

Inadequate pre-operative evaluation and preparation: a review of 197 reports from the Australian Incident Monitoring Study

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Summary

The Australian Incident Monitoring Study database was examined for incidents involving inadequate pre-operative patient preparation and/or evaluation. Of 6271 reports, 727 had appropriate keywords, of which 197 (3.1%) were used for subsequent analysis. All surgical categories were represented. In 10% of reports the patient was not reviewed pre-operatively by an anaesthetist, whilst in 23% the anaesthetist involved in the operating theatre had not performed the pre-operative assessment. Death followed in seven cases, major morbidity in 23 cases, admission to a high-dependency unit or intensive care unit in 17 cases, and surgery was cancelled in nine cases. Poor airway assessment, communication problems and inadequate evaluation were the most common contributing factors. Respondents indicated that the incident was preventable in 57% of cases. Proposed corrective strategies include improved communication, quality assurance activities, development of protocols and additional training. A structured assessment of the airway, along with improvements in information exchange, patient assessment, and use of clearly defined patient management plans and pathways would prevent most of the incidents reported.

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It is essential that all patients undergoing anaesthesia have a pre-operative assessment and management plan. The traditional method of pre-operative preparation involves reviewing the patient the night before surgery, examining the results of investigations ordered by the surgical house officers and ordering premedicant drugs. Evolving anaesthetic practices along with financial constraints have changed this pre-operative process with the advent of dedicated pre-operative clinics staffed by other professionals and an increasing focus on day surgery and day of surgery admission. This has rationalised pre-operative investigations, reduced direct anaesthetist–patient contact prior to surgery and increased reliance on anaesthetists assessing patients for other colleagues. Anaesthetists may have to rely on the implicit judgement of a colleague rather than on an explicit, fully documented assessment. There have been

warnings in Australia that deficiencies in this process have been associated with avoidable morbidity and mortality attributable to anaesthesia [1–3].

The Australian Incident Monitoring Study (AIMS) has been used to investigate several components of anaesthetic practice, including crisis management, obstetric practice, aspiration pneumonia and the role of anaesthetic assistants [4–6]. The aim of this study was to identify problems involved with pre-operative patient evaluation and preparation and to suggest appropriate remedial strategies.

Methods

Of the first 6271 incidents reported to AIMS, those reports which noted ‘pre-operative assessment inadequate/incorrect’ or ‘pre-operative patient preparation

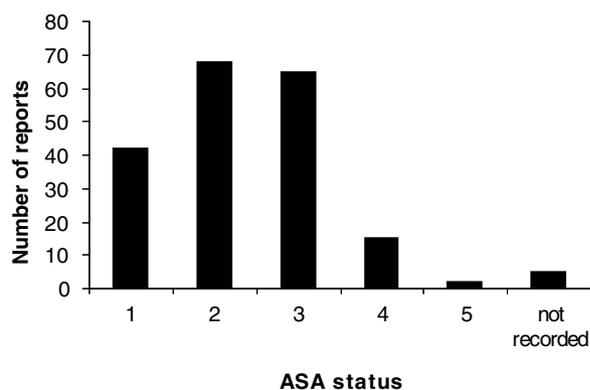


Figure 1 Distribution of ASA status in the 197 reports.

inadequate/incorrect' were extracted. Each form was reviewed separately by three specialist anaesthetists and relevant information was entered onto a Microsoft Excel spreadsheet (Microsoft Corporation, Seattle, USA). Data were entered as originally recorded on the individual AIMS reports. The following data fields were analysed: nature of surgery, surgical category, whether seen by an anaesthetist pre-operatively, whether seen by the same anaesthetist pre-operatively, American Society of Anesthesiologists (ASA) status, outcome, whether the incident was preventable, and suggested corrective strategies. Categories were developed to group common problems leading to adverse events. In some fields (e.g. suggested corrective strategies) more than one answer was recorded.

Results

When the AIMS database of 6271 reports was examined, there were 478 reports relating to 'pre-operative assessment inadequate/incorrect' and 248 reports relating to 'pre-operative patient preparation inadequate/incorrect' (11% of AIMS reports). Of these 726 reports, 197 had incidents that were clearly related to problems with

Table 1 Surgical specialties associated with incident

Surgical type	No.	Surgical type	No.
General surgery	73	Radiology/Imaging	4
Orthopaedic	32	Dental surgery	4
Urology	14	Neurosurgery	4
Gynaecology	11	Unclassified	3
Ear Nose & Throat	9	Obstetrics	3
Cardiothoracic	9	Intravenous access	1
Plastic surgery	8	Maxillofacial surgery	1
Vascular surgery	8	Pain	1
Endoscopic procedures	7		
Ophthalmology	5		

Table 2 Most significant contributing factor involved in the generation of the incident ($n = 197$)

Contributing factor	% Number of reports
Poor airway assessment	29
Communication problem	23
Inadequate evaluation	21
Drug management error	10
No anaesthetic review	7
Inadequate pre-operative resuscitation	6
Inadequate blood x-matched	3
Patient factors	1

As many reports had several contributing factors, the most significant one was noted for each incident.

pre-operative assessment or preparation. The remainder had less clearly defined issues only partly relating to pre-operative care. These 197 reports, which comprise 3.1% of the total AIMS database, were used for this analysis.

In 10% of reports, the patient had not been seen by any anaesthetist pre-operatively, whilst in 23% the anaesthetist involved in administering anaesthesia was not the one who assessed the patient pre-operatively. The reports where there was no anaesthetic review at all were split equally between elective and emergency surgery. Overall, just over one-quarter of reports were from emergency cases.

The ASA status of the patients involved is shown in Fig. 1, with surgical specialty associated with the incident shown in Table 1. Factors making a significant contribution to the incident are categorised in Table 2, with the three most common being communication problems, airway assessment and inadequate patient evaluation (Tables 3 and 4). Most outcomes were of minor significance; however, some were associated with death,

Table 3 Factors involved with Communication Problem ($n = 46$)

Nature of communication problem	% Number of reports
<i>Casenotes or chart</i> (e.g. charts unclear, missing or confusing)	39
<i>Hospital processes</i> (e.g. failure to communicate orders, requests, management plans or implement agreed clinical pathways)	24
<i>Patient factors</i> (e.g. extremes of age, developmental delay or patients failing to impart important information)	24
<i>Language difficulties</i> (e.g. Extremes of age, English not main language and difficulties arose from failure to illicit important information)	13

Table 4 Factors involved with inadequate pre-operative evaluation ($n = 42$).

Area involved with inadequate evaluation	% Number of reports
Respiratory system	38
Cardiovascular system	26
Emergency procedure	11
Diabetes mellitus	7
Dental history	5
Other	5
Alcohol history	2
Muscular dystrophy	2
Haematology	2

Number rounded to nearest percentage

major physiological change or admission to intensive care (ICU) or high-dependency units (HDU) (Tables 5 and 6). The reporters indicated that the incident was definitely preventable in 57% of cases and possibly preventable in 21%; 'unpreventable' incidents made up only 5% of cases. Suggested corrective strategies are shown in Table 7.

Brief descriptions of cases with serious outcomes together with the most important contributing factors are given below.

Death ($n = 7$)

Patient 1. A patient with a complex medical history, including significant cardiorespiratory comorbidities, was reviewed by an anaesthetic trainee, who failed to appreciate the gravity of the case. The patient was inadequately investigated; the usual cardiac medications were omitted pre-operatively and the patient subsequently suffered a cardiac arrest on the ward.

Patient 2. A quadriplegic patient underwent surgery for the percutaneous removal of a renal stone, which was associated with significant blood loss. No blood had been cross-matched for the procedure. Profound intra- and postoperative bleeding were thought to have contributed to a cardiac arrest on the ward postoperatively.

Patient 3. A patient with end-stage renal failure was scheduled for the insertion of a peritoneal dialysis catheter. The patient was noted to have an ejection fraction of less than 20% by one anaesthetist, but this information was not communicated to the anaesthetist administering the anaesthetic. A cardiac arrest occurred in the recovery room.

Table 5 Outcome of incidents ($n = 197$).

Incident	% Number of reports
No adverse outcome	45
Minor physiological change	18
Major physiological change	12
High Dependency Unit admission	7
Prolonged stay	7
Operation cancelled	5
Death	4
Intensive Care Unit admission	2
Unknown	2

Number rounded to nearest percentage

Patient 4. A history of recent onset of symptoms of bulbar problems and difficulty with breathing in a patient requiring sedation for magnetic resonance imaging was not communicated to the anaesthetist. In addition, an adequate clinical history could not be obtained from the patient who had a significant developmental disability. A respiratory arrest ensued, complicated by pulmonary aspiration. The patient subsequently died in ICU.

Patient 5. Increasing doses of inotropes were required for the treatment of intra-operative hypotension in a patient presenting for coronary artery surgery. Following a review of the patient's old casenotes, it became apparent that the patient had a subclavian artery stenosis on the same side as the arterial line insertion site. The patient died of refractory hypotension 36 h later.

Patient 6. A patient undergoing a laparoscopic cholecystectomy developed intra-operative myocardial ischaemia and subsequently died from left ventricular failure. The cardiac history, which included an admission to hospital 2 months earlier with a suspected myocardial infarction should have warranted further cardiac investigation and probable postponement of surgery.

Patient 7. A patient scheduled for thyroid surgery was reviewed by another anaesthetist. The patient suffered possible aspiration and a peri-operative myocardial infarction. She died subsequently in ICU. A history subsequently obtained from her relatives revealed significant increasing shortness of breath in the weeks prior to surgery.

ICU/HDU admission ($n = 17$)

Examples are highlighted in Table 6.

Table 6 Background to patients admitted to intensive care or high-dependency units.

Cause	Result
● Probable pre-operative myocardial ischaemia not noted on pre-operative review.	Intra-operative ischaemia
● No pre-operative ECG in patient with known ischaemic heart disease.	Intra-operative VT.
● No blood cross-matched for a procedure with the potential for significant blood loss.	Massive fluid transfusion and postoperative ventilation required.
● Inadequate assessment in patient transferred from another hospital.	
● Cessation of cardioactive medication pre-operatively with resulting intra-operative myocardial ischaemia.	Postoperative haemodynamic monitoring.
● Late addition to operating list of patient with inadequate pre-operative resuscitation.	Marked fluid shifts and postoperative ventilation required.
● Marked electrolyte disturbance not communicated to anaesthetist by surgical team.	Intra-operative arrhythmia.
● Insufficient review of casenotes with important details not noted.	Major comorbidities not noted.

Operation cancelled ($n = 9$)

The majority of cancelled operations resulted from inadequate communication between surgeon and anaesthetist, anaesthetist and anaesthetist, or patient and anaesthetist. Specific examples include the following:

Patient 1. A patient on monoamine oxidase inhibitors presented for coronary artery surgery. The anaesthetist cancelled the surgery and suggested the monoamine oxidase inhibitors should have been stopped pre-operatively.

Patient 2. Late cessation of warfarin therapy by the surgical team in a patient scheduled for elective surgery. Attempted reversal with fresh frozen plasma led to an allergic reaction and cancellation of the case.

Table 7 Suggested corrective strategies* ($n = 197$).

Suggested corrective strategy	%	Number of reports
Improved communication	39	
Quality Assurance activity	15	
Additional training	10	
Protocol development	10	
Additional equipment	3	
Improved environment	2	
Improved supervision	2	
Equipment checking protocol	1	
Additional equipment	0.5	
Fatigue alleviation routine	0.5	
Not stated	36	

*Some respondents noted more than one corrective strategy.

Patient 3. Although the patient was assessed in the pre-operative clinic, the ECG was not reviewed pre-operatively. Evidence of myocardial ischaemia led to cancellation of the case on the day of surgery.

Principal contributing factors

The principal contributing factors to all adverse incidents are shown in Table 2; poor assessment of the airway, inadequate evaluation and communication problems were the most common (73% of incidents in total). These groups were subsequently analysed for possible causes.

Poor assessment of the airway ($n = 57$)

The majority of airway problems reported were not anticipated by the anaesthetist concerned. In eight reports there was evidence that the patient was a known 'difficult intubation', and in 15 a difficult airway was suspected. In the majority of cases of a suspected or recognised difficult airway, a 'standard' anaesthetic technique was used rather than one more appropriate for this situation. Planned use of awake fiberoptic intubation was uncommon.

In the group in which airway problems were not anticipated, the airway was either not obviously difficult ($n = 18$) (such as Mallampati class 3 or 4, limited mouth opening) or was assessed poorly ($n = 16$). The two most common reasons cited were limited time for assessment between cases and/or pressure from the surgeons to proceed. Two cases warrant brief discussion. In the first, the pre-operative examination of the patient failed to identify the presence of dental bands that prevented adequate mouth opening for laryngoscopy; their removal allowed easy intubation. In the second, patient problems in positioning the head of a female patient with her hair

tied in a 'bun' led to a very difficult laryngoscopy (her head could not be extended at the atlanto-axial joint).

Poor communication (n = 46)

Difficulties in communication arose because of language problems, requirements for interpreters, poor communication of anaesthetic and/or surgical plans and problems with patients not providing relevant information. Deficiencies in written notes in medical records and charts were the most common cause of breakdown in communication. Patients commonly failed to mention important information to the health professionals (e.g. warfarin usage prior to regional blockade, a history of symptomatic supraventricular tachycardia in a child, inadequate fasting prior to surgery). An obese patient managed with a laryngeal mask delivered a baby 3 days later; her pregnant state was not mentioned to the anaesthetist. A patient developed bronchospasm following the administration of a nonsteroidal anti-inflammatory drug. Specific questions had failed to elicit her asthmatic state, although she finally admitted to being an asthmatic on subsequent questioning.

Several reports reflected problems with communicating instructions between different groups within the operating room and pre-admission area. For example this resulted in the insertion of an epidural into the wrong patient and in another case, pre-admission for optimisation of a medical condition did not occur and the patient presented on the morning of surgery.

Inadequate evaluation (n = 42)

The areas in which problems were not detected are listed in Table 3. Inaccurate assessment of the respiratory and cardiovascular systems was responsible for the majority of these incidents. For example a 19-year-old patient presented in the operating room with an abnormal ECG. Clinical examination revealed a very loud murmur that had not been detected on pre-operative examination. In another patient an ECG was not performed in a patient with documented ischaemic heart disease. The anaesthetist decided to proceed without a pre-operative ECG and the patient subsequently developed bradycardia followed by ventricular tachycardia. A patient with suspected ischaemic heart disease and valvular pathology was a late addition to the operating room list. No investigations were performed as a result of 'pressure to proceed' from the surgeons and the patient developed intra-operative ST segment changes on the ECG.

Discussion

The importance of an adequate and comprehensive pre-operative evaluation has been recently emphasised in the Australian 1994–96 triennial report into anaesthetic

related peri-operative deaths [1]; inadequate pre-operative assessment and management was implicated in 53 of the 135 deaths attributable to anaesthesia. A recently released report from the Victorian Consultative Committee on anaesthesia-related mortality indicated that problems associated with pre-operative assessment were implicated in 18 out of 43 deaths in Victoria, Australia [2]. An earlier analysis of the first 2000 reports to AIMS showed a six-fold increase in mortality in patients who had an inadequate pre-operative assessment compared to those who had been thoroughly assessed [3].

Almost one in 10 of the first 6000 incidents reported to AIMS listed inadequate preparation/evaluation as a contributing factor, and specific identifiable problems leading to an incident made up 3% of reports. These incidents occurred over the whole range of surgical specialties and ASA grades and were not confined to emergency patients nor those with multiple comorbidities.

Logistic problems may preclude pre-operative assessment in some patients prior to arrival in the operating theatre. However, half the reports with no assessment at all were in elective patients. This is contrary to the guidelines of most anaesthetic colleges and societies. Reasons commonly cited included: pressure of time, pressure from surgeons to proceed, late addition of patients to operating lists, changes in the order of operating lists and patients arriving late for surgery.

In almost one in four cases the anaesthetist who provided the pre-operative assessment did not administer the anaesthetic. This pattern of assessment is increasingly common with the introduction of pre-admission clinics for elective surgery.

The three most common contributing factors to the most serious incidents merit further discussion.

Inadequate airway assessment is of particular concern, as it is widely accepted that a proper assessment is a mainstay of safe anaesthetic practice. Most of the problems with airways or intubation were not anticipated. In addition, in many instances the anaesthetist performing the pre-operative assessment was not the practitioner involved with the case. Subsequent evaluation of the airway revealed some feature (e.g. short fat neck, micrognathia, limited neck mobility) known to predispose to airway problems.

In some cases there was clear evidence in the medical record that there had been a previous problem with intubation, yet the anaesthetic technique did not appear to have been adapted. There appeared to be a reluctance to perform awake fiberoptic intubations. This may reflect opinion that equates fiberoptic intubation with 'seriously difficult intubations' or may be indicative of inadequate training in this area. There were also cases where a

difficult airway was suspected, but a fiberoptic scope was not available.

Communication problems were central to most of the reported incidents. Medical records were not always available to the anaesthetist at the time of surgery. Even when records are available, all relevant information may be difficult to access and some, including results of clinical investigations, may be lost, mislaid or misfiled. Paper systems are very prone to these problems. Electronic data collection and transferral, though potentially more efficient, is not in widespread use. Where it is available, software incompatibility, both intra- and interhospital, may create difficulties. Communication problems led to planned processes (or pathways) not being followed.

The hospital environment is complex, with numerous departmental interfaces. Communication problems can arise between and within groups such as medical and nursing staff, patients and their relatives or friends and referring doctors. Where communication is difficult, interpreters should be available and time must be set aside to elicit information.

A major component of pre-operative assessment evaluates the overall clinical status of the patient and frequently involves planning the management of complex medical problems over the peri-operative period. Inadequate evaluation and planning, particularly with respect to respiratory and cardiovascular problems, contributed to several incidents. There were deficiencies in the performance of both the surgical or medical team and the anaesthetist.

Since well over half of the incidents were considered preventable, strategies to minimise these deficiencies are needed. The development of clear protocols and guidelines for pre-operative assessment, investigations and drug management would minimise confusion and reduce the potential for making poorly informed decisions. Formalising the assessment of the airway and recording the findings on the anaesthetic chart or pre-assessment form would identify more airway problems. This could include the Mallampati classification, thyromental distance, inter-incisor depth, neck mobility, neck length and size, and dental survey. Potential difficult intubations should be clearly documented on the anaesthetic chart and also the operating list to ensure all operating room personnel are aware of this possibility. Pre-operative instructions for patients should be issued in writing and verbally and complemented by newer methods such as information

videos. Anaesthetists must recognise they are responsible for the overall clinical management of the patient rather than simply providing a technical service. The ability to diagnose, evaluate and manage medical problems is no longer the sole responsibility of physicians, especially when there are implications for anaesthesia.

The implementation of these proposals requires considerable funding and management. The development of explicit assessment and planning should be supported by current best practice guidelines based on reliable evidence. Evidence based decision trees could be used to produce a comprehensive yet individual management plan for each patient. This plan can then be discussed with the patient pre-operatively so that the final version includes patient preference.

This study of pre-operative management of patients has highlighted several deficiencies in the process. By focusing on key areas such as improvements in airway assessment, patient medical evaluation and communication, it is hoped that the number of incidents associated with this phase of anaesthetic management can be reduced.

Acknowledgments

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References

- 1 Davis NJ, ed. *Anaesthesia Related Mortality in Australia 1994–1996*. Melbourne: Capitol Press, 1999.
- 2 Mackay P, ed. *Seventh Report of the Victorian Consultative Committee on Anaesthesia-related Morbidity and Mortality*. Victorian Government Press, 1999.
- 3 Runciman WB, Webb RK. *Australian Society of Anaesthetists Newsletter* 1994; **94**: 15–7.
- 4 Runciman WB, Webb RK, Klepper ID, Williamson JA, Barker L. Crisis management – validation of an algorithm by analysis of 2000 incident reports. *Anaesthesia and Intensive Care* 1993; **21**: 579–92.
- 5 Sinclair M, Simmons S, Cyna A. Incidents in obstetric anaesthesia and analgesia: an analysis of 5000 AIMS reports. *Anaesthesia and Intensive Care* 1999; **27**: 275–81.
- 6 Kluger MT, Bukofzer M, Bullock M. Anaesthesia assistants: their role in the development and resolution of anaesthetic incidents. *Anaesthesia and Intensive Care* 1999; **27**: 269–74.