfusion and cardiopulmonary embolectomy during which procedure she died. Autopsy revealed *massive pulmonary embolism*, lung infarctions and *deep vein thrombosis* in the left leg (Case also included in Chapters 7 and 8).
7. A 32 year old para 2, weight 128 kg, had repeat elective Caesarean section at 38 weeks' gestation. Estimated blood loss was 1,000 mL. There was postoperative fever and *anaemia (haemoglobin value 7.7 g/dL)*. The woman consented to blood transfusion after several days. Ultrasound examination showed a pelvic haematoma. Antibiotic therapy was given postoperatively and heparin was commenced on the tenth day postpartum. The woman appeared to be improving but was found dead in her hospital bed on the thirteenth day postpartum. Autopsy revealed *pulmonary embolism* and *pelvic haematoma* (Case also included in Chapters 6 and 8).
8. A 34 year old para 1, weight 87 kg, with *hypertension* had Caesarean section at 39 weeks' gestation. She had had a previous classical Caesarean section at 30 weeks' gestation. She was discharged well six days after delivery. She was readmitted on the tenth day after delivery with *hemiparesis and dysarthria*. CT scan suggested *middle cerebral artery thrombosis*. In spite of appropriate treatment, cardiac arrest with failed resuscitation occurred on the nineteenth day after delivery. A clinical diagnosis of pulmonary embolism was made. Autopsy was not performed (Case also included in Chapters 3 and 8).

Comment

Table 20 shows the distribution of the deaths in comparison with those in the preceding nine triennia. The proportion of the total deaths due to thromboembolism (eight of 84 or 9.5 per cent) lies within the range of recent triennia with the remarkable exception of the 1982–84 triennium when only four of the 94 maternal deaths were due to thromboembolism. It is of interest that the number of deaths associated with Caesarean section has decreased, although the Caesarean section rate increased in comparison with previous triennia. Unlike the last triennia, none of these eight women were Aboriginal.

An avoidable factor was identified by the relevant expert committee in only one case. However, factors predisposing to thromboembolism were present in several cases: Caesarean section (4), obesity (3), anaemia (2), pelvic inflammatory disease (2). Although three of the eight women died suddenly without warning signs (Cases 1, 5 and 8) there were others where there were problems that were either not reported to the medical attendant or where different treatments may have been beneficial (prophylactic anticoagulation therapy, investigation for deep venous thrombosis). Case 2 indicates that anticoagulation therapy may fail to prevent embolism when deep vein thrombosis is diagnosed. Case 6 illustrates that the modern trend to avoid blood transfusion for postpartum anaemia may be a risk factor for thromboembolism.

Table 20 Distribution of deaths from thromboembolism in ten triennia

	Number of deaths									
	1964-66	1967-69	1970-72	1973-75	1976-78	1979-81	1982-84	1985-87	1988-90	1991-93
Death during pregnancy	3	15	5	4	7	1	1	2	3	2
Death after abortion/ miscarriage	6	-	2	-	-	-	-	-	1	-
Death after operation for ectopic pregnancy	-	-	1	-	-	-	-	-	-	-
Death after vaginal birth	22	23	10	6	3	1	1	3	3	2
Death after Caesarean section	13	5	4	1	3	6	2	2	5	4
Total	44	43	22	11	13	8	4	7	12	8
Total number of causes	275	237	244	137	106	98	94	86	96	84
Percentage of total	16.0	18.1	9.0	8.0	12.2	8.1	4.2	8.1	12.5	9.5

CHAPTER 10

AMNIOTIC FLUID AND AIR EMBOLISM

Amniotic fluid embolism

There were five deaths which were classified as resulting from entry of amniotic fluid and contents into the maternal circulation.

Amniotic fluid embolism classically presents as sudden cardiorespiratory arrest or as postpartum haemorrhage associated with blood coagulation failure. In either case, the woman is often a multipara in strong labour, with a large fetus. Those women who do not show the cardiorespiratory phase (which is often fatal) usually present with haemorrhage and blood coagulation failure.

Clinical summaries:

1. A 35 year old para 1, had an uneventful pregnancy and was admitted to a metropolitan hospital at term in early labour. Three hours after admission a vaginal examination was performed to assess the progress of labour. ***The membranes ruptured during this examination and the patient collapsed with a cardiac arrest.*** Immediate resuscitation was unsuccessful and the patient died. The baby was delivered by classical Caesarean section, was hypoxic and in poor condition and died 36 hours later. Autopsy revealed evidence of ***amniotic fluid embolism*** (Case also included in Chapter 8).
2. A 29 year old para 2, had an uneventful antenatal course until she was admitted to hospital at 36 weeks' gestation with a blood pressure of 140/90. An ultrasonograph had revealed a low-lying placenta which was clear of the internal cervical os. After three days she was discharged from hospital as her blood pressure had returned to normal and there was no proteinuria or oedema. Subsequently, when at term, she presented at a Level 2 hospital with a history suggestive of ruptured membranes. This was confirmed on examination. She was not in labour at this stage. The amniotic fluid was noted to be slightly meconium stained and cardiotocography revealed some decelerations of the fetal heart rate. An oxytocin infusion was commenced on the day of admission and labour progressed well until eight hours later when fetal heart rate decelerations occurred again. The Syntocinon was discontinued and the labour continued satisfactorily. After one hour in the second stage of labour, ***she had a seizure and, despite vigorous resuscitation, she died.*** At this time, the fetal heart rate was 68 beats per minute; the baby was delivered by Caesarean section, while the mother was being resuscitated but died the next day of profound perinatal asphyxia. Maternal postmortem examination revealed evidence of extensive ***amniotic fluid embolism*** (Case also included in Chapter 8).

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3. A 33 year old para 2, laboured spontaneously at home at 41 weeks' gestation in the care of an independent midwife. Labour progressed well until ***the woman complained of faintness, vomited and became confused and distressed.*** She had ***fresh vaginal bleeding*** and there was fetal bradycardia. She was referred to a Base Hospital within 45 minutes and delivered a stillborn infant soon afterwards. She developed severe ***postpartum haemorrhage*** and ***disseminated intravascular coagulopathy***. General anaesthesia was given for removal of the placenta; 18 hours after delivery laparotomy was performed, because of persistent bleeding. A full thickness ***uterine tear*** on the posterolateral wall was identified and ***subtotal hysterectomy*** was performed. Cardiac arrest occurred two days later, during another laparotomy performed because of further haemorrhage. Autopsy revealed evidence of ***amniotic fluid embolism*** fetal material in pulmonary arterioles (Case also included in Chapter 7).
 4. A 35 year old para 1, had an uneventful pregnancy, and labour was induced four days postterm. When the cervix reached 6–7 cm dilatation a small ***antepartum haemorrhage*** occurred. Fetal scalp blood analysis at this time revealed marked fetal acidosis. Therefore, ***an emergency Caesarean section was performed.*** During the operation, there was difficulty with haemostasis which ultimately led to an abdominal ***subtotal hysterectomy*** being performed. During the operative procedure the patient became shocked and it became impossible to maintain cardiac output. The patient died intraoperatively. At autopsy, all lobes of the lungs showed the presence of fetal squames, squamous casts and meconium within small branches of the pulmonary artery and within pulmonary capillaries. The findings were consistent with ***amniotic fluid embolism and disseminated intravascular coagulation*** (Case also included in Chapters 7 and 8).
 5. A 41 year old multigravida, with a grade 4 ***placenta praevia***, gestational diabetes, polyhydramnios and iron deficiency anaemia was admitted to hospital at 33 weeks' gestation. Two weeks after admission, she reported absent fetal movements and fetal cardiotocography indicated decreased fetoplacental reserve. Accordingly, a ***Caesarean section was performed under general anaesthesia.*** A live infant was delivered by ***internal version and breech extraction*** through the lower uterine segment incision as the fetal lie was transverse. The patient became hypotensive after the uterine incision had been repaired although blood loss was estimated at less than one litre. In the intensive care unit, a coagulation screen showed ***coagulopathy***. The patient received massive resuscitation over the next 48 hours, but renal and liver function deteriorated progressively, and there was increasing respiratory difficulty. She died eight days after delivery. At autopsy, there was evidence of

disseminated intravascular coagulation and early diffuse pulmonary alveolar damage. In addition, there was evidence of amniotic fluid within the pulmonary vasculature. Thus, the pathologist concluded, that the cause of death was ***disseminated intravascular coagulation following amniotic fluid embolism*** (Case also included in Chapters 6, 7 and 8).

Comment

In this triennium, three of the five cases of amniotic fluid embolism presented with ***cardiorespiratory shock in labour***; none of these women was in strong labour or of advanced parity, and in only one had labour been enhanced by an oxytocic infusion. One of these three women (Case 3) showed clinical evidence of ***blood coagulation failure***, although the persistent postpartum haemorrhage may have been contributed to by ***rupture of the uterus***. In the other two cases, the women collapsed during ***Caesarean section*** and both developed ***blood coagulation failure***, although only one (Case 4) had severe haemorrhage. In the previous nine triennia there was a total of 60 cases of amniotic fluid embolism and in seven the first signs of the complication occurred during Caesarean section as in two of the five cases (Cases 4 and 5), in the 1991–93 triennium. Analysis of these cases provides few clues for prevention. Heroic resuscitative efforts can be ineffective once haemorrhage occurs, in association with blood coagulation failure.

Air embolism

Clinical summary:

1. A 29 year old woman at 34–38 weeks' gestation died from ***blood loss and air embolism*** due to a ***penetrating wound to the lower neck***. She was found dead at home. Analysis of blood and liver showed the presence of ***alcohol, methadone, diazepam and nordiazepam*** (Case also included in Chapter 12).

Comment

This case was included in this chapter, but the cause of death was related to homicide without disturbance to the genital tract. In previous triennia, air embolism was related to abortion (17), coitus (2), Caesarean section (1), suction curettage (1), manual removal of the placenta (1) and normal delivery (1).

CHAPTER 11

SUICIDE, SELF-ADMINISTERED OVERDOSE AND/OR COEXISTENT PSYCHIATRIC DISORDER

It was considered that this group of deaths warranted a separate chapter, since they accounted for ten of the 84 deaths (11.9 per cent). During the 30 years from 1964–93 inclusive covered by the ten triennial reports, there has been a progressive reduction in the total number of maternal deaths from 275 to 84, a reduction of 69.5 per cent. During the past 30 years there have been major changes in the absolute and relative contribution of the former five leading causes of death, as follows:

- (i) The number of deaths from toxæmia and allied conditions (ie preeclampsia, eclampsia, hypertension) fell from 43 and 50 in the first two triennia to 17 and nine in the last two triennia.
- (ii) Deaths from all causes of hæmorrhage combined (placental abruption, placenta prævia, ectopic pregnancy, postpartum hæmorrhage and ruptured uterus) fell from 72 and 47 in the first two reported triennia to 12 and 15 in the last two triennia.
- (iii) Pulmonary embolism contributed 44 and 43 deaths respectively in the first two triennia and 12 and eight in the last two triennia.
- (iv) Abortion and its complications contributed 45 and 25 deaths in the first two triennia and one and one in the last two triennia.
- (v) Caesarean section with its necessary anaesthesia contributed 69 and 55 deaths in the first two triennia and 40 and 39 in the last two triennia, in spite of a four to five-fold increase in the Caesarean section rate and the recent tendency to perform Caesarean section in moribund or dead women, even at early gestations, all such cases being included in the report.

These changes are listed to illustrate why the ten deaths in this chapter deserve special consideration eg they outnumber those from pulmonary embolism and abortion combined.

Times and attitudes have changed as shown by the following comment concerning the ten deaths from suicide in the NHMRC Maternal Mortality 1964–66 Report: 'Six patients committed suicide early in the pregnancy, probably at a time of severe depression precipitated by the fact that they were pregnant. There was no information as to whether termination of pregnancy had been discussed with any of these women. The other four women, all of whom had been treated for psychoneurosis, committed suicide in the puerperium.'

The absolute and relative contribution of suicide, self administered overdose and/or psychiatric disease to maternal mortality in the ten triennia covered by these reports are consecutively as follows:

1964–66	10 of 275
1967–69	6 of 237
1970–72	17 of 244
1973–75	5 of 137
1976–78	5 of 106
1979–81	4 of 98
1982–84	3 of 94
1985–87	3 of 86
1988–90	8 of 96
1991–93	10 of 84

Clinical summaries:

Suicide (6)

1. A 35 year old para 1, with a history of *psychiatric illness* and *heroin addiction* died from a self-administered dose of *phenobarbitone* and *benzodiazepines* at 34 weeks' gestation.
2. A 27 year old para 0, was admitted to hospital at 35 weeks' gestation in a state of confusion and delivered a macerated baby 19 hours later. The patient died 14 hours after delivery. Autopsy revealed *massive hepatic necrosis* due to *paracetamol poisoning*.
3. A 36 year old para 3, with *diabetes mellitus* was found dead hanging by a rope around the neck following a minor family dispute at 36 weeks' gestation. The cause of death was asphyxiation following hanging.
4. A 30 year old para 0, with a long history of *schizophrenia* died from multiple injuries when she threw herself from a high building nine days after a normal delivery of a healthy infant, one day after her discharge from hospital.
5. A 27 year old para 0, weight 43 kg, developed *puerperal depression* and died two weeks after delivery from self-administered *salicylate overdosage*.

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6. A 26 year old para 0, with a history of *chronic severe schizophrenia* was delivered by Caesarean section of an *infant with severe cardiac disease*. The baby was alive at discharge seven days after birth but eventually died. The mother returned to live with her parents but left after the death of her baby. Her body was washed up on a beach nine weeks after delivery. ***Although this death occurred more than 42 days postpartum it was accepted as a maternal death because of the circumstances.***

Self administered overdose

7. A 28 year old para 3, was admitted to hospital with an *overdose of dextropropoxyphene, salicylate and alcohol* at 14 weeks' gestation. She developed *disseminated intravascular coagulation* and died in spite of massive resuscitation (Case also included in Chapter 2).
8. A 27 year old para 1, with a history of *postnatal depression* after the first baby, discharged herself against medical advice 15 hours after a normal delivery of her second child. She presented moribund to another hospital 18 days postpartum and died 40 hours later in spite of haemodialysis. Toxicology screening had revealed high serum levels of *methyl alcohol*.

Coexistent psychiatric disorder (2)

Clinical summaries:

1. A 36 year old para 1, weight 84 kg, developed *postnatal depression* and *pelvic inflammatory disease* one week after a normal delivery. She had a long history of psychiatric disease, was agitated and refused examination. She was treated with antibiotics and appropriate drugs but cardiac arrest occurred. Autopsy revealed *pulmonary embolism and pelvic vein thrombosis* (Case also included in Chapters 6 and 9).
2. A 28 year old woman, who was receiving treatment for *schizophrenia*, was delivered by Caesarean section for failure to progress in labour. She developed *persistent pyrexia* six days after delivery and died from heart and respiratory failure 16 days after delivery. The coroner concluded that death resulted from the *malignant pyrexia syndrome* or septicaemia or a combination of both. She had developed dyspnoea 24 hours after Caesarean section and had a respiratory arrest. She also developed a temperature of 40 °C whilst on the respirator (Case also included in Chapter 8).

Comment

The clinical details of several of these cases is not clear-cut. Differentiation between murder, suicide and accidental death is sometimes not possible with the data available to the expert committees. For example death from a drug overdose may be deliberate or accidental, and the precipitating cause may be psychiatric disease, drug addiction or a pregnancy complication such as death or malformation of the baby. These considerations explain why two of the ten deaths were classified as 'indirect' and six as 'incidental' maternal deaths (Tables 2 and 3).

Recent research indicates that the incidence of postnatal depression is at least 10-15 per cent. This is another reason why psychiatric illness requires special consideration in this report. Medical illness, drug addiction and unstable social problems are seen in various combinations. Medical practitioners and other health professionals who care for women during pregnancy and the puerperium must be alert to recognise those who require psychiatric attention. Avoidable factors in these deaths concern family social circumstances and/or psychiatric illness which to quote one coroner's report 'are without easy, immediate or apparent answers'.

The first requirement is to identify the size of the problem. For perspective it should be noted that during the 30 years spanned by the ten triennial reports, maternal deaths have fallen, as stated above, from 275 to 84, but the number of mature pregnancies has remained relatively unchanged having ranged from 667,649 in 1964-66, reaching a peak of 790,818 in 1970-72, and a trough of 678,098 in 1976-78 and thereafter increasing progressively to 769,253 in 1991-93. Consideration of these cases indicates that the risk of a person committing suicide is often not predictable. Antenatal and postnatal depression should not be lightly regarded, and care should be taken to ensure that the appropriate support services are available, including specialised psychiatric support. Women with narcotic drug addiction, past or present, need additional care during and after pregnancy, and may require specialised support.

Domestic violence was possibly implicated in the deaths of several women. There are a number of approaches that could be taken to reduce such deaths. Women are entitled to protection under the law from physical attack and assault. It should be noted, that assault is considered an assault whether or not it occurs in the home or is perpetrated by a sexual partner. One of the avenues the law provides to protect women against an attack is the possibility to obtain a restraining order which has the effect of a court order. It is not acceptable to assume this issue is unavoidable or somehow inevitable in certain social groups. Domestic violence is a potentially serious issue for all women, whatever their ethnic background or socio-economic status.

For the purpose of this report, it is important to distinguish between puerperal psychosis and postnatal depression.

Puerperal psychosis is a severe, usually a psychotic episode that occurs in 1–2 per 1,000 births, most commonly within the first two weeks postpartum. Women with a history of affective disorders are estimated to have a 20–25 per cent risk of developing puerperal psychosis.¹ Other risk factors are being a single parent, having a first baby and having a Caesarean birth.^{1,2,3} Puerperal psychosis is associated with an increased risk of both suicide and infanticide.⁴ However, epidemiological studies have demonstrated that overall, there is a considerably lower risk of suicide during pregnancy and the first postnatal year than at other times, and that motherhood appears to offer a protective effect.^{5,6}

The postpartum progress of any woman with a history of psychotic illness, should be followed carefully by a psychiatric team, particularly in the first two to three weeks following childbirth. Postnatal home visits by nurses with mental health and midwifery skills should lead to early identification, referral and admission to a specialist psychiatric unit for treatment.

Non-psychotic depressive illness, usually known as postnatal depression, is a common cause of morbidity in the postnatal year with a prevalence of 10 to 20 per cent internationally⁷ and 10 to 15 per cent within Australia.^{8,9} At a time when there is societal expectation to be happy, depression after childbirth can be devastating for a woman. *Women who are depressed after childbirth can be isolated and unaware that appropriate support and facilities exist.*¹⁰ Depression after childbirth is poorly recognised by health care professionals who are often seen by women to be more concerned about the welfare of the baby.¹¹ Certain geographical areas have inadequate resources to deal with postnatal depression.

The Ten-item Edinburgh Postnatal Depression Scale will detect major depression with excellent sensitivity and specificity, and can be used in the context of the availability of adequate treatment resources.¹² One-to-one non-directive counselling has been shown to reduce existing postnatal depression in a randomised trial and should be more widely available as a treatment option.^{11,13,14}

Notes

1. Gitlin MJ, Pasnau RO. (1989) 'Psychiatric syndromes linked to reproductive function in women: A review of current knowledge'. *Amer J Psychiat* 146: 1413-22.
2. Kendell RE, Rennie D, Clarke JA, Dean C. (1981a) 'The social and obstetric correlates of psychiatric admission in the puerperium'. *Psychol Med* 11: 341-50.

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3. **Kendell RE, McGuire MJ, Connor Y, Cox JL.** (1981b) 'Mood changes in the first three weeks after childbirth'. *J Affect Dis* 3: 317-326.
 4. **Brockington IF, Winokur G, Dean C.** (1982) 'Puerperal psychosis'. In: *Motherhood and Mental Illness*, Brockington IF & Kumar R (Eds.); Academic Press, London, 37-69.
 5. **Appleby L.** (1991) 'Suicide during pregnancy and in the first postnatal year'. *BMJ* 302: 137-40.
 6. **Kendell RE.** (1991) 'Suicide in pregnancy and the puerperium: much rarer now, thanks to contraception, legal abortion and less punitive attitudes'. *BMJ* 302: 126-27.
 7. **Romito R.** (1989) 'Unhappiness after Childbirth'. In: *Effective Care in Pregnancy and Childbirth*. Chalmers I, Enkin M, Keirse MJNC (Eds.) Oxford University Press, Oxford; 1433-45.
 8. **Stamp GE, Crowther CA.** (1994) 'Postnatal depression: A South Australian prospective survey'. *Aust NZ J Obstet Gynaecol* 34: 164-67.
 9. **Astbury J, Brown S, Lumley J, Small R.** (1994) 'Birth events birth experiences and social differences in postnatal depression'. *Aust J Pub Health* 18(2): 176-184.
 10. **New South Wales Department of Health.** (1994) *Postnatal Depression Services Review*, Sydney.
 11. **Holden JM, Sagovsky R, Cox JL.** (1989) 'Counselling in a general practice setting: Controlled study of health visitor intervention in treatment of postnatal depression'. *BMJ* 298: 223-6.
 12. **Cox JL, Holden JM, Sagovsky R.** (1987) 'Detection of postnatal depression – development of the 10-item Edinburgh postnatal depression scale (EPDS)'. *Br-J Psychiat* 150: 732-6.
 13. **Holden JM.** (1991) 'Postnatal depression: Its nature, effects, and identification using the Edinburgh postnatal depression scale'. *Birth* 18(4): 211-21.
 14. **Gerard J, Holden JM, Elliott SA, McKenzie P, McKenzie J, Cox JL.** (1993) 'A trainer's perspective of an innovative programme teaching health visitors about the detection, treatment and prevention of postnatal depression'. *J Advanced Nursing* 18: 1825-32.

CHAPTER 12

MISCELLANEOUS DEATHS

This chapter is important mainly because it contains 28 of the 84 deaths (33.3 per cent); six of the 28 deaths were included in one or more other chapters because Caesarean section was performed (5 cases), or association with infection (1), haemorrhage (1), heart disease (1) air embolism (1). ***The expert committees judged that one of these 28 cases was a direct maternal death, six were indirect deaths and 21 were incidental deaths.*** The expert committees judged only two of the 28 cases to have *avoidable factors*, these being a household electric appliance left on (1), and an injury associated with a motor vehicle accident (1). Although only two cases were judged to be potentially avoidable, it is clear from the clinical summaries that a range of medical diseases can suddenly pose critical complications during pregnancy whether the diagnosis was previously unknown (disseminated lupus erythematosus, haemolytic anaemia, acute leukaemia) or well known but under inadequate control for a variety of reasons (drug addiction, asthma). Brief details of a death from ***metastatic trophoblastic disease*** are included as an addendum since the pregnancy occurred in 1988, and the statistics related to this case belong in the previous triennium. However, it is important to mention that this has been the only case of ***metastatic trophoblastic disease*** as a cause of death in the last four triennia.

Clinical summaries:

Homicide

1. A 27 year old woman died from severe brain damage due to ***firearm injury*** (two shots of 0.22 calibre entering above and behind the right ear) when about seven months pregnant.
2. An 18 year old woman at term died from a ***shot-gun wound*** to the left side of her head.
3. A 29 year old woman at 34–38 weeks' gestation died from ***blood loss and air embolism*** due to a ***penetrating wound to the lower neck***. Analysis of blood and liver showed the presence of ***alcohol, methadone, diazepam and nordiazepam*** (Case also included in Chapter 10).
4. A 22 year old woman was ***murdered*** 16 days after delivery of her first child, by multiple ***stab wounds to the neck*** and ***ligature strangulation***.

Traffic and other injuries (11)

Clinical summaries:

Household fire

1. A 38 year old para 1, at 38 weeks' gestation died from *carbon monoxide poisoning*, together with her husband and 18 month old son, when an electric toaster left on at the power point overheated and caused a fire which raged through their home.

Motor vehicle injuries

2. A 38 year old para 4, about six months pregnant, died instantly from head injuries when the vehicle of which she was the *driver* collided with another vehicle.
3. A 29 year old para 2, seven months pregnant, was the *driver* of a motor vehicle involved in a head on collision with another vehicle. She died from multiple chest and abdominal injuries.
4. A 38 year old para 2, at 38 weeks' gestation, was the *driver* of a car that collided with a *passenger train* at a level crossing. She was thrown from the car and died three hours later from multiple injuries. Caesarean section resulted in a stillborn infant (Case also included in Chapter 8).
5. A 35 year old woman, the *driver* of a sedan car with her 11 day old infant a passenger in a baby capsule in the rear of the vehicle, was involved in a head on collision with a semitrailer. Mother and child were killed instantly.
6. A 21 year old para 1, died from multiple injuries at 12 weeks' gestation, when a *passenger* in the car driven by her husband was involved in a collision with another vehicle.
7. A 27 year old para 0, at 24 weeks' gestation was involved in a two vehicle collision. She died from multiple thoracic and abdominal injuries in spite of resuscitation and surgery.
8. A 17 year old woman at about 25 weeks' gestation was one of a group of eight who drank alcohol from early morning with no other food intake. In the early afternoon, she was with some members of the group in a car which was involved in an accident on the highway and all were killed.

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9. A 33 year old para 2, at 26 weeks' gestation was involved in a two vehicle traffic accident. She died from multiple abdominal injuries in spite of attempts at resuscitation.
 10. A 28 year old para 1, a known heroin user who was taking methadone, died three days after early release from jail at 38 weeks' gestation, from transection of the spinal cord as result of a motor car accident. She was a *front seat passenger* (seat belt status unknown) in a vehicle which hit a tree. The cause of the accident is unknown.
 11. A 29 year old para 2, and her five-week old daughter were crushed to death when a semitrailer careered down a hill into the lounge of their home.

Comment

The number of deaths from traffic injuries in the ten triennia were 2, 8, 7, 15, 5, 3, 8, 4, 8 and 10 respectively. Designation of avoidability, apart from failure to wear a seat-belt or when a driver is shown to have excessive blood levels of drugs or alcohol, is difficult since many injuries are potentially avoidable, some more so than others. The result in this triennium must be judged to be unsatisfactory.

Neoplasms (5)

Clinical summaries:

1. A 26 year old para 1, had *disseminated mucinous adenocarcinoma of the bowel* diagnosed at 20 weeks' gestation. Hysterectomy, salpingo-oophorectomy, omentectomy and bowel resection were performed, however, the woman died eight days later.
2. A 35 year old para 3, weight 85 kg at 16 weeks' gestation, was found to have *hepatosplenomegaly* and *anaemia* when she reported weight loss and lethargy at 32 weeks' gestation. CT scan and guided biopsy revealed metastatic *adenocarcinoma of the liver with a probable colonic primary*. The mother died 23 days after delivery of a surviving infant (birth-weight 1,324 g) born normally at 33 weeks' gestation.
3. A 36 year old para 2, died from *metastatic melanoma* diagnosed by chest X-ray at 32.5 weeks' gestation when she developed *anaemia*, oliguria and proteinuria suggestive of the HELLP syndrome. She was delivered of a surviving infant (birth weight 1,746 g) but continued to deteriorate and died six days later. The diagnosis was confirmed by biopsy of multiple abdominal metastases seen at laparotomy (Case also included in Chapter 8).

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4. A 29 year old para 0, presented at 32 weeks' gestation with fever, abdominal pain, loin pain and malaise. *Anaemia* and investigation of *disseminated intravascular coagulation* led to the diagnosis of *acute myelocytic leukaemia*. Caesarean section was performed but the mother had a cardiac arrest soon afterwards while in the intensive care unit. Autopsy revealed recent *myocardial infarction* and leukaemic blasts within blood in all organs (Case also included in Chapters 4 and 8).
 5. A 32 year old para 1, had a *brain tumour* diagnosed following first trimester miscarriage and died five days later. Autopsy revealed a grade 2 *astrocytoma* causing raised intracranial pressure (Case also included in Chapter 2).

Comment

The number of deaths in this group in the ten triennia beginning with 1964–67 were 12(1), 8, 20(5), 5(1), 7, 3(2), 11, 3, 6 and 5 the figures in parentheses denoting the number of deaths from choriocarcinoma or complication of hydatidiform mole. Malignant neoplasms are rare in pregnancy and the case details provided illustrate some of the unusual presentations that occur.

ADDENDUM

In this triennium a 37 year old para 3, died from *metastatic trophoblastic disease*, five years after evacuation of a *hydatidiform mole*. This woman was initially referred to an oncology unit for management but the details of subsequent follow-up are not available.

Autoimmune and/or haematological disease (3)

Clinical summaries:

1. A 21 year old para 1, developed nausea, headache and left-sided paralysis at eight weeks' gestation. Tests indicated *systemic lupus erythematosus*. The woman had convulsions nine days after admission and CT scan showed bilateral *cerebral infarctions*. Death occurred soon afterwards.
2. A 33 year old woman was transferred to Australia from a neighbouring country, at 20 weeks' gestation, for management of *hepatosplenomegaly*. *Autoimmune haemolytic anaemia* was diagnosed. *Splenectomy* was performed when prednisone therapy failed. Portal vein thrombosis occurred and the haemolysis continued in spite of *plasmapheresis*. Labour was induced when intrauterine *fetal death* occurred. Shortly after delivery the woman had a *cerebral haemorrhage* and died.

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3. A 17 year old para 0, had a normal pregnancy and delivery and went home on postpartum day five. On postpartum day 16 she was admitted to hospital semiconscious with vomiting, diarrhoea, fever, abdominal pain and headache. She had ***abnormal liver function tests, disseminated intravascular coagulation*** and signs of ***uterine sepsis***. She had *curettage* performed then ***abdominal hysterectomy*** when her condition failed to improve. She developed renal failure and died 21 days after delivery. Although it was considered that ***overwhelming sepsis*** had followed ***severe endometritis***, autopsy revealed a large ***intracerebral haemorrhage*** with the sections of the kidneys showing features of the ***haemolytic uraemic syndrome*** (Case also included in Chapter 6).

Comment

These three women each had a potentially horrendous medical disease and each was managed by a team of specialists without avail. The treatment regimens used in these cases succeed in other women with similar ailments.

Asthma, epilepsy, anaphylaxis, cerebral infarction, unexplained (5)

Clinical summaries:

1. A 20 year old para 0, had a long history of severe ***asthma***. She also suffered from a mild form of epilepsy. A ***cardiac arrest*** was managed successfully just before pregnancy. At about 30 weeks' gestation the woman had a severe ***asthma attack***, with fits and ventricular fibrillation resulting in '***hypoxia and death from asthma and pulmonary oedema from an unknown cause***'. She had received a tetanus toxoid injection earlier in the day prior to death.
2. A 31 year old para 0, smoker, weight 90 kg, had a history of ***asthma***. Spontaneous labour at 41 weeks' gestation resulted in ***failed forceps delivery***. During preparation for Caesarean section anaphylaxis occurred with induction of anaesthesia with thiopentone and suxamethonium. Death occurred from circulatory failure and cardiac arrest, and was considered to be due to an ***anaphylactic reaction to suxamethonium*** (Case also considered in Chapter 8).

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3. A 31 year old para 1, had a Caesarean section at 37 weeks' gestation because of **placental abruption**. She had postoperative pyrexia and anaemia (haemoglobin value 9.5 g/dL). Ten days after discharge home she developed **right ulnar artery embolism** associated with **subclavian artery thrombosis**. In spite of heparinisation, **embolism to the right cerebral artery** resulted in **cerebral infarction** and death 17 days after delivery. Autopsy revealed the right innominate artery as the probable source of the emboli (Case also included in Chapters 7 and 8).
 4. A 17 year old collapsed at 29 weeks' gestation and died following **orogenital intercourse**. Autopsy showed no evidence of air embolism or any other significant pathology.
 5. A 23 year old para 0, weight 99 kg, had a blood pressure of 140/85 and trace of proteinuria at 36.4 weeks' gestation. She was found **collapsed in the shower** at 39.2 weeks' gestation and could not be resuscitated. Autopsy revealed no cause of collapse or death (Case also included in Chapter 3).

Comment

In Case 1 severe asthma was a prominent feature in the train of events resulting in death. The combination of epilepsy with asthma presents clinical difficulties since hypoxia due to an asthma attack can cause 'fitting' that can be diagnosed as epilepsy.

In Case 2 the cause of death was an anaesthetic complication in a woman with a history of asthma. In Case 3 the relationship between placental abruption and subclavian artery thrombosis is obscure. The final two unexplained deaths remain a complete mystery. In Case 4 the expected evidence of air embolism was not evident at autopsy. Likewise in Case 5 the clinical diagnosis of amniotic fluid embolism was not supported by histological examination of the lungs. 'Unexplained' is an unsatisfactory label for a maternal death. However, there have been several cases in every triennium, including 1991–93, where the various State subcommittees have expressed reservations concerning the final designation of cause of death. It is better for a death to remain presently unexplained than to be coded without proper clinopathological evidence.

APPENDIX

THE EXPERT COMMITTEES

The composition and titles of the State and Territory Maternal Mortality Committees are as follows:

New South Wales Maternal and Perinatal Committee

Professor R P Shearman
(Chairman)
Dr J Arnold
Dr D Barclay
Professor M J Bennett
Dr A Child
Dr H Chilton
Dr C de Costa
Dr C Fisher
Professor I S Fraser
(to November 1992)
Dr M Frommer
Professor D Henderson Smart
Ms P Mulholland
Dr E Murphy
Professor P Russell
Dr B Spurrett
Professor B Trudinger
Professor W A W Walters

Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity Maternal Mortality Subcommittee

Professor N A Beischer
(Chairman)
Dr C N De Garis
to December 1991)
Dr D W Fortune
Dr D G Johnson
Dr W H Kitchen
(from January 1992)
Professor R J Pepperell
Dr P M Renou
Mr I C Ross

Queensland Committee for the Maternal Mortality Subcommittee

Dr I Thomas
(Chairman)
Professor E Mackay
(Obstetrician)
Dr R Hemsley
(Obstetrician)
Dr J King
(Obstetrician)
Ms M Barton
(Midwife)
Dr K Forbes
(Obstetrician)
Dr J Bell
(Pathologist)
Dr A Jones
(General Practitioner)
Dr E Hewett
(Anaesthetist)
Dr V O'Hara
(Acting Secretary)
Dr K Murphy
(Secretary)

South Australian Maternal, Perinatal and Infant Mortality Committee Maternal Subcommittee

1991-1992

Professor W R Jones
(Chairperson)
Ms L Barber
Dr J Biggins
Dr H M Chambers
Professor J Robinson
Dr B Wheatley
Dr A Chan *(Medical Secretary)*

1993

Professor J Robinson
(Chairperson)
Ms L Barber
Dr J Biggins
Dr H M Chambers
Associate Professor A MacLennan
Dr B Wheatley
Dr A Chan
(Medical Secretary)

**Maternal Mortality Committee
of Western Australia**

Professor C A Michael
Dr G Lilburne
(January 1990 to January 1994)
Dr J M Henzell
(January 1990 to January 1993)
Dr J A Cumming
(January 1993 to January 1996)
Dr J Chambers
(Deputy Member)

January 1990 to January 1993

Dr M L Kailis
(Provisional Member)
Dr P D Higgins
(Provisional Member)
Mrs J A E Cairns
(Provisional Member)
Dr J R Akers
(Deputy Provisional Member)
Ms C Burgess
(Deputy Provisional Member)

January 1991 to January 1994

Dr M D Jones
(Provisional Member)
Dr D Mildenhall
(Provisional Member)
Ms K Oldfield
(Provisional Member)
Dr G R Melvin
(Deputy Provisional Member)
Dr R Kirk
(Deputy Provisional Member)
Ms Y Strawbridge
(Deputy Provisional Member)

January 1993 to January 1994

Ms Y Strawbridge
(Provisional Member)
Mrs M Baird
(Deputy Provisional Member)

January 1993 to January 1996

Mrs J A E Burgess
(Provisional Member)
Mrs C Watson
(Deputy Provisional Member)

**Tasmanian Maternal Mortality
Committee**

This Committee did not meet during the 1991–1993 triennium although there was one maternal death reported.

Northern Territory Maternal and Child Health Committee

1991

Dr A Plant
Dr I Humphrey
Dr C Connors
Dr P Wilson
Dr J Erlich
Dr T Weeramanthri
Dr D Rowling
Dr G Durling
Sr D Williams
Dr B Young
Dr M Punitham
Dr F Quadros
Dr T T Lee

1992

Dr M Dunjey
Dr J Condon
Dr Vino
Dr C Connors
Dr A Ruben
Dr R Anderson
Dr J Erlich
Dr A Bell
Sr J Taylor
Mr J McComb
Ms H Boulden
Ms C Croft
Ms L McDonald
Ms C Rae
Dr T Weeramanthri
Dr J Edgar
Dr I Humphrey
Dr P Wilson
Mrs M Struthers
Dr C Clohesy
Dr S Girle

1993

Dr M Dunjey
Dr Vino
Dr C Connors
Dr A Ruben
Dr R Anderson
Dr D Ashbridge
Dr M Gilles
Dr D Devanesan
Dr J Wakerman
Dr J Erlich
Dr A Bell
Sr D Williams
Ms M Sheridan
Dr M Pearson
Dr D Davies
Dr F Pisconeri
Ms H Boulden
Ms C Croft
Sr J Taylor
Ms C Rae
Dr T Weeramanthri
Dr J Edgar
Dr I Humphrey
Dr P Wilson
Mrs M Struthers
Dr C Clohesy
Dr S Girle
Ms K Hayes

Australian Capital Territory Maternal, Perinatal, Infant Mortality and Morbidity Committee

This Committee did not meet during the 1991–93 triennium although there was one maternal death reported.

DATA COLLECTION

State committees collect maternal deaths data through a variety of formal and informal channels. Sources of data include direct information from hospitals; postmortem and coroners' reports; midwives' reports; medical practitioners' reports; clinical case notes; newspaper reports; and 'through the grapevine'.

Each State has a slightly different data collection methodology.

In New South Wales the Director General of Health has instructed all hospitals to notify maternal deaths. Information is also obtained from the register of births, deaths and marriages via the Australian Bureau of Statistics and there is an arrangement with the coroner's office to provide reports for all maternal deaths.

The Northern Territory information regarding maternal deaths comes from the Midwives' Collection, monthly medical superintendent reports and the coroner's office. Hospital morbidity data are also checked.

In South Australia, hospitals provide data through the completion of incident report forms. The coroner's office asks doctors to inform them of maternal deaths and midwives must complete a supplementary birth record data form for all births that are >20 weeks' gestation or birth-weight >400g. Other data sources include pathologists and the attending practitioner.

In Queensland all deaths, including maternal deaths, are reported via the Registrar General's office to the Australian Bureau of Statistics, where deaths are coded according to the International Classification of Diseases (ICD9). A quarterly report is provided via the Queensland Government Statistician's office to the Council Secretariat. In addition, Coroner's autopsy reports of maternal deaths are received from the state centre for forensic pathology. Information about maternal deaths is also received by informal mechanisms.

Victoria has no organised system with hospitals to provide maternal deaths data. A variety of sources are used including death certificates from the registrar of births, deaths and marriages; midwives' reports; and newspaper reports. Case histories are built up from postmortem reports, police reports and confidential medical reports.

In Western Australia there is no organised system with hospitals. Sources include notification by the attending practitioner and death certificates. Case histories are gathered from hospital and attending medical practitioner clinical case notes and by coronial and postmortem reports.

The small populations of Tasmania and the Australian Capital Territory ensure that detailed information is easily retrieved from hospitals, the coroner's office and attending practitioners.

THE NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

The National Health and Medical Research Council (NHMRC) is a statutory authority within the portfolio of the Commonwealth Minister for Health and Family Services, established by the *National Health and Medical Research Council Act 1992*. The NHMRC advised the Australian community and Commonwealth, State and Territory Governments on standards of individual and public health, and supports research to improve those standards.

The NHMRC advises the Commonwealth Government on the funding of medical and public health research and training in Australia and supports many of the medical advances made by Australians.

The Council comprises nominees of Commonwealth, State and Territory health authorities, professional and scientific colleges and associations, unions, universities, business, consumer groups, welfare organisations, conservation groups and the Aboriginal and Torres Strait Islander Commission.

The Council meets four times a year to consider and make decisions on reports prepared by committees and working parties following wide consultation on the issue under consideration.

The Council publishes extensively in the following areas:

- Child health • Clinical practice • Communicable diseases • Dentistry
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