REPORT ON ANAESTHETIC RELATED MORTALITY IN AUSTRALIA 1985 - 1987

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WORKING PARTY ON ANAESTHETIC MORTALITY
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FOREWORD

The compilation of information about those factors which contribute to the risk of death occurring under anaesthesia is an important role for the National Health & Medical Research Council. I believe that the publication of this report will provide anaesthetists, administrators, surgeons and clinical teachers with the information which they need to make the best decisions in their own sphere of responsibility. This report will also provide potential patients with information for their own decision making.

The data in this report would never have been accessible without the cooperation of a number of individuals and organisations. The most important of course are the anaesthetists who reported their problems to their state committees frankly and in sufficient detail to allow the state committees to form valid opinions as to the relevant causes of the problems. I thank them for their cooperation. Secondly we owe a debt to the state committees whose members have devoted many hours voluntarily to the detailed consideration of the data provided to them and have attempted to unravel the often complex problems which that data revealed.

Finally we must thank the state committee chairmen who, together with consumer representation have formed the Health Care Committee's Working Party on Anaesthetic Related Mortality which has compiled this report.

I commend the report in the belief that it represents a valuable milestone in the provision of information about the risks and hazards of anaesthesia to those who need it, anaesthetists and the public.

Professor John Chalmers
CHAIRMAN
National Health & Medical Research Council

INTRODUCTION

For many years anaesthetists in Australia have campaigned for improved collation and reporting of Anaesthetic Mortality data. The setting up of State Anaesthetic Mortality Committees has been a slow process. In 1960 the New South Wales Special Committee Investigating Deaths Under Anaesthesia was set up. Under Dr Ross Holland's guidance this Committee provided an initiative which all other Australian states have since followed in one way or another.

All states with the exception of Tasmania now have their own committees. Tasmania uses the facilities provided by the New South Wales committee, the Australian Capital Territory seems likely to follow that precedent and in the future, the Northern Territory may well use the South Australian facilities.

This report summarises data collected by the committees in New South Wales, Victoria, Queensland, Western Australia and South Australia during the years 1985 to 1987.

The data are incomplete and the Working Party is still a long way from being able to provide firm, statistically valid data and conclusions. However unless a start is made, even with incomplete data, no progress at all can result.

Anaesthetists throughout Australia are grateful to the National Health & Medical Research Council for providing the resources to allow the work of national data collection to begin. In 1972-73 the Board of the Faculty of Anaesthetists sought the assistance of the NH&MRC to establish, as a public health measure, a national committee to collect information derived by state committees. In 1982 the Faculty of Anaesthetists, Royal Australasian College of Surgeons attempted to initiate the national collection of anaesthetic mortality data but the attempt was unsuccessful. In 1988 Professor Michael Cousins of Flinders University wrote to the NH&MRC asking if it would be prepared to facilitate the compilation of state data to allow the preparation of a national survey of anaesthetic mortality and the factors which contribute to it. The NH&MRC responded by holding a meeting of interested parties in Sydney, in May 1989, to discuss the mechanisms by which this goal might be achieved.

At this meeting a Working Party on Anaesthetic Mortality was convened with the following membership:

Dr J Paull (Chairman)	Victoria
Professor T Cramond	Queensland
Dr N J Davis	Western Australia
Dr W Fuller	South Australia
A/Professor D Jackson	Consumer nominee, (to June 1990) pharmacologist
Dr N Thomson	Epidemiologist Australian Institute of Health
Dr J Warden	New South Wales
Dr C Mead (Secretary/Convenor	Health Care Committee (to June 1990)
Dr B Orchard (Secretary/Convenor)	Health Care Committee (from June 1990)

This Working Party has gathered together the available state data and compiled this report.

DATA COLLECTION

Information to consider each case properly regarding deaths associated with anaesthesia is obtained in various states as follows:

New South Wales

The Special Committee Investigating Deaths under Anaesthesia follows up all cases which are reported to the coroner. This is done by sending an appropriate form to the anaesthetist involved in each case. Further details are requested if necessary. In New South Wales the Coroner's Act 1980, Section 13 (3) (f) specifies that a death is examinable when a person dies while under or as a result of or within a period of 24 hours after the administration of an anaesthetic administered in the course of a medical, surgical or dental operation or procedure or an operation or procedure of a like nature.

It is compulsory that such deaths are reported to the coroner and the details are then forwarded to the Special Committee by arrangement with the coroner's office. Reporting of cases to the Special Committee by anaesthetists is voluntary but a very high response rate has been achieved over a number of years.

Victoria

The Victorian Consultative Council on Anaesthetic Mortality and Morbidity enquires into the circumstances of death or morbidity occurring during or as a result of anaesthesia.

Reporting of such cases to the Council is voluntary. Council welcomes reports from practitioners in every part of the state and has attempted to make reporting forms available in every operating theatre, recovery room, delivery suite and intensive care ward in Victoria.

Queensland

The Committee to Enquire into Perioperative Deaths is authorised by Order in Council "to conduct scientific research and studies into perioperative deaths to reduce anaesthetic morbidity and mortality in Queensland".

The reporting of such deaths to the Committee is voluntary but information is also received from the forensic pathologist who conducts coroner's autopsies The autopsy reports are forwarded to the Director General of Health where there is any suggestion that the death was caused, or could have been caused, by the anaesthetic agent or technique, or where the death was attributable to the surgical technique, or where death occurs within 48 hours of the administration of the anaesthetic.

The Director General of Health then seeks the cooperation of the surgeon and anaesthetist to complete the notification to the Committee to Enquire into Perioperative Deaths.

The Committee was established under Section 154M, Part IVC of the Health Act. This provides protection of information supplied to the Committee and the source from which it came.

Western Australia

The authority for the Anaesthetic Mortality Committee lies with the Commissioner of Health.

Deaths are referred to the Investigator (who is appointed by the Minister for Health on the recommendation of the Committee) if death has occurred within 48 hours of administration of anaesthesia or if death at any time is thought by a medical practitioner to have been caused by anaesthesia. Reporting is mandatory under the Health Act.

Under the Act the investigator refers to the Committee only those cases where, in his view, anaesthesia played a significant part in the death.

South Australia

The South Australian Anaesthetic Mortality Committee considers any reports on deaths which occur from whatever cause during or within 24 hours of an anaesthetic, or later if the death was likely to have occurred as a consequence of the anaesthetic.

Information about anaesthetic related deaths reaches the Committee from a variety of sources. This information comes mainly from the teaching hospitals, from anaesthetists and by indirect reports of mishaps. Such reports are followed up by telephone or letter if a report is not received directly from the anaesthetist.

Special forms are supplied by the Anaesthetic Mortality Committee to all hospitals where anaesthetics are given and, if necessary, are sent to anaesthetists when mishaps occur.

The reporting of such cases to the Anaesthetic Mortality Committee is voluntary.

Tasmania

At the request of the Tasmanian Regional Committee of the Faculty of Anaesthetists, Royal Australasian College of Surgeons, details of deaths under anaesthesia in that state are now being reported to the New South Wales Special Committee.

The views of the New South Wales committee are conveyed solely to the Tasmanian anaesthetists concerned and the cases are not included in the NSW reports. No Tasmanian data is included in this report since this mechanism was not in operation during the 1985-87 triennium.

Australian Capital Territory

The Australian Capital Territory is likely to follow the Tasmanian lead and make use of the NSW facilities.

Northern Territory

The Northern Territory may well avail itself of South Australian facilities in the future.

With the exception of Western Australia, where it is mandatory, the notification and reporting of anaesthetic related deaths is voluntary. The various committees involved encourage such reporting by personal contact, publicity through such organisations as the Faculty of Anaesthetists, Royal Australasian College of Surgeons and the Australian Society of Anaesthetists and by liaising with coroners' offices.

Reporting is also encouraged by the enactment of legislation in the various states which confers confidentiality on any such reports made to a recognised committee. Such legislation is felt to be essential if the work of the committees and their reports are to become more effective. It should be noted that on occasions when legal opinion has cast doubt on whether such legislation does confer confidentiality, committees have ceased to function until such questions have been clarified. In New South Wales, South Australia and Victoria this problem has occurred and changes to existing legislation have been required.

No state committee can guarantee that the reporting rate is 100%, but in a number of states the committees feel that the frequency of reporting is very high.

The Working Party has been able to prepare an estimate of the number of anaesthetics given in Australia over the triennium. This estimate has been prepared using public hospital data supplied to the Faculty of Anaesthetists of the Royal Australasian College of Surgeons by state health authorities together with Health Insurance Commission data about the number of anaesthetic items for which patient rebates were paid over the same period. It has been assumed that each patient is billed for 1.4 rebate items on each occasion an anaesthetic is administered.

CONFIDENTIALITY

The question of confidentiality of information was uppermost in the minds of the chairmen of the state committees when the working party met. The continued existence of the state committees is based on their ability to maintain the confidentiality of those who report cases to them and who provide the detailed information necessary to properly consider each case. Anything which could be seen to weaken that confidentiality had to be avoided.

This NH&MRC Report deals with the pooled final output of each state committee rather than the with detailed information which they receive. It lists the numbers of cases in the broad categories defined below and comments on the principal problems which the state committees have identified as being significant factors involved in anaesthetic related deaths.

Because of this, the confidentiality of those who report their problems to their state committees is not threatened in any way.

DATA QUALITY

The collection of data in each state takes place under different circumstances. In Western Australia reporting of anaesthetic related deaths is mandatory. In all other states the reporting of anaesthetic related deaths to the appropriate committee is voluntary, except insofar as the Coroner's Act in each State requires the reporting of deaths related to anaesthesia to the state coroner and the coroner, if he thinks appropriate, may then inform the committee. The coroner in these states may report cases to the committee but is not obliged to do so.

In South Australia problems which arose in relation to the operation of the state committee led to the loss of data for six months during the study period. Efforts to retrieve these lost data have resulted in only limited success.

In most states it is possible that appropriate cases may not be reported, either because death certificates are issued and the coroner is not involved or because anaesthetists regard the deaths as inevitable and "not worth reporting".

Further difficulties are presented by those cases in which problems arose during anaesthesia but were apparently overcome.
The patients may require intensive care for an extended period and may eventually succumb after prolonged hospitalisation.

The immediate cause of death may be perhaps pneumonia or cardiac failure but because of the remoteness of the anaesthetic problems, their role in the eventual demise of the patients may never be formally established. It is probably rare for such cases to be reported to state committees.

The Australian Council on Health Care Standards (ACHS) specifies that the director of anaesthetics in an accredited hospital should ensure that anaesthetic related deaths are reported to the state committee responsible for investigating such deaths. It would appear that in a number of hospitals this may not happen. It is perhaps appropriate for the ACHS to enquire further during the accreditation process, as to the effectiveness of the mechanisms which are in place, to ensure that this requirement is met in each hospital seeking accreditation.

A further problem hindering the effective statistical analysis of these data is the unreliability of the denominator. The Working Party has been able to estimate the total number of anaesthetics given in Australia during the period of review, but the potential sources of error are large. Whilst it has been possible to estimate the number of private anaesthetics given by non-specialists and by specialists during the triennium, the Working Party has been unable to determine the total numbers of anaesthetics given by specialists, non specialists and by trainees.

The total numbers of patients in various categories, for example low risk or high risk cannot be determined from the data available.

For these reasons readers of this report are advised that no conclusions based on any attempted analysis of these data can be supported. In effect, the data presented are indications of the revealed magnitude of the problems described but do not give any indication of their true magnitude.

CLASSIFICATION OF CASES

In each state, the committee investigating deaths has used slightly different methods of categorisation. These differences have developed over the years as individual committees have attempted to identify or isolate problems which have appeared from time to time to be important. All the systems are broadly based on a system first used by the Association of Anaesthetists of Great Britain and Ireland.

The Working Party has agreed that the following method of categorisation will be used in this report. Cases will be classified as:

Category I	Where it is reasonably certain that the death was caused by the anaesthetic agent or technique of administration or in other ways coming directly within the anaesthetist's province.
Category II	Similar cases in which there is some element of doubt as to whether the agent or the technique was entirely responsible for the fatal result.
Category III	Cases in which both the anaesthetic and the surgical technique contributed to the fatal result.

In each of these principal categories, four subcategories identify the phase of anaesthesia during which the problem arose. They are:

Subcategory 1	Inadequate preoperative assessment.
Subcategory 2	Problems arising during the induction of anaesthesia.
Subcategory 3	Problems arising during the maintenance of anaesthesia.
Subcategory 4	Problems in the recovery room and/or during post anaesthesia care.

Four subheadings identify the nature of the problem:

Subheading i	Problems related to drug administration.
Subheading ii	Problems related to equipment.
Subheading iii	Problems related to techniques used.
Subheading iv	Other problems.

Each state committee has reclassified its data where appropriate to fit this agreed pattern.

In each category and subgroup the Working Party has attempted to highlight the most common factors identified as being important contributors to anaesthetic related deaths.

CLASSIFICATION OF ANAESTHETISTS

For the purposes of this report, anaesthetists have been classified as follows:

Specialist
Trainee
Non specialist

A specialist has been defined as an anaesthetist recognised by the National Specialist Qualifications Advisory Committee. A Trainee may be an intern, resident or most commonly a Faculty of Anaesthetists registered Vocational Trainee. The latter trainees are supervised by specialists in accordance with Faculty Policy Document E3, The Supervision of Trainees in Anaesthesia.

Non specialists are in the majority of cases general practitioners with a wide range of anaesthetic experience and in a few cases surgeons, physicians or dental practitioners.

PATIENT STATUS

State committees have adopted several different methods of assessing patient status at the time anaesthesia was attempted. In some states the American Society of Anesthesiologists (ASA) Classification of Physical Status is used (see Appendix) whilst in others the patients are classified as follows:

Good
Fair
Poor
Desperate

In most cases "Good" corresponds to ASA 1, "Fair" corresponds to ASA 2, "Poor" corresponds to ASA 3 & 4 and "Desperate" is equated with ASA 5. This classification has been used to grade patients in this report.

RESULTS

The number of anaesthetic related deaths reported to an appropriate committee in each state are set out in Table 1.

State	Number of anaesthetic related deaths reported, 1985-87.
NSW	1000+
VIC	126
QLD	223
WA	274
SA	85
TAS	not available
ACT	not available
NT	not available
Total	1700+

Table 1.
Number of anaesthetic related deaths reported to an appropriate committee in each state for the triennium 1985-87.

The disparity which is obvious between the numbers of anaesthetic related deaths reported and the population of the states involved suggests that the frequency of reporting may vary significantly between states.

In some states, the anaesthetic related deaths initially reported are culled. In New South Wales for example, those cases in which minimal doses of local anaesthetic were used are excluded at this stage.

Table 2 shows the number of anaesthetic related deaths considered by an appropriate committee (or in Western Australia, the Investigator) in each state after the cull is completed.

State	Number of anaesthetic related deaths considered, 1985-87
NSW	700+
VIC	126
QLD	159
WA	274
SA	85
TAS	not available
ACT	not available
NT	nil available
Total	1300+

Table 2.
Number of anaesthetic related deaths considered by an appropriate committee in each state (or in Western Australia, the Investigator), after the initially reported cases have been culled for the triennium 1985-87.

In Table 3 is listed the number of anaesthetic related deaths in each state where the appropriate committee believed anaesthesia could be regarded as partly or wholly responsible for the death, i.e. that they are anaesthetic attributed deaths. (In Western Australia, the Investigator, a member of the state committee, considers each anaesthetic related death and refers to the full committee, those in which anaesthesia could be regarded as partly or wholly responsible for the death, i.e. could be regarded as an anaesthetic attributed death).

For the triennium this represents, throughout the whole of Australia, one anaesthetic attributed death per week.

State	Number of anaesthetic attributed deaths, 1985-87
NSW	83
VIC	48
QLD	10
WA	5
SA	7
TAS	not available
ACT	not available
NT	not available
Total	153

Table 3.
Number of anaesthetic related deaths in which the anaesthetic agent or technique was considered by an appropriate committee to be partly or wholly responsible for the death, i.e. the number of anaesthetic attributed deaths for the triennium, 1985-87.

On average about a fifth of anaesthetic related deaths initially reported to anaesthetic or perioperative mortality committees are ultimately found to be wholly or partly due to the anaesthetic or some aspect of its management, i.e. are anaesthetic attributed deaths.

Role of Anaesthetics and Surgery in Anaesthetic Attributed Deaths

Of these 153 anaesthetic attributed deaths, just under half (72) were felt by investigating committees to be in Category 1. That is they were caused by the anaesthetic agent, the anaesthetic technique or some other problem directly within the anaesthetist's sphere of responsibility.

In rather more than a fifth (32) of the deaths there was some doubt as to whether the agent or technique was entirely responsible. This means however that matters within the anaesthetist's province did play a major but not necessarily sole role in the death.

In about a third (49) of the deaths, the surgical management was a contributing factor and both anaesthetics and surgery were responsible for the death. These data are summarised in Table 4.

Category	Number of anaesthetic attributed deaths, 1985-87
I (Anaestheticprincipal cause)	72
II (Anaesthetic probably caused death)	32
III (Anaesthetic and Surgery caused death)	49
Total	153

Table 4.
Principal categories of cause of death in 153 anaesthetic attributed deaths in which the anaesthetic agent or technique was considered partly or wholly responsible for the death for the triennium 1985-87.

Stage of Anaesthesia at which the Complications Leading to Death Originated

The principal problem leading to the anaesthetic attributed death was further classified into subcategories as described on page 11. Inadequate or inappropriate preoperative assessment was a major factor in about a third (46) of the deaths. In about a fifth (32), the problems arose during the induction of anaesthesia, in about a third (49) during the maintenance phase and in just under a fifth (26), the problem arose in the recovery ward or in the postoperative period. These data are summarised in Table 5.

Stage of anaesthesia problem originated	Number of anaesthetic when attributed deaths
Subcategory 1 (Preoperative assessment)	46
Subcategory 2 (During induction)	32
Subcategory 3 (During maintenance)	49
Subcategory 4 (During recovery)	26
Total	153

Table 5.
Phases in anaesthesia during which problems resulting in anaesthetic attributed deaths arose for the triennium, 1985-87.

Principal Factors Causing Anaesthetic Attributed Death

As described earlier, (see page 12), the principal factors leading to anaesthetic attributed death have been further classified to demonstrate the nature of problems which caused death. For the period in question, these are summarised in Table 6. Faults of technique were thought to be responsible in more than half of the deaths. The relative lack of equipment problems as a cause of death is gratifying and suggests that efforts by the Faculty of Anaesthetists to encourage checking of equipment and by manufacturers to improve the safety of equipment have paid dividends.

Nature of Problem causing death	Number of anaesthetic attributed deaths, 1985-87
Subheading i (Drug administration related)	39
Subheading ii (Equipment related)	4
Subheading iii (Technique problems)	92
Subheading iv (Other problems)	18
Total	153

Table 6.
The principal causes of anaesthetic attributed deaths for the triennium, 1985-87.

Patient Status

While an arbitrary grading of the patient's preoperative condition into four categories - good, fair, poor and desperate - may lack objectivity and be considered a coarse classification, it has useful clinical application.

Fifty three (53) of a sample of 132 patients were considered by anaesthetists to be in poor condition and 24 to be desperately ill. It is a cause for concern however that death occurred in 25 patients considered by anaesthetists to be good risks and in 30 considered to be fair risks.

Education programmes must stress the importance of preoperative history and assessment, recognition of events such as anaphylaxis and malignant hyperpyrexia and familiarity with established protocols for immediate treatment of these incidents if anaesthetic morbidity and mortality are to be avoided.

Table 7 listing the preoperative physical risk status of patients as assessed immediately prior to an anaesthetic (see pages 12 and 13 for detail) shows that poor patient status was, as might be expected, a significant risk factor for an anaesthetic. However the patients who were regarded as being healthy and who died directly as a result of an anaesthetic are a matter of great concern.

Patient risk status	Number of anaesthetic attributed deaths
Good	28
Fair	36
Poor	70
Desperate	19
Total	153

Table 7.
The preoperative patient physical risk status in anaesthetic attributed deaths for the triennium, 1985-87.

Category of Anaesthetist and Category of Death

In 132 of the anaesthetic attributed deaths reported to the NH&MRC, the category of the anaesthetist principally responsible for the anaesthetic was provided. Health Insurance Commission data suggests that during this triennium, specialist anaesthetists gave between 88% and 91% of all private anaesthetics. In most, if not all of the larger metropolitan public hospitals most anaesthetics are given or are supervised by specialist anaesthetists but the data provided by state health authorities is not sufficiently detailed to allow the Working Party to quantify this more precisely.

Table 8 lists for the sample of 132 cases, the category of the anaesthetist, classified as specialist, trainee or non-specialist in relation to the category of the anaesthetic attributed death as described on page 11.

Category of anaesthetist	Category of anaesthetic attributed death			Total
	I	II	III	
Specialist	45	20	34	99
Trainee	8	3	7	18
Non-specialist	10	2	3	5
Total	63	25	44	132

Table 8.
Category of anaesthetist related to category of anaesthetic attributed death in a sample of 132 anaesthetic attributed deaths for the triennium, 1985-87. Category I, Anaesthetic principally responsible: Category II, Anaesthetic probably responsible: Category III, Both anaesthetic and surgery responsible.

Specialists were responsible for 99 (three quarters) of the anaesthetics in the sample, trainees for 18 and non-specialists for 15.

On superficial examination, the contribution of the specialist and the trainee to anaesthetic attributed mortality appears high. No conclusions can be drawn because important information is missing.

What was the total number of anaesthetics administered by each group? What was the nature of the surgery and the condition of the patient?

Methods of reporting must be devised so that there is objective evidence of why particular patients died at particular times. Autopsy reports are valuable in revealing chronic ischaemic heart disease or chronic lung diseases, but they rarely give any information on events that preceded death. Inadequate blood and fluid replacement, relative or absolute drug overdose, respiratory inadequacy, hypoxia, will not be apparent at autopsy. This becomes even more significant when autopsies are done by other than forensic pathologists.

The quest for objective evidence about why particular patients died must be directed to the anaesthetists and the anaesthetics administered.

Essential information required includes:

* training and experience of the anaesthetists especially in the areas of anaesthetics practice requiring special expertise, eg. paediatrics, obstetrics, day surgery

* the work environment:

  - the adequacy of ventilation of the theatre suite
  - the appropriate scavenging equipment

* the general health of the anaesthetists

* an adequate staff establishment to ensure:

  - supervision of trainees
  - regular meals for all staff
  - regular relief during long cases and
  - that fatigue is avoided

* availability of :

  - trained assistance
  - monitoring devices
  - recovery room facilities and intensive care support with adequately trained nursing staff

* should patients be transferred rather than have anaesthetics given by non-specialists?

In brief, that the training, experience and skill of the anaesthetists are appropriate to deliver safe anaesthesia to the patients, recognising the gravity of the patients' condition and the surgery required.

The public has a right to be assured that by looking into the cause of anaesthetic mortality, it is possible to identify those areas of anaesthetic practice where improvement is indicated, to make recommendations to overcome the problems and then to ensure that inadequacies have been corrected. By these means, patient safety will be enhanced.

Category of Anaesthetist and Patient Status

In Table 9 the category of the anaesthetist is compared with the physical status of the patient prior to anaesthesia in a sample of 132 anaesthetic attributed deaths.

Category of Anaesthetist	Status of Patient: Good	Fair	Poor	Desperate	Total
Specialist	17	21	42	19	99
Trainee	3	7	5	3	18
Non-specialist	5	2	6	2	15
Total	25	30	53	24	132

Table 9.
Category of anaesthetist compared with patient preoperative risk status in a sample of 132 anaesthetic attributed deaths for the triennium, 1985-87.

Category of Death and Patient Age

In a sample of 143 anaesthetic attributed deaths, two thirds of the deaths occurred in the age group, 61 - 90 years. The Working Party has no data which allows it to determine what proportion of total anaesthetics is given to this age group of patients but it is likely that they represent a significant proportion of an anaesthetic department's case load.

In the older age group, 71 - 90 years, surgery begins to play a more significant role as a contributing cause of death. Table 10 summarises the data for a sample of 143 anaesthetic attributed deaths.

Age group of patient in years	Category of anaesthetic attributed death			Total
	I	II	III	
0-10	1	-	-	1
11-20	3	1	-	4
21-30	13	2	1	16
31-40	5	-	1	6
41-50	5	1	5	11
51-60	7	6	7	20
61-70	12	11	6	29
71-80	16	9	18	43
81-90	9	3	10	22
91+	-	-	1	1
Total	71	23	49	143

Table 10.
Category of anaesthetic attributed death for various age groups in a sample of 143 anaesthetic attributed deaths for the triennium, 1985-87.

Cause of Death

In a number of state reports sufficient information is provided to pinpoint the cause of death. The following list, Table 11, represents the commoner causes of death noted in the reports. Septicaemia is listed as an anaesthetic related cause because in the opinion of the relevant committee the anaesthetist, during the preoperative management, did not recognise the condition as a potential problem or provided inadequate pre-anaesthetic therapy. Respiratory failure is listed for the same reasons, or because it was unrecognised during the recovery or immediate post operative period and was related to errors of anaesthetic management.

Cause of death

Acid aspiration
Airway obstruction
Anaphylaxis
Cardiac arrest
Cardiac failure
Cardiogenic shock
Cerebral hypoxia
Drug overdose
Halothane related hepatic failure
Intravenous injection of local anaesthetic
Malignant hyperpyrexia syndrome
Respiratory failure
Pipeline transposition
Pulmonary artery rupture during Swan Ganz catheter insertion

Table 11.
The principal causes of death in a sample of anaesthetic attributed deaths for the triennium, 1985-87.

Total Anaesthetics Given in Australia During the Triennium

Data from the Health Insurance Commission indicates that 3.3 million anaesthetic items were billed for private patients during the triennium 1985-87. Other data suggest that each anaesthetic attendance results in approximately 1.4 anaesthetic items being generated. This figure excludes the preoperative visit items. This means that about 2.77 million anaesthetics were given to private patients during the period in question. State health authority data, unfortunately incomplete, suggests that about 880,000 public hospital patients and 20,000 compensable patients were anaesthetised in public hospitals each year during this period, a total of 900,000 per year or 2.7 million for the triennium.

The total of privately insured and public hospital and compensable patients treated in public hospitals over the triennium is 5.47 million, or 1.8 million per year. A significant number of anaesthetics cannot be accounted for since they are given to compensable patients in private hospitals and the Working Party has no data on this group.

These data, unfortunately incomplete, do however allow the Working Party to confirm that each year a little over 10% of Australia's population has an anaesthetic.

Anaesthetic Mortality Rate for the Triennium

The 153 anaesthetic attributed deaths, in a triennium in which over 5.47 million anaesthetics were given, represents a minimum anaesthetic mortality rate of approximately 1:36,000 anaesthetics given i.e. of the order of a minimum of 2.8 anaesthetic deaths per 100 000 anaesthetics given.

DISCUSSION

This initial compilation of reports of anaesthetic related deaths has been a valuable exercise in several ways.

Chairmen of each of the state committees responsible for investigating anaesthetic related deaths have been brought together and have discussed the mutual problems of data collection, interpretation and reporting.

These meetings have highlighted the need for investigating committees to obtain further cooperation from state coroners if the committees are to identify anaesthetic related deaths reliably and are to investigate them. It appears that in several states the coroners routinely report anaesthetic related deaths to the investigating committee but in other states, the coroners, while cooperative when approached, do not routinely notify the state committees of deaths which should be investigated by those committees.

The Working Party believes that the Australian Health Ministers' Advisory Council (AHMAC) should be informed of this problem and that State Health Ministers should be asked to ensure, as far as possible, that state coroners routinely report anaesthetic related deaths to their appropriate state investigating committee.

The indirect and incomplete evidence about the number of anaesthetics given in Australia referred to previously, indicates that the following apply:

Anaesthetics given	5,470,000
Anaesthetic related deaths referred	1,700+
Anaesthetic related deaths considered	1,200+
Anaesthetic attributed deaths	153
Minimum anaesthetic attributed death rate, per 100,000 anaesthetics	2.8

Identified Problems in the Preoperative Period

During the collation of the data it became apparent that several common threads represented by commonly identified problems existed. Some of these problems have been referred to in Table 11. In this discussion these common problems will be considered in a little more detail, with a view to assisting anaesthetists, trainees, surgeons, clinical teachers, patients and administrators who will be responsible for minimising the occurrence of these problems in the future.

The Working Party is concerned that more than a quarter of the anaesthetic attributed deaths (46 of 153) were related to inadequate preoperative assessment and management.

A number of problems have been identified and warrant the attention of anaesthetists:

1. Communication

Poor communication between the surgeon and anaesthetist apparently contributed to problems of patient management in several cases, leaving the anaesthetist without sufficient information to safely manage the patient. In some cases this problem was compounded by the inadequate recording of important information in the patient's record.

2. Delay in Treatment

Delays in the definitive surgical treatment in a number of cases led to a fatal outcome and complicated the anaesthetic more than might have been necessary if treatment had been instituted earlier. Elderly patients with intra-abdominal sepsis presented the most frequent example of this problem. Several state committees have warned of the potential danger of underestimating the seriousness of intra-abdominal sepsis in the elderly.

3. Inadequate Fluid Resuscitation

In several cases the anaesthetic was commenced in the face of inadequate fluid resuscitation, most commonly in patients with multiple injuries. Assessment of the fluid status of these patients is often very difficult but inadequate monitoring leading to underassessment of fluid loss is clearly potentially fatal as several cases demonstrated. The patient who is on beta blocking drugs and who suffers major trauma presents an even more difficult problem because of the obtunding of the normal reflexes which help the anaesthetist and surgeon to assess fluid loss.

4. Failure to See and Assess the Patient Preoperatively

In a number of fatal cases the anaesthetist had failed to personally see or assess the patient preoperatively. As a result the anaesthetist had entered a medical minefield with a result which was almost inevitable. The Faculty of Anaesthetists Policy Document P7, The Pre-Anaesthetic Consultation sets out the goals of this event and emphasises its importance as a significant factor in ensuring safe anaesthesia. This Working Party can only emphasise the importance of adequate preoperative assessment as a starting point for safe anaesthesia.

Identified Problems during the Induction and Maintenance of Anaesthesia

1. Pipeline transposition

For those anaesthetists who thought that technological advances in engineering and monitoring would ensure that this event could not happen, the occurrence of a nitrous oxide/oxygen pipeline transposition was an unpleasant and unfortunately fatal reminder that Murphy's Law is still operating.

As so often happens the fatal result was the outcome of a whole series of apparently minor problems each of which contributed to an eventual failure to recognise that the gas coming from the oxygen rotameter was not oxygen.

If implemented by hospitals and observed by anaesthetists the Faculty of Anaesthetists Policy Document P18, Monitoring During Anaesthesia will dramatically reduce the possibility that this sort of event can occur again.

The Working Party has noted the relatively small number of events involving equipment misuse or failure and believes that the Faculty of Anaesthetists policy documents dealing with the equipping of anaesthetising locations and the checking of equipment have almost certainly played a major role in minimising equipment related fatalities.

2. Acid Aspiration

Acid aspiration was identified as the cause of death in at least 5 cases during the triennium. Associated factors include pregnancy, obesity, the lithotomy position, lightly anaesthetised patients, sick emergency patients and patients undergoing endoscopy under excessive operator administered sedation.

3. Anaphylaxis

Anaphylaxis or severe anaphylactoid reactions were the cause of death in several cases. In those cases where the cause was identified, the responsible drugs included thiopentone, suxamethonium and alcuronium.

4. Malignant Hyperpyrexia Syndrome

In at least one case the malignant hyperpyrexia syndrome caused the death of a patient. Despite vigorous treatment the patient developed fatal cerebral hypoxia. It is essential that all hospitals have well publicised arrangements in hand which allow dantrolene to be obtained rapidly and in adequate quantities.

5. Drug Related Deaths

Excessive drug dosage resulting in hypotension, depression of protective reflexes, prolonged or recurrent "curarisation" and other problems were a feature of several cases. The accidental intravenous injection of a large dose of local anaesthetic also resulted in death.

At least three fatal cases of halothane related hepatitis occurred during the triennium. In two of the cases other potentially hepatotoxic factors were present but the sequence of repeat halothane anaesthetics at short intervals, with post anaesthetic fever strongly suggests that halothane was a major factor in the liver failure.

Anaesthetists must ensure that they are aware of the risk factors associated with halothane related hepatitis and take appropriate action when they are present.

6. Spinal Anaesthetic vs General Anaesthetic

Those committees which dealt with deaths which occurred during or after spinal anaesthetic discussed the problem of the relative benefits and disadvantages of these two forms of anaesthetic at length. The committees were unanimous in their condemnation of the common belief that the patient who is unfit for general anaesthetic is automatically a candidate for a spinal anaesthetic. This technique is not necessarily a panacea for the sick and frail surgical patient.

Committees did not conclude that one technique was necessarily superior to the other. In both cases the anaesthetist must have a full understanding of the physiological changes induced by the different forms of anaesthetic and must be alert to the need to recognise and treat those changes as they arise. Continuing care and monitoring in the postoperative period is an essential component of each technique.

7. Other Management Problems

Other problems identified as contributing to the fatal outcome were:

i. a failure to have a secure intravenous access prior to induction of anaesthesia in patients who are ill or who have multiple risk factors present

ii. a need to be aware of the difficulties associated with the prone position, particularly in relation to maintenance of the airway and adequate ventilation

iii. detection of cyanosis in Aborigines. Several anaesthetists commented on the difficulty they had experienced in detecting cyanosis in anaesthetised Aborigines. The advent of pulse oximetry will potentially eliminate this problem. The fact that the Faculty of Anaesthetists Policy Document P18,

Monitoring During Anaesthesia, required the provision of oximetry for every anaesthetised patient by the end of January 1990 should be known to every anaesthetist and hospital administrator

8. Cardiac Arrest Management

A number of patients suffered cardiac arrest during the induction or maintenance of anaesthesia and during the recovery phase. In some cases the management of the cardiac arrest could only be described as unusual. Investigating committees suggested it is essential that all hospitals ensure that all staff are familiar with the latest cardiac arrest protocols.

Identified Problems During the Postoperative Period

A number of patients died in the immediate or more remote postoperative period. In several cases no recovery room was available and in others inadequate post anaesthetic monitoring contributed to cardiac or respiratory arrest. As mentioned earlier, the effects of drugs administered during anaesthesia may contribute to significant respiratory depression or airway obstruction in the recovery period. This in turn may induce cardiac arrest which in this situation is often difficult to manage successfully. Muscle relaxants and opiates, together with benzodiazepines have contributed to these post-anaesthetic problems.

In several cases inadequate postoperative fluid therapy led to prolonged hypotension which ultimately proved fatal.

CONCLUSIONS

The Working Party concludes that this review of anaesthetic related mortality in Australia in the 1985 - 87 triennium has proved extremely useful from a number of points of view. It has brought together the chairmen of all the state committees and has facilitated discussion of a number of problems related to data collection, categorisation, reporting and the role of the state coroners in providing information to the committees.

In addition, the review of the causes of anaesthetic attributed mortality will serve to highlight for anaesthetists, surgeons, clinical teachers, patients and administrators the potential problems which can lead to fatal outcomes.

The review has highlighted the lack of information about the total number of anaesthetics given in this country and emphasises the importance of attempting to remedy this if valid comments are to be made about the incidence of anaesthetic related mortality. The figure of a minimum of 2.8 deaths per 100,000 anaesthetics is most unreliable but it does provide a benchmark of sorts by which future anaesthetic management and data collection may be judged.

RECOMMENDATIONS

As a result of its investigations the Working Party proposes the following recommendations:

1. That a uniform system of anaesthetic related mortality reporting with adequate financial and computer support be developed in Australia.
2. That this system of reporting be implemented in sufficient time to allow correlation of information for the 1991 - 93 triennium.
3. That, despite the inadequacies of the data, a report for the 1988 - 90 triennium be prepared.
4. That a committee be established by the NH&MRC to report on anaesthetic related mortality in Australia.

AMERICAN SOCIETY OF ANESTHESIOLOGISTS, (ASA) CLASSIFICATION OF MEDICAL STATUS

Grade 1. A patient who has no organic disease or in whom the disease is localised and causes no systemic disturbance.

Grade 2. A patient exhibiting slight to moderate systemic disturbance which may or may not be associated with the surgical complaint and which interferes only moderately with the patient's normal activities and general physiological equilibrium.

Grade 3. A patient exhibiting severe systemic disturbance which may or may not be associated with the surgical complaint and which seriously interferes with the patient's normal activities.

Grade 4. A patient exhibiting extreme systemic disturbance which may or may not be associated with the surgical complaint, which interferes seriously with the patient's normal activities and which has already become a threat to life.

Grades 1E, 2E, 3E, 4E.
A patient who is operated upon in an emergency who would otherwise be in Grades 1,2,3 or 4.

Grade 5. The rare person who is moribund before operation, whose preoperative condition is such that he is expected to die within 24 hours even though not submitted to the additional strain of operation.

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