Seventh Report of The Victorian Consultative Council on Anaesthetic Mortality and Morbidity

Cases Reported During 1993-96

Edited by:
Patricia Mackay M.B.Ch.B., F.A.N.Z.C.A., F.R.C.A.
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Consultative Council on Anaesthetic Mortality and Morbidity
5/555 Collins Street, Melbourne, Australia 3000
Telephone: 9616 8817 Facsimile 9616 8300
Contents

Introduction 1
Terms of Reference of the Council 1

Membership of the Council 2

Operation of the Council 3
Confidentiality 3
Data Collection 3
Validity of Data 4
Uniformity of Coronial Legislation 4
National Survey on Anaesthetic Mortality 5
Relationship with Specialist Organisations 5
Output of the Council 5
Terminology 6
Anaesthetic Mortality 6
Anaesthetic Morbidity 6
Critical Incident 6

Reports of Mortality and Morbidity 7
Classification of Cases Reported to the Council 7

Mortality 8
Total Deaths Reviewed 8
Autopsy Rate 8
Causes of Death 9

Anaesthetic Related Deaths 10
Causal or Contributory Factors 10
Age Distribution of Cases of Mortality 10
Risk Factors 11
Status of Anaesthetist 12
Location of Event 12
Type of Hospital 12
Type of Anaesthesia 13
Type of Surgery 13

Morbidity 15
Reports of Morbidity 15
Analysis of Causes of Anaesthesia Related Mortality and Morbidity

- Aspiration of Gastric Contents 16
- Pneumothorax 16
- Acute Pulmonary Oedema 17
- Pulmonary Embolism 17
- Respiratory Obstruction or Failure 18
- Drugs 19
- Drugs Related Anaphylaxis 19
- Drug Related Convulsions 19
- Specific Problems with Regional Anaesthesia 20
- Maternal Mortality 21
- Pre-Operative Assessment 22
- Iatrogenic Injuries 22
- Hypotension, Myocardial Ischaemia and Cardiac Failure 23
- Complications of Monitoring 23
- Organisational Problems 24

Conclusions 25

Recommendations 26

References 27
The Victorian Consultative Council on Anaesthetic Mortality and Morbidity was established in 1976 under Section 13 of the 1958 Health Act.

The Council operates pursuant to Section 24 of the Health Act (as amended)

**TERMS OF REFERENCE OF THE COUNCIL**

- To enquire into the circumstances of deaths and illnesses during or as a result of anaesthesia
- To take such action as is appropriate to alleviate or to prevent the occurrence of such deaths or illnesses
- To keep a register of such deaths or illnesses
- To improve the practice of anaesthesia by publication of pertinent factors discovered during the enquiry
- To report to the Minister annually upon anaesthesia generally and to make such recommendations as may seem appropriate
Membership of the Council

Chairman

A specialist anaesthetist appointed by the Minister. There have been 4 chairmen since the establishment of the Council.

1976-1981  Dr Kevin McCaul (dec)
1982-1990  Dr John Paull
1991      Dr Noel Cass (acting)
1991-present Dr Patricia Mackay

Nominated Representatives of Medical Societies

Since establishment in 1976 there have been changes in membership and the current membership comprises

The Australian Society of Anaesthetists
Dr Richard Connock (resigned 1998) Dr Anthony Weaver, Dr Patrick Hughes, Dr Alex Babarczy.

The Australian and New Zealand College of Anaesthetists
Dr David Scott, Dr Mark Langley, Dr Phillip Ragg

The Australian and New Zealand Intensive Care Society
Dr John Santamaria

Royal Australasian College of Surgeons
Mr Graham Syme

The Royal College of Pathologists of Australasia
Professor Stephen Cordner
Associate Professor David Ranson

Royal Australian College of General Practitioners
Dr Anthony McCarthy

Department of Human Services
Dr Michael Ackland

Council Staff

Executive Officer  Ms Kay Munro

Section 24 of the The Health Act 1958 which relates to the operation of Consultative Councils was revised in 1996 to provide for co-option, with approval of the Minister, of additional members from time to time where special expertise may be required. Such co-opted members are bound by the same rules of confidentiality as are Council members. Provision was also made to enable the Council to distribute other documents, such as the information bulletin, in addition to the formal reports.
Under the auspices of the Victorian Department of Human Services the Council meets monthly and discusses the cases of mortality and morbidity prepared by the Chairman. The functions of the Council are to identify avoidable causes of morbidity or mortality related to anaesthesia (in most cases multifactorial) rather than to assess individual fault, and to disseminate as widely as possible the results of deliberations and possible strategies for prevention. The principal function is a quality assurance process rather than a clinical audit.

CONFIDENTIALITY

It is emphasised that strict confidentiality is maintained at all times. The Council is very conscious of the fact that reporting of mortality and morbidity is voluntary and that the specialty of anaesthesia has a long history of participation in both audit and quality assurance activities. Victorian anaesthetists are generous in their co-operation and it is essential that their confidence is maintained by the Council having in place very strict protocols for the handling of information provided.

The Consultative Council is listed as a prescribed Council under the Health (Prescribed Consultative Council) regulations 1986 and the provisions of the Health Act 1958 (amended 1995). Sections 24 and 24A prohibit any disclosure of information which would lead to the identification of a person from whom or in relation to whom the information was obtained. Thus no personal information of any kind may be released by any present or past member of Council to any authority under any circumstances unless authorised by both the Minister for Health and the reporting doctor.

The Council believes that the processes in place for maintenance of confidentiality are secure. No breaches of confidentiality have been reported to the Council or been the subject of any complaint. All members of the Council are convinced that proper evaluation of all factors leading to death or morbidity can only be completed if there is the possibility of direct communication between the Chairman and the doctor concerned.

DATA COLLECTION

In Victoria direct reporting to the Council of mortality and morbidity related to anaesthesia is voluntary. Information is obtained by the Chairman from direct reports by anaesthetists and other medical practitioners. Some hospital quality assurance committees also provide information and a system is in place whereby the identity of patient and hospital is codified and the Chairman can contact the quality assurance co-ordinator if further information is required. The Chairman also has access to the Coroner’s files which are public documents and the Council uses these files to gather further information, as necessary, from direct discussions with the anaesthetist or surgeon or by reviewing appropriate sections of the hospital record and by obtaining autopsy reports. It is emphasised that while the Council is advantaged by the cooperation of the State Coroner’s Office, the Coroner does not have access to reports received by the Council or to the views of the Council.
After complete de-identification, the cases are presented to Council for discussion and classification. In the case of direct referrals the opinions of the Council are then conveyed to the medical practitioner concerned. Minutes of meetings are retained and all relevant data are entered into a secure and dedicated computer programme. There is no information in the computer database that identifies patient, doctor or hospital. Information is then analysed for major reports, information bulletins, teaching and responses to requests from medical practitioners. The process is slow but secure lines of communication must be maintained and the Council has a policy of avoiding publication of data on cases not finalised by the Coroner. This may mean a two year delay.

VALIDITY OF DATA
The level of voluntary reporting has increased since the previous report. The Council believes that information from voluntary reports and the obligatory reports to the Coroner along with follow-up with anaesthetists provides sufficient information to draw some reasonable conclusions and justify certain recommendations. However the total number of cases reported to Council do not completely reflect the true picture of mortality and morbidity in Victoria. In Western Australia, where mandatory reporting to Council is legislated, in the triennium 1994-96 the number of deaths classified per million of population was 238. This contrasts with a rate of 53 per million in Victoria and 145 per million for New South Wales. Thus, while the Council believes that it has assessed most cases of anaesthetic related mortality, there has to be concern about the reliability of the reporting system.

At present there is no information available to Council on total numbers of anaesthetics given in Victoria, and consequently no accurate mortality rate can be provided. In contrast, the Consultative Council on Obstetric and Paediatric Mortality and Morbidity, as a result of having an accurate denominator and mandatory reporting, has been able to report on data which provide international benchmarks on infant and maternal mortality rates. Unfortunately anaesthetic mortality committees in Australia, which have been world leaders in undertaking an audit of outcomes, currently have no valid epidemiological data to support claims about what we believe is the very high level of safety of anaesthesia in Australia.

However, following representations from this Council and the Australian and New Zealand College of Anaesthetists, the National Centre for Classification in Health has revised the current Australian Coding Standard on Anaesthesia and, from July 2000, anaesthetics will be captured on the hospital inpatient database. This will represent a significant advance for proper analysis of data.

UNIFORMITY OF CORONIAL LEGISLATION
The present Victorian legislation for reporting deaths associated with anaesthesia is confusing and less satisfactory than in all other Australian States. Many doctors are unsure when death associated with anaesthetic-related procedures should be reported. Junior staff are frequently left to report cases and to complete the Coronial deposition and as a result the amount of information provided to the Coroners is substandard.

This Council believes that for deaths associated with anaesthesia both anaesthetist and surgeon (or proceduralist) should be required to provide information to the Coroner. In addition the definition of an anaesthetic for the purpose of reporting to the Coroner should be expanded to identify the changing role of anaesthetists in providing regional
and general anaesthesia, sedation, resuscitation and pain management. Moreover, provision of anaesthesia is no longer restricted to operative surgery but is involved in an ever expanding range of complex interventional procedures performed outside the operating theatre. These circumstances must be included in any audit of mortality or morbidity.

NATIONAL SURVEY ON ANAESTHETIC MORTALITY

Under the sponsorship of the Australian and New Zealand College of Anaesthetists, the Chairman of the State Consultative Councils have been appointed to the Mortality Committee of the College and have pooled the available data from all states to provide a national report. The first report covered the years 1991-93 and the 1994-6 report has just been released. This most recent report reviews the 135 deaths attributable partly or wholly to anaesthesia and, based on an approximate figure on the numbers of anaesthetics administered in Australia each year, assesses the mortality rate in the order of one death per 65,000 procedures. In Victoria, based on the same calculation, the rate for 1993-96 is one death per 62,000 procedures. In considering anaesthetic mortality in healthy patients or those with minor disability only, the rate is calculated as one death per estimated two million procedures, which compares very favourably with all other published figures.

RELATIONSHIP WITH SPECIALIST ORGANISATIONS

The Council receives strong support from both the Australia and New Zealand College of Anaesthetists (ANZCA) and the Australian Society of Anaesthetists. The Chairman attends meetings of the Victorian Regional Committee of the ANZCA which provides assistance in publicising the activities of the Council and also is invaluable in facilitating distribution of the Information Bulletins issued by the Council. The ANZCA also provides the very considerable support for the National Mortality Committee, chaired by the President, and comprising the chairmen of the State Councils. A new initiative in 1999 has been the extension of the Maintenance of Professional Standards Programme of the ANZCA to recognise that a report to Consultative Councils which is of sufficient detail merits qualification for 3 points. In Victoria, to avoid compromising confidentiality, the Chairman provides the anaesthetist concerned confirmation of eligibility for points in a separate letter from the response to the report.

OUTPUT OF THE COUNCIL

• The major reports of the Council have a wide distribution, not only to anaesthetists, but to all medical practitioners in Victoria as well as to hospital administrators, learned colleges and other health care personnel. They are now published on the internet at http://www.dhs.vic.gov.au/phd/hce/epid/anae/6th_rep/index.htm

• Regular information bulletins are also issued one or two times per year to all Victorian anaesthetists to impart information the Council perceives as needing rapid promulgation, particularly in relation to new techniques, equipment or drugs. Prior to 1998 these were sent to specialist anaesthetists only but the circulation now also includes rural general practitioner anaesthetists. These bulletins have been well received and have succeeded in highlighting a number of new problems.
• The Chairman represents the Council at monthly meetings of the Victorian Regional Committee of the ANZCA and raises issues of concern which are published in the regular newsletters of the Regional Committee, sent to all Victorian Fellows of the College and also publicised in the national bulletins of the ANZCA.

• The Chairman is the Victorian representative on the Mortality Committee of the ANZCA and provides the Victorian data for the National Mortality Report as well as participating in meetings and discussions on major issues and future strategies in relation to anaesthetic mortality.

• With the introduction of a sophisticated computer programme the Chairman and members of Council can now respond rapidly to specific enquiries from medical practitioners and contribute to teaching and discussions at medical meetings both in the city and, in particular, in rural centres.

On this occasion a report covering the years 1993-96 is produced but henceforth, to retain consistency with the National Report on Anaesthetic Mortality sponsored by the ANZCA, it is proposed that there should be triennial reports and that the regular bulletins with more recent information continue to be distributed.

TERMINOLOGY
While there is lack of uniformity in the definition of anaesthesia, this Council is of the opinion that modern anaesthesia encompasses the use of a sedative, analgesic, local or general anaesthetic drug or any combination of these. Thus the Council has considered a number of events relating to peri-operative care (e.g. acute pain management)

ANAESTHETIC MORTALITY
Death in association with anaesthesia refers to any death occurring during or within 24 hours of the completion of a procedure performed in association with some form of anaesthesia or those deaths that have occurred as a result of an anaesthetic or procedural incident even if more than 24 hours have elapsed.
Death attributable to anaesthesia refers to deaths which were caused by the anaesthetic agent, technique or management and in addition includes cases in which some doubt exists about the role of anaesthesia and the contributory factors of the surgery and the condition of the patient. (See Table 1)

ANAESTHETIC MORBIDITY
Morbidity is defined as any event related to an anaesthetic procedure which causes a life-threatening incident, temporary or permanent disability or significant distress. Morbidity was categorised as major or minor according to outcome.

CRITICAL INCIDENT
A critical incident is identified as any incident which did, or could if not detected in time, affect patient safety. The Council does not specifically collect critical incidents although inevitably some such incidents are reported and these are included although it is recommended that these be directed to the Australian Incident Monitoring Study (AIMS)
REPORTS OF MORTALITY AND MORBIDITY
495 cases comprising 360 deaths and 135 cases of significant morbidity were reviewed.

CLASSIFICATION OF CASES REPORTED TO THE COUNCIL
All cases were classified according to the criteria as agreed by the National Working Party on Anaesthetic Mortality convened by the ANZCA. The same classification (with two additional items) was used for morbidity which is only studied in Victoria. (Table 1)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reasonable certainty that death or morbidity was entirely caused by the anaesthetic agent or technique of administration or in other ways coming directly within the province of the anaesthetist</td>
</tr>
<tr>
<td>2</td>
<td>As for category 1 except for some element of doubt whether the death or morbidity was entirely caused by the anaesthetic agent or technique</td>
</tr>
<tr>
<td>3</td>
<td>Death or morbidity contributed to by both the anaesthetic and surgical procedures</td>
</tr>
<tr>
<td>4</td>
<td>Death or morbidity entirely related to surgical procedures or complications</td>
</tr>
<tr>
<td>5</td>
<td>Inevitable deaths in which anaesthetic and surgical techniques were apparently satisfactory but the risk of death was extremely high</td>
</tr>
<tr>
<td>6</td>
<td>Deaths classifiable as fortuitous when the cause could not have reasonably been expected and was not related to the indication for surgery and was not due to factors under the control of the anaesthetist or surgeon</td>
</tr>
<tr>
<td>7</td>
<td>Deaths which could not be assessed despite considerable data</td>
</tr>
<tr>
<td>8</td>
<td>Deaths which could not be assessed on account of inadequacy of data</td>
</tr>
<tr>
<td>9</td>
<td>A critical incident where a problem is identified but no morbidity occurs</td>
</tr>
<tr>
<td>10</td>
<td>Morbidity in which anaesthesia and surgical techniques were apparently satisfactory</td>
</tr>
</tbody>
</table>

A coding “G” has been introduced to identify those deaths which have been considered wholly or partly due to anaesthesia but where no correctable factor could be identified and the Council could not suggest any alternative technique.

Subcategories relating to causal or contributory factors were also considered. In addition there was identification of all problems by use of keywords to enable cross references for reports and for special enquiries.
TOTAL DEATHS REVIEWED

360 deaths were reviewed and the number of deaths reviewed each year of the four year period was similar (Table 2).

43 of the 360 deaths were identified as being in categories 1,2,3. (wholly or partly related to anaesthesia).

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6-8</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>17</td>
<td>66</td>
<td>6</td>
<td>98</td>
</tr>
<tr>
<td>1994</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>13</td>
<td>56</td>
<td>5</td>
<td>89</td>
</tr>
<tr>
<td>1995</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>19</td>
<td>53</td>
<td>6</td>
<td>85</td>
</tr>
<tr>
<td>1996</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>16</td>
<td>55</td>
<td>5</td>
<td>88</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>13</td>
<td>11</td>
<td>65</td>
<td>230</td>
<td>22</td>
<td>360</td>
</tr>
</tbody>
</table>

AUTOPSY RATE

Of the 360 cases reviewed, autopsies were recorded in 67(19%) and in the 43 anaesthesia related deaths there were 11 autopsies (26%) These figures may not be completely accurate as some hospital autopsies may not have been notified. However the low autopsy rate is a matter for serious community concern as information about the cause of death and the factors contributing to death may be suspect without the information from an autopsy.
# CAUSES OF DEATH

17 primary causes of death were identified in the 360 cases classified by the Council.

## TABLE 3 Causes of death according to classification

<table>
<thead>
<tr>
<th>Primary Cause</th>
<th>Category 1&amp;2 Anaesthetic Related</th>
<th>Category 3 Both Anaesthetic &amp; Surgical</th>
<th>Category 4 Surgically Related</th>
<th>Category 5 Inevitable</th>
<th>Category 6 Fortuitous</th>
<th>Category 7&amp;8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaphylaxis</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspiration</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cardiac Failure</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>68</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CVA</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Drug Overdose</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dysrhythmia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Embolism</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>1</td>
<td>3</td>
<td>33</td>
<td>120</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hypotension</td>
<td>8</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypoxia</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial Infarct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Neurological</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Failure</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Respiratory Obstruction</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septicaemia</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>32</strong></td>
<td><strong>11</strong></td>
<td><strong>65</strong></td>
<td><strong>230</strong></td>
<td><strong>7</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
CAUSAL OR CONTRIBUTORY FACTORS

Deaths attributable to anaesthesia are almost always the result of more than one adverse factor. In this analysis 14 contributory factors were identified in the 43 cases of anaesthetic related mortality, representing an average of 2.65 per case.

Six cases were classified as G where no alternative or better technique could be suggested by the Council.

TABLE 4 Causal or contributory factors in the 43 cases of anaesthetic-related mortality

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inadequate pre-operative assessment or management</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Equipment malfunction</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Problems related to drugs (choice, dosage, adverse reaction)</td>
<td>114</td>
</tr>
<tr>
<td>4</td>
<td>Problems related to anaesthetic techniques used (technique, ventilation, airway management)</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>Other factors including medical condition</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>Organisational factors including inadequate communication, supervision, planning</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Inadequate post-operative care</td>
<td>5</td>
</tr>
</tbody>
</table>

AGE DISTRIBUTION OF CASES OF MORTALITY

All cases were classified according to age in decades. In categories 1, 2 and 3, where anaesthesia could be implicated, 36 of the 43 cases (84%) were over the age of 60 and 13 of these were over the age of 80 (Table 5).

TABLE 5 Age in decades by category

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6-8</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>1.60</td>
</tr>
<tr>
<td>10-19</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0.55</td>
</tr>
<tr>
<td>20-29</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1.38</td>
</tr>
<tr>
<td>30-39</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>2.50</td>
</tr>
<tr>
<td>40-49</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4.16</td>
</tr>
<tr>
<td>50-59</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>21</td>
<td>1</td>
<td>7.77</td>
</tr>
<tr>
<td>60-69</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>16</td>
<td>63</td>
<td>3</td>
<td>25.83</td>
</tr>
<tr>
<td>70-79</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>22</td>
<td>79</td>
<td>9</td>
<td>33.33</td>
</tr>
<tr>
<td>80-89</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>48</td>
<td>5</td>
<td>19.44</td>
</tr>
<tr>
<td>90-100</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>3.33</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>13</td>
<td>11</td>
<td>65</td>
<td>230</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>
RISK FACTORS

Level of risk was assigned according to the 5 point physical status classification of the American Society of Anaesthesiologists (ASA) (Table 6)

TABLE 6 ASA classification of risk

<table>
<thead>
<tr>
<th>ASA</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A normal healthy patient</td>
</tr>
<tr>
<td>2</td>
<td>A patient with mild systemic disease</td>
</tr>
<tr>
<td>3</td>
<td>A patient with severe systemic disease</td>
</tr>
<tr>
<td>4</td>
<td>A patient with severe systemic disease that is a constant threat to life</td>
</tr>
<tr>
<td>5</td>
<td>A moribund patient who is not expected to survive without the operation</td>
</tr>
<tr>
<td>E</td>
<td>Affixed to each grade if the patient is operated on in an emergency</td>
</tr>
</tbody>
</table>

In Council categories 1, 2 and 3 it should be noted that there was only one case classified as ASA 1 or 2 and that of the remaining 42 cases 25 had severe systemic disease with multiple risk factors and the other 17 had life threatening illness. 15 of the 43 cases (35%) were undergoing emergency procedures (Table 7)

TABLE 7 Risk in anaesthesia related deaths

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ASA 2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>ASA 3</td>
<td>12</td>
<td>7</td>
<td>6</td>
<td>25</td>
<td>58.1</td>
</tr>
<tr>
<td>ASA 4</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>15</td>
<td>34.9</td>
</tr>
<tr>
<td>ASA 5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>13</td>
<td>11</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>15</td>
<td>34.9</td>
</tr>
</tbody>
</table>
**STATUS OF ANAESTHETIST**

In classifying the status of the responsible anaesthetist, inadequate supervision of trainees was identified in 13 of the 43 cases. The level of the trainee was not always identifiable and in future reports the level of training according to ANZCA guidelines will be employed. (Table 8)

**TABLE 8** Status of the anaesthetist in anaesthesia-related deaths

<table>
<thead>
<tr>
<th>Category</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist</td>
<td>13</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Trainee (accredited)</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Trainee (non accredited)</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>1*</td>
</tr>
</tbody>
</table>

*proceduralist

**LOCATION OF EVENT**

23 of 43 (72%) deaths occurred within the precincts of the operating theatres or procedural areas. Of concern were the 6 deaths occurring in general wards suggesting a need for more facilities for high dependency post-operative care (Figure 1)

**FIGURE 1** Location of event leading to death

**TYPE OF HOSPITAL**

Death occurred in major metropolitan or regional hospitals in 31 of the 43 cases (72%). Only slight significance can be attached to these figures as these hospitals usually attract patients with the highest risk factors. (Figure 2)

**FIGURE 2** Type of hospital where the event occurred
TYPE OF ANAESTHESIA
The small numbers limit the significance that is attached to these figures but it should be noted that regional anaesthesia was involved, at least in part, in 24 of the 43 cases (55.7%). (Figure 3)

FIGURE 3 Type of anaesthesia in anaesthesia related deaths

Type of anaesthesia in anaesthesia related deaths

TYPE OF SURGERY
Fifteen categories of surgery were identified in the 360 cases and the majority of deaths occurred in cardiac, vascular and general abdominal surgery.

TABLE 9 Type of Surgery

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Number of cases</th>
<th>Operations not completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic</td>
<td>104</td>
<td>80</td>
</tr>
<tr>
<td>Cardiac Surgery</td>
<td>71</td>
<td>31</td>
</tr>
<tr>
<td>Cardiac Procedures</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Peripheral Vascular</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Thoracic Surgery</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>General Surgery</td>
<td>75</td>
<td>26</td>
</tr>
<tr>
<td>Orthopaedic</td>
<td>33</td>
<td>11</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Urology</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>ENT</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Gynaecology</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Endoscopy</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Obstetric</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Airway Intubation</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>No procedure</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Dental</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Comments on surgical procedures

1 “Intubation” involved surgical or endoscopic procedures to relieve airway obstruction.

2 “No procedure” involved one case where induction of anaesthesia in a moribund patient was commenced but death occurred before any procedure could be performed and a second where the surgical unit cancelled the operation after induction of anaesthesia following a mistaken diagnosis of ruptured abdominal aortic aneurysm.

3 In the case of aortic surgery during this period, it was noted that in a very high proportion (77%) of emergency cases the operation for ruptured aortic aneurysm was not completed. In a significant number of these cases the patient had suffered severe prolonged hypotension or asystole prior to admission to hospital and the Council did question the indications for operation and the use of massive resources in view of the predictably inevitable outcome.

4 Most of the operative deaths associated with cardiac surgery occurred when patients failed to be weaned from bypass and a significant proportion of these were repeat procedures or where valve replacement was also performed.

5 Five of the orthopaedic procedures where intraoperative death occurred involved joint replacement surgery and the use of methyl methacrylate.

6 Deaths following endoscopy are not referred to this Council unless an anaesthetist has been involved in the anaesthesia or the resuscitation. The Council believes this may not be a true reflection of the number of fatalities associated with endoscopy under intravenous sedation.

7 The one obstetric death will be discussed further.
REPORTS OF MORBIDITY

A total of 135 cases of morbidity was considered. Of these, 104 were classified as being related to anaesthesia. There were 92 cases of major morbidity, 34 of minor morbidity and 4 critical incidents. (Table 10)

TABLE 10 Causes of morbidity

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>Number of Reports</th>
<th>Categories 1, 2, 3 Anaesthesia related</th>
<th>Categories 4-8 Not anaesthesia related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaphylaxis</td>
<td>9</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Aspiration</td>
<td>18</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Blood Transfusion</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Cardiac Failure</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cardiorespiratory</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Convulsion</td>
<td>10</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dysrhythmia</td>
<td>15</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Embolism</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Equipment</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hyperpyrexia</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Hypotension</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Hypoxia</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Intubation</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Myocardial Infarct</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Neurological</td>
<td>14</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonary Oedema</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Respiratory Depression</td>
<td>12</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Respiratory Obstruction</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Reversal of Relaxant</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Shock</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Trauma</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Vascular Complication</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>135</strong></td>
<td><strong>104</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>
Analysis of Causes of Anaesthesia Related Mortality and Morbidity

ASPIRATION OF GASTRIC CONTENTS

Mortality (5 cases)
Aspiration occurred following induction in two patients with acute intestinal obstruction. All appropriate preventive anaesthetic measures had been taken but a nasogastric tube had not been employed pre-operatively. Gastric aspiration occurred in one patient undergoing a rigid bronchoscopy but bleeding from a lung malignancy also contributed to the fatal hypoxia.

There were two potentially preventable deaths: one involved the use of inadequate airway protection associated with a laryngeal mask airway in an orthopaedic patient who had been fasted for over 24 hours following a fracture of the femur. The second involved the use of a small dose of a non-depolarising relaxant prior to rapid sequence induction in a patient with known reflux and a history of previous aspiration. Both these patients had significant co-morbidities.

Morbidity (18 cases)
Morbidity as a result of aspiration occurred in four emergency and fourteen elective procedures. 14 of the patients were classified as ASA 1,2,3. Specialist anaesthetists were involved in 10 cases and trainees in 8.

The use of a laryngeal mask airway was associated with three cases, one during insertion and two when anaesthesia became light during maintenance. All three had asthma or obesity and this type of airway maintenance was probably inappropriate.

Unplanned admission to ICU for one to three days occurred in six cases and two day-stay patients required admission to hospital for one and five days respectively.

PNEUMOTHORAX

There was one anaesthesia-related death in an asthmatic patient as a result of pneumothorax following severe bronchospasm and the use of high inflation pressures. The complication was not recognised early and irreversible hypoxic damage ensued.

One surgical death resulted from a pneumothorax developing intra-operatively following the insertion of a stent during oesophagoscopy in a patient with malignant disease. This patient had multiple risk factors.

Anaesthetic related pneumothorax occurred in one case following intercostal blocks. One surgical case of capnothorax occurred during a laparoscopic cholecystectomy highlighting the need for careful monitoring and prompt management by the anaesthetist. This complication, although rare, may be associated with subcutaneous or mediastinal emphysema and may result from surgical trauma or perforation of gas through a congenital diaphragmatic defect. One anaesthetic report of considerable
significance concerned the use of high inflation pressures during bronchospasm as a result of an anaphylactic reaction to suxamethonium. Despite all appropriate measures to treat the anaphylaxis the patient did not respond and cardiac arrest occurred. After prolonged efforts it was decided to abandon resuscitation. Ventilation was ceased although the monitors remained on while the anaesthetist reviewed the trends on the monitor record prior to writing a deposition. Some minutes later an ECG wave form appeared and an oxygen saturation was registered. Resuscitation was immediately resumed and the patient recovered. This problem of dynamic hyperinflation of the lungs causing severe interference with venous return and even compression of the right ventricle is well recognised in the intensive care setting. Treatment of this problem is by a short inspiration phase, six to eight seconds, to maintain hypercapnia to much higher than normal levels. It is important that the risk of dynamic hyperinflation be recognised as in the next triennium (1997-99) the Council has received a number of reports where hyperinflation has been implicated as a cause of acute fall in cardiac output.

**ACUTE PULMONARY OEDEMA**

In the two deaths in which pulmonary oedema occurred the patients were known to have severe cardiac disease. General anaesthesia was administered by trainees who underestimated the severity of the cardiac dysfunction and inappropriate doses of anaesthetic agents were employed. In the morbidity group, circulatory overload by excess intravenous fluids was identified in three. Of particular interest were the first reports of negative pressure pulmonary oedema, usually associated with extubation and respiratory obstruction and occurring in young ASA1 patients undergoing relatively minor surgery. Three such reports are included in this period but in the next triennium many more cases have been reported. It is considered that the syndrome may be related to rapid emergence associated with the newer short-acting anaesthetic agents and muscle relaxants in patients with good respiratory musculature and active laryngeal reflexes. It almost always results in unplanned admission to an intensive care or high dependency unit.

**PULMONARY EMBOLISM**

Fourteen deaths occurred as a result of pulmonary embolism and two were related to peripheral vascular embolism occurring during surgery. One death was related to anaesthetic technique which resulted in air being introduced under pressure into the central venous system through a pressure infusion during elective repair of an abdominal aortic aneurysm. The patient had many risk factors and was classified as ASA4. This complication resulted in a period of hypotension which was appropriately managed, the operation completed and the patient returned to ICU. He subsequently died from sepsis and multi organ failure two weeks later and it was considered that the episode did in part contribute to his death. It is of note that of the five cases related to surgery, all were associated with joint replacement and related to reaming of the femoral shaft and insertion of methyl methacrylate. Two were in elective replacements and three in cases with recent fractures of the neck of femur. All cases were over the age of 70 and suffered from cardiac and
other multiple risk factors. It is believed that the fat or marrow embolism associated with the reaming of the femoral shaft and the insertion of the methyl methacrylate results in a sudden increase in right ventricular load and myocardial depression which these elderly patients are unable to tolerate. In patients with a fractured neck of femur there may also be some pre-existing fat embolism as a result of the fracture.

Two cases of morbidity as a result of air embolism were reported, one classified as surgical as a result of open venous sinuses during hepatic resection and the other as a result of error in preparation of an intravenous pressure infusion pump with the air not properly flushed out.

**RESPIRATORY OBSTRUCTION OR FAILURE**

Respiratory obstruction was responsible for two deaths, one following intravenous anaesthesia by a non anaesthetist in a patient with a malignant obstruction and the other as a result of intubation difficulty in a patient with acute epiglottitis. Respiratory depression and hypoxia along with lack of supervision of a trainee and inadequate assistance in an imaging department resulted in the death of a patient with pulmonary hypertension.

There were three fatalities as a result of respiratory failure, probably from oversedation with midazolam and fentanyl in very sick patients. Disconnection at the common gas outlet combined with failure of an oximeter and poor setting of ventilator alarms contributed to the death of an unstable cardiac patient following bypass. A dislodgement or obstruction of an endotracheal tube in a prone patient resulted in severe hypoxia with permanent cerebral damage. Inappropriate monitoring systems were a contributory factor. Failure to intubate was reported in one obstetric patient but the emergency caesarean section was successfully completed with the use of a laryngeal mask airway and cricoid pressure.

Of concern are the complications associated with administration of anaesthetic agents for establishment of an airway by personnel engaged in emergency resuscitation who may have had little training in anaesthesia or knowledge of the associated problems in certain hazardous situations. Such reports do not normally come to this Council when no anaesthetist has been involved and the incidence is unknown but it was noted in the National Report on Anaesthesia Related Mortality 1991-1993 that there was a disproportionately high number of deaths when anaesthesia was administered as an adjunct to resuscitation.
DRUGS

Drugs were judged to be a major contributory factor in 14 deaths and 41 cases of morbidity.

Eight deaths were as a result of inappropriate use of intravenous sedative and narcotic agents, usually in frail elderly patients in whom the very low tolerance for such drugs was not appreciated. Overdose and possible intravascular injection of local anaesthetic agents resulted in two deaths. In the remaining cases overdose of halothane and enflurane were implicated. Inappropriate choice or dosage of a relaxant agent resulted in hyperkalaemia following suxamethonium in a patient with neurological disease and in pneumothorax following hyperinflation in an inadequately relaxed asthmatic patient.

The important causes of drug related morbidity were errors resulting in overdose of narcotic agents in post-operative pain management, oversedation, allergic reactions to muscle relaxants, overdose of local anaesthetic drugs and side effects of volatile anaesthetic agents. It is noteworthy that only one case of hepatitis was reported, in association with the use of enflurane following two previous anaesthetics with halothane. There were three reports of malignant hyperpyrexia. All were severe reactions and occurred in young patients undergoing minor operations. This disorder is very rare but is a life threatening crisis. It is a credit to the anaesthetists and the anaesthetic training programme that the protocols for management of this unexpected and demanding complication were able to be instituted rapidly both in the public and private hospitals concerned and all three patients survived.

DRUG-RELATED ANAPHYLAXIS

There was one death, classified as inevitable, where the patient with many other risk factors developed anaphylaxis to Haemaccel. It is noteworthy that there were two deaths and three non fatal cases classified as surgical related to intra-operative administration of the intravenous antibiotics, penicillin and vancomycin. There are further such reports in the next triennium. It is usually the anaesthetist who is required to administer the drug and to treat the complication and it appears that treatment is less likely to be successful than in cases of allergy to anaesthetic drugs. Prudent practice dictates that, following a test dose, the antibiotic is administered very slowly, either prior to induction of anaesthesia or when the patient is stable following intubation.

The three non fatal reactions to drugs employed by anaesthetists followed administration of suxamethonium, atracurium and Haemaccel.

DRUG-RELATED CONVULSIONS

There were eight reports of seizures occurring after general anaesthesia, all following the use of propofol as an induction agent. In two, major clonic spasms occurred immediately following induction while in the remaining six symptoms appeared in the Recovery Room or the ward; three of these had also received pethidine infusions although maximum doses of pethidine had not been delivered. One patient had poorly controlled epilepsy and both propofol and enflurane had been used as well as naloxone; she required 24 hours care in a high dependency unit. No other cause was found for the remaining cases although only two were fully investigated.
World opinion on the association of propofol and abnormal CNS events is conflicting. Propofol is recognised as an anticonvulsant, yet the literature also records many cases of unexplained seizure activity from grand mal to opisthotonos and myoclonic movements in the peri-operative phase in association with the use of propofol. Whilst in many reports cause of the abnormal CNS states was ascribed to the concomitant administration of pethidine, in Australia in the years 1996-98 the Adverse Drug Reactions Advisory Committee (ADRAC) received 31 adverse reports in which propofol was the sole agent. The mechanism for these reactions is not clear but may be due to a differential effect at cortical and subcortical levels resulting in increased excitatory activity.7,8 This Council would welcome any further reports of morbidity associated with propofol and recommends that all adverse reactions to drugs are also reported to ADRAC.

**SPECIFIC PROBLEMS WITH REGIONAL ANAESTHESIA**

In 24 of the 43 deaths (55.8%) regional anaesthesia had been employed as the sole anaesthetic or in combination with a general anaesthetic. All the patients were ASA3 or 4. It is not possible to make conclusions regarding the relative safety of general versus regional anaesthesia from this small sample. In addition, the physical condition of the patient may have influenced the choice of mode of anaesthesia.

There were no identifiable problems with the technical aspects of regional procedures. The most common cause of problems was hypotension in elderly patients - either acutely following institution of a neuraxial block or sustained for a long period often in conjunction with a general anaesthetic. Contributory factors were low cardiac reserve, hypovolaemia and acute blood loss. In three fatal cases there was a sudden fall in blood pressure followed by asystole, all in patients over 85. Two deaths associated with convulsions were considered to result from overdose of bupivacaine in a caudal epidural block in a 95 year old patient and intravascular lignocaine 1% in a supraclavicular brachial plexus block in a patient with severe cardiac disease.

There were 18 cases of morbidity associated with regional anaesthesia. Again, hypotension was an important factor and was the first sign of difficulty in 11 cases. Consequences included pulmonary aspiration, myocardial infarction and prolonged recovery from surgery. The Council feels that it is important to recognise that chronically hypertensive or elderly patients often tolerate even mild hypotension poorly and certainly have a greatly diminished capacity to recover should an additional insult occur.

Neurological complications are likely to be under reported and there were only seven such reports in association with anaesthesia or post-operative pain relief in this period. Of these, five cases had a high probability of a significant association with the regional anaesthetic. The seven cases are summarised as follows:
• Paraplegia following a prolonged abdomino-perineal resection of the rectum. Neurological opinion was that it was due to interference of the spinal cord blood supply associated with a difficult sacral dissection.

• Delayed diagnosis of lower leg compartment syndrome as a result of confusion about the effectiveness of the epidural pain relief although very prolonged pelvic surgery in the lithotomy position was the likely cause.\(^9\)

• Residual motor and sensory block of the foot associated with a poorly managed epidural for pain relief that resulted in an unrecognised high block for 12 hours on the third post-operative day. No pathology was demonstrated.

• An epidural abscess following a Caesarean section. The patient had gone home but re-presented on the 8th day with pyrexia and leg weakness. Laminectomy revealed indurated fat but no pus. The patient had suffered from some minor sepsis and the relationship of the abscess to the epidural was uncertain. There was a good recovery.

• A spinal cord infarction followed a traumatic insertion of an epidural at T10 and was diagnosed by MRI. There was some minor long term leg weakness and sphincter dysfunction.

• Foot drop following a spinal for a transurethral resection of prostate. This was noted on the 2nd postoperative day but not reported to the anaesthetist until the 4th day after which urgent investigations were undertaken but no pathology reported. There has been some residual paresis.

• A cauda equina lesion following a spinal anaesthetic resulted in mild bladder and bowel dysfunction.

Following epidural pain relief in labour there were two reports of spinal headache and 1 case of lumbar pain and prolonged sensory loss in the leg. This was associated with a traumatic needle insertion and air in the paravertebral muscles was found on X-ray. There was also one case of pressure sores due to inadequate surveillance.

MATERNAL MORTALITY
From 1992-1996 there were 265,524 births and 23 cases of maternal mortality.\(^{10}\) There were no cases directly related to anaesthesia. However one death followed cardiorespiratory arrest and irreversible hypoxic brain damage in a 26 year old pre-eclamptic primipara who had an uncomplicated emergency Caesarean Section under spinal anaesthesia using bupivacaine with a small added dose of intrathecal morphine (0.2 mg), for post-operative pain relief. Cardiorespiratory arrest occurred 12 hours later after some prodromal signs of respiratory difficulty. Because of the extremely small dose of morphine employed, the Council was unable to determine the role of the drug despite an extensive literature review and consultation. Other factors considered were a possible eclamptic seizure, amniotic fluid or air embolism and the quality of surveillance in the ward. As a result, the case could not be classified.
PRE-OPERATIVE ASSESSMENT

Inadequate pre-operative assessment and/or management was identified as a major contributory factor in 16 of the anaesthesia related deaths and two of the surgical deaths. 12 of these were elective cases. Five of the deaths and four cases of significant morbidity were in day stay patients. This is of considerable concern and although pre-operative assessment clinics were relatively uncommon in this particular triennium, inadequate assessment continues in subsequent years to play a significant contributory role in mortality and morbidity. Problems identified were poor communication and organisation and the use of relatively inexperienced trainees to perform assessment which resulted in underestimation of the degree of cardiac disability, particularly in relation to aortic stenosis.

In view of the massive increase in day stay and same day admission surgery, a major issue is the provision of adequate opportunity for pre-operative evaluation and sufficient time to optimise any patient problems. The anaesthetist administering the anaesthetic must carry the responsibility for adequate assessment and preparation, irrespective of any evaluation performed by colleagues or other personnel. Thus they must be more pro-active both in encouraging properly organised pre-operative clinics and in resisting pressures to anaesthetise inadequately prepared patients.

IATROGENIC INJURIES

Iatrogenic injuries were identified in two deaths and 22 cases of anaesthesia-related morbidity. In one death, air embolism associated with an infusion device was a contributory cause and the other a result of pulmonary artery monitoring. Both patients had many risk factors.

Morbidity reports included overloading with intravenous fluids, unnoticed disconnection of an arterial line, haemothorax associated with insertion of central venous lines, air embolism from inadequate priming of IV lines, errors in narcotic and epidural infusions, a retained throat pack, a compartment syndrome associated with posture, hyperinflation, intra-arterial injection, failure to ascertain allergy, and a perforation of lung by an endobronchial tube stillette.

Of particular concern were the drug errors in preparing infusion solutions, mainly associated with pain management. Life-threatening cardiorespiratory arrest followed errors in programming pumps in two cases and in a third case by interference with the integrity of a reflux valve in a giving set by the insertion of a male port of another giving set. These errors were a result of poor communication, inexperience and failure to have adequate protocols for post-operative pain management. This report covers a period when pain management was being introduced widely, often with insufficient resources and training of ancillary staff. Unfortunately these complications continue to be reported in subsequent years even though pain management units are more formalised. It must be stressed that safe pain management entails adequate resources for equipment, introduction of strict protocols, proper training and careful surveillance by all clinical staff.
There is one report of a retained throat pack in this series and, despite the warning in the previous report (1989-92) and in information bulletins, sporadic reports continue to appear in the period 1997-99. This Council strongly emphasises the very serious risk of disastrous hypoxic brain damage and anaesthetists should insist that theatre staff ensure the same strict protocols are followed for handling throat packs as apply to the management of surgical packs.

**HYPOTENSION, MYOCARDIAL ISCHAEMIA AND CARDIAC FAILURE**

A significant number of cases of post-operative myocardial infarction and ischaemic cerebrovascular accidents were reported following periods of intra-operative hypotension. It appears that prolonged periods of even moderate hypotension must be avoided in patients with known cardiovascular disease and in those with a high likelihood of occult cardiovascular disease. Early aggressive intervention with a judicious combination of vasopressors and fluid replacement is essential to ensure that adequate perfusion pressures are maintained throughout anaesthesia at a level appropriate for the individual, taking into account the pre-operative arterial pressure. It appears that many anaesthetists are too tolerant of hypotension in this patient group and this Council believes that a more active approach is warranted, irrespective of the anaesthetic technique utilised.

The cases of primary cardiac failure had common to them inadequate and poor pre-operative assessments. There was failure to appreciate the severity of each of cardiomyopathy, aortic stenosis and pulmonary hypertension. Pre-operative echocardiography is simple, non-invasive and provides much useful information in those patients in whom pre-operative history or examination findings leave doubt about the adequacy of left ventricular function or the presence or severity of valvular heart disease. This particularly applies to aortic stenosis which may be severe and life-threatening yet causes little evidence of symptoms until late. In some instances there was inappropriate management of the airway, excessive use of volatile anaesthetic agents, and inadequate treatment of hypovolaemia or hypotension, often by junior and inexperienced anaesthetists. In two cases of unexpected mortality patients had been managed as same day admissions and both were felt by Council to have been completely unsuitable candidates.

Dysrhythmias precipitating significant physiological disturbance occurred in association with a variety of circumstances: vagal stimulation, hyperkalaemia, high spinal, use of cocaine and adrenaline, paediatric intubation using suxamethonium, intravascular injection of local anaesthetics and torsade de pointe in a previously healthy young adult.

**COMPLICATIONS OF MONITORING**

There were five reports of complications of invasive monitoring. One was haemorrhage as a result of unnoticed disconnection of a radial artery catheter, two were of haemothorax following central venous catheterisation, one was of air embolism during insertion of a central line and one case was of accidental fracture of an arterial catheter requiring surgical removal of the distal fragment.
ORGANISATIONAL PROBLEMS

MORTALITY (8 cases)

• Two cases were contributed to by the absence of senior guidance to trainees, both anaesthetic and surgical, who failed to recognise acute hypovolaemia and subsequent delays in organising blood transfusion proved fatal.

• A patient with asthma of unrecognised severity was anaesthetised in a free standing day care unit with insufficient equipment, drugs or staff to manage an acute emergency.

• Intubation under general anaesthesia of a patient with severe glottic oedema was attempted without the availability of a surgeon to perform an emergency tracheostomy when the attempt failed.

• Poor communication, inadequate assessment and an inexperienced thoracic anaesthetist were contributory factors in an ASA 4 patient with a haemothorax.

• Administration of an intravenous anaesthetic agent by a proceduralist in the absence of an anaesthetist and in a remote location to a patient with respiratory obstruction resulted in irreversible hypoxia and cardiac arrest.

• Inexperienced assistance and a junior trainee contributed to death from aspiration of a sedated patient during insertion of a spinal anaesthetic.

• A trainee with limited paediatric anaesthetic experience was unsupervised during the performance of an investigation on a child with advanced cardiac disease in a remote imaging unit.

MORBIDITY (8 cases)

• Inadequate pain management procedures in the ward occurred in 5 cases and ranged from inadequate monitoring of epidural infusions to failure to recognise surgical complications when breakthrough pain occurred, errors in infusion dosage and errors in communication between consultant and trainee. All these patients were at high risk of an adverse outcome although there was only one unplanned admission to ICU.

• Incorrect (but not incompatible) fresh blood was administered to a cardiac patient as a result of inadequate labeling procedures in the pre-bypass room where there were preparations for 2 surgical patients undergoing bypass in adjacent theatres.

• Failure to check the history resulted in morbidity in three cases with known allergy, known hyperkalaemia and known history of difficult intubation.

• A substantial intravascular injection of local anaesthetic occurred during an axillary block performed in a remote location. There was both inadequate monitoring and venous access and the equipment for management of the cardiac arrest was inaccessible.
• There was a delay in detection of a major hypoxic event, contributed to by a problem with an outmoded monitor which was not suitable for major surgery in the prone position.

• Other organisational problems related to the commencement of major surgery before booking or confirming an intensive care bed and failure to organise or check arrangements for blood in cases where substantial haemorrhage could be expected.

Conclusions

The anaesthetic mortality rate in Victoria is extremely low and attests to the high standard of practice of anaesthesia in this State. However the Victorian Consultative Council on Anaesthetic Mortality and Morbidity has identified various system failures that resulted in an imperfect outcome. A thoughtful analysis of major engineering disasters of the past century by Henri Petroski in “To Engineer is Human” 12 led him to define five clear categories of failure within any particular system. These are ignorance, lack of supervision, economy either in initial costs or maintenance, unforseen circumstances, and human based errors, the latter including lapses, carelessness and deliberate short cuts even by persons who are normally careful and competent. The very same issues can be identified in the mishaps that occur in the practice of anaesthesia.

This four year review of mortality and morbidity in the practice of anaesthesia in Victoria has identified the following factors.

• **Insufficient pre-operative evaluation** set against the increasing numbers of patients of advanced age, the increasing presence of major medical diseases, the complexity of modern surgery and pressures to bypass necessary procedures for evaluation and preparation of patients with identified problems.

• **Inadequate supervision of trainees** attributable in part to shortage of senior anaesthetists and in part to economic rationalism in an environment in which there is a rapidly expanding need for the delivery of anaesthetic services.

• **Lack of proper maintenance of equipment** due to shortage of both properly trained ancillary staff and skilled assistance in all locations in which anaesthesia is administered.

• **Poor communication** in the context of the required interdisciplinary planning for modern management of peri-operative patients.

• **Inadequate infrastructure and ineffective protocols for managing post-operative pain.**
The Victorian Consultative Council presents this report as a confirmation of the high level of safety of modern anaesthesia which is the culmination of the educational activities of the Australian and New Zealand College of Anaesthetists and the Australian Society of Anaesthetists. This Council supplements these activities by promoting audit and analysis of anaesthesia - related mortality and morbidity, and by communicating concerns over circumstances in which safety of anaesthesia can been compromised. The Council therefore has a very important role in minimising the occurrence of adverse events and limiting their effects when adverse effects do occur. Hence the ultimate goal of maintaining absolute safety in anaesthesia is closer to achievement.

Recommendations

• Mandatory reporting to the Council of all deaths occurring within 24 hours of anaesthesia or as a result of anaesthesia sedation or pain management.

• Definition of the term “anaesthesia” to encompass all activities by anaesthetists in the peri-operative period.

• Standardised requirements for coronial depositions throughout Australia to ensure that uniformly formatted information is provided by the senior anaesthetist and the senior surgeon (or procedural specialist) involved in any reportable death.

• Inclusion of anaesthesia procedures in the Victorian Admitted Episodes Database (VAED).

• Acknowledgment of the essential participation of anaesthetists in pain management by Ministerial appointment to the Council of a representative of the Faculty of Pain Medicine.

• Guidelines for the operation of Consultative Councils to minimise reduplication of case analysis whilst maintaining independence and codes of confidentiality.

• Continuing collection of morbidity data combined with more effective acquisition of details of major morbidity data from anaesthetic quality assurance programmes in all Victorian hospitals.

• Encouragement of non-specialist rural anaesthetists to participate in the activities of the Council by allocation of points for their Maintenance of Standards Programme for appropriately documented reports on mortality or morbidity.
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