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Editorial

Iatrogenic Harm and Anaesthesia in Australia

At the time of publication of this editorial, it will have been almost exactly 10 years since Carmen Lawrence, then Federal Minister for Health, prematurely released the results of the Quality in Australian Health Care Study (QAHCS) in Federal Parliament on 1 June 1995[1]. This study has engendered considerable interest and comment, as reflected by the fact that the formal publication of the results, in the *Medical Journal of Australia* some months later[2], already ranks amongst its 10 most cited papers in its 90 year existence[3].

The frequency with which patients in Australia were being harmed by health care surprised everyone, including the investigators. Of particular concern was the fact that an ostensibly identical study, also on 15,000 admissions in 1992, but of American rather than Australian medical records, showed that the rate of iatrogenic harm was five times greater in Australia (16.6%)[2] than the U.S.A. (3.4%)[4]. However, a re-analysis of the data from both studies carried out by the Harvard School of Public Health and the Australian Patient Safety Foundation (APSF), showed that the rates for both countries are most likely around the 10 to 12% mark[5,6], a rate confirmed now in several other countries[7-10].

The medical profession was understandably angry 10 years ago when it was "ambushed" by the results of QAHCS study, when few even knew it was being carried out. Virtually the only specialty which received positive acclaim was anaesthesia[11]. Nearly half of the adverse events (48%) were attributed to surgery, whereas anaesthesia was implicated in only 2%, and these were associated with less disability, no deaths and fewer additional days in hospital (3 versus 7).

That anaesthetists in Australia should have emerged so well is perhaps not surprising. Anaesthetists worldwide have been involved in systematic studies of iatrogenic harm, with a view to its prevention, since the first Hyderabad Chloroform Commission in 1888[12]. Australia was the first country in the world to collect and study all anaesthetic deaths on an ongoing basis, starting with the New South Wales Ministerial Committee for investigating anaesthesia-related deaths in 1960[13]. Australia was also the first country to set up a national anaesthesia incident monitoring system (AIMS) in 1988[14]. The Australian and New Zealand College of Anaesthetists has effectively set national standards for many years by publishing over 50 "guidelines". By 1992, the year from which the medical records were drawn for the QAHCS, the use of both oximetry and capnography for every anaesthetized patient had effectively been mandated in Australia and New Zealand. Data from the AIMS study had shown that more than half of all anaesthesia incidents are first detected by a monitor, and that over 90% of these would be detected by the combined use of oximetry and capnography[15]. This had a major influence on the international standards for anaesthesia safety, endorsed by the World Federation of Societies of Anaesthesiologists in 1994, which recommended that oximeters and capnographs be purchased before plenum anaesthetic machines[16].

Now that the QAHCS is 10 years old, AIMS is 17 years old and Mortality Reviews are nearing the half century mark, it is worth taking stock with respect to what we know, and what we need to do, to maintain and further enhance the safety of anaesthesia. There are some recent analyses of things that go wrong with anaesthesia in Australia. In this issue there is an article reviewing over 1,200 adverse anaesthesia outcomes reported to a medical defence organisation (MDO) over a five-year-period[17], and this month, the journal *Quality and Safety in Health Care* will publish 26 articles on crisis management in anaesthesia, which are based on an analysis of 4,000 AIMS incidents collected over about a five-year period[18]. The latest review of anaesthesia mortality in Australia was published in 2002[19], and there is the information from the QAHCS[2].

WHAT DO WE KNOW?

Although the QAHCS events occurred in 1992, they are worth summarizing as this is the only information with some epidemiological validity about the relative frequency of what goes wrong in anaesthesia, albeit from a sample of only 15,000 records. Just over half of the 48 anaesthesia-related events could be classified into just three categories. Postoperative nausea and vomiting accounted for over a quarter; these were cases of unplanned overnight admission after day surgery. Accidental dural puncture during placement of an epidural catheter in labour and laryngospasm/aspiration together accounted for another quarter. The next most common categories were delayed recovery and neurological problems

(including one dense hemiplegia) and then there were two cases each of trauma due to intubation, corneal abrasion, problems arising from local anaesthesia, postoperative hypotension and postoperative cardiac arrest. There was one case of delayed transfer to theatre and one case of intra-operative dysrhythmia.

What of the 1,200 medicolegal reports and 4,000 incidents? Although the data are only very roughly comparable, Table 1 shows a comparison of the yields from these studies. Events in seven of the ten categories in Table 1 were found by the QAHCS. The classification used for mortality review does not allow comparison with QAHCS or the data in Table 1[19].

TABLE 1

*Types of anaesthesia-related iatrogenic outcomes reported to an MDO and of incidents reported to AIMS, ranked by the number of reports to an MDO**

Type of Event	Reports to MDO**		Reports to AIMS**	
	n=1231		n=4000	
	No.	%	No.	%
Airway instrumentation injuries	261	21	8	0.2
Problems with epidurals/spinals	218	18	189	5
Respiratory problems	83	7	1276	32
Awareness	82	7	41	1.0
Nerve injuries	56	5	–	–
Eye injuries/problem	55	5	6	0.2
Vascular catheter complications	49	4	128	3
Other nerve block problems	37	3	35	0.9
Cardiac arrest#	27	2	25	0.6
Allergic reactions†	25	2	148	4

* Another study of medicolegal reports in Australia had similar results, with the first two categories also making up 39%, and with 5 of the remaining 8 categories being represented in the top 10[20].

** Reports could be classified into more than one category in both studies.

\# There were substantially more deaths and brain injuries than cardiac arrests in both studies.

† There were substantially more problems with drugs other than allergic reactions, but the categories were not comparable between the studies.

Airway instrumentation injuries make up 20 to 30% of all reports to MDOs, but represent only 1 to 2% of payouts[17,20]. There are only a few incident reports, as both cause and remedy are obvious. All reasonable claims should simply be paid out.

Problems with epidurals and spinals make up nearly one in five reports to MDOs but account for over 50% of payouts. The problems range from inadequate anaesthesia, especially in obstetrics, where they are often the sole form of anaesthesia, to serious neurological injury and circulatory collapse. They also make up 11% of incidents reported to AIMS. Although nearly half of these problems could be handled by a "core" generic crisis management algorithm, the remainder would require a specific subalgorithm for regional anaesthesia[18]. It is important to note that over 50 types of problems were encountered, emphasising the difficulty in working from first principles in a crisis, and the need for the use of "precompiled responses". That there were six deaths amongst these incidents emphasises the need for effective crisis management[18]. It is noteworthy that the classification used for mortality review does not identify the use of regional anaesthesia as distinct from general anaesthesia[19]. Hence, awareness of the diversity, severity and cost of the problems associated with regional anaesthesia has not been as high as might have been desirable. This is one important "take home message". The problems associated with regional anaesthesia, and how to deal with them, merit a definitive review.

Respiratory problems made up only 7% of medicolegal reports, but 32% of the incidents reported to AIMS. This indicates that problems with the airway and breathing still command considerable attention from the anaesthetist, but are generally well dealt with. Of major significance is the fact that hypoxic brain damage and death resulting from problems with ventilation, such as circuit disconnection, and from undetected oesophageal intubation, have for practical purposes been eliminated from anaesthesia in Australia, although these were major sources of morbidity, mortality and litigation world-wide prior to 1990[21]. Of the eleven AIMS cardiac arrests which were attributed purely to anaesthetic technique (of the 129 reported), six involved hypoxia due to problems with ventilation, but all eleven patients left the hospital well[22].

Problems with airway management remain the main challenge. These are not shown in Table 1, as they were not separately identified in the MDO analysis. There were 166 difficult intubations amongst the AIMS reports, half of which were not predicted. In 23 cases it was also difficult to ventilate with a face mask; 12 patients required emergency airway procedures[18]. There were three cases of brain damage from airway problems in the medicolegal reports, and in the AIMS series there was one cardiac arrest from laryngospasm, three cardiac arrests and a death from airway obstruction and four deaths due to aspiration[18].

A breakdown of the major categories of respiratory problems in the two studies is shown in Table 2. It is important to note that the medicolegal reports contain too few examples of each of the problems, with the possible exception of aspiration, to gain a comprehensive picture of the nature of the problems and their contributing and minimizing factors. More information is needed to devise corrective strategies.

TABLE 2
Types of respiratory problems reported to an MDO and AIMS ranked by number of reports to an MDO

Type of Event	Number—MDO	Number—AIMS
Aspiration	33	98
Airway obstruction	9	62
Pulmonary oedema	6	35
Respiratory arrest/failure	8	21
Laryngospasm	5	189
Pneumothorax	5	24
Pneumonia/atelectasis	6	11
Bronchospasm	2	103
Hypoxia	2	584

This is the second important "take home message" and will be discussed below.

One quarter of the medicolegal reports of awareness and one half of those to AIMS involved awake paralysis before induction. Half of the remainder could have been avoided by simple checking and "scanning" procedures and the use of volatile agent monitors.

Nerve injuries from both general and regional anaesthesia provide a significant medicolegal caseload, but are not represented in the AIMS report as they manifest only after the anaesthesia process has been completed.

Discussion of the remaining problems is beyond the scope of this paper, but the important fact to note in Table 1 is that there are fewer than 60 cases in each category for the medicolegal reports and in three of these categories for the AIMS reports, even though these represent some of the most commonly encountered problems. When these categories are further subdivided into clinically useful entities, as was done for respiratory problems in Table 2, there are only a few examples of most problems. This precludes characterizing them in sufficient detail to allow the reliable development of preventive strategies. Mortality reviews and medical record reviews, likewise, provide insufficient examples of the problems to characterize them.

WHAT SHOULD WE DO?

Maintaining and improving the safety of anaesthesia is a challenge that requires eternal vigilance and relentless attention. With each advance, there are new opportunities for things to go wrong in unforeseen and sometimes unforeseeable ways. An illustrative case in which a competent, experienced anaesthetist was charged with manslaughter after a hypoxic brain death in a teenager introduces the series of papers on crisis management during anaesthesia[18]. A filter, introduced to prevent cross-infection, blocked during resuscitation and compromised ventilation due to becoming encrusted with dried pulmonary oedema froth. The problem, which evolved from a patient problem (negative pressure pulmonary oedema) to a previously unreported equipment problem (a blocked filter), both manifesting as difficulty with ventilation, is a classic example of a complex case in which the use of "pre-compiled responses" might have been the only way to ensure that the right things were done in the right sequence. However, this would have required the latest information to be available, to have been incorporated into such a response, and for the response to have been disseminated.

New problems during anaesthesia are now sufficiently rare to render prospective data collection too inefficient for routine use—a ubiquitous electronic record for all anaesthetics is still some time away. However, there is a wealth of information in existing collections of things that go wrong as long as it is collated and classified in a useful, accessible form. Sources include reports to MDOs, incident reports, sentinel events, root cause analyses, coronial recommendations, complaints, audits and reviews of mortality and morbidity. A comprehensive suite of software tools for collecting, classifying and analysing this information has been developed by the APSF to allow it to be available on-line in a national or international repository. This suite of tools has been recommended in a report by the Institute of Medicine of the American Academy of Sciences as part of a national incident reporting system for the U.S.A.[23]. Information is elicited using interactive computer screens which have intuitively arranged cascades of questions, allowing deconstruction of each event, rapid comprehensive extraction of information and its storage in over 1.5 million categories. No new data collection is needed at source—just proper collation, classification and analysis. This system also has the means for tracking the process of dealing with the problems identified, for constructing risk registers, and for disseminating alerts and warnings.

The Australian Council for Safety and Quality in Healthcare is now in the fifth year of its existence, and although it has resolved to have a standard classification and a national repository of such information, progress has been slow with little impact on practising clinicians. The major internationally acknowledged successes in patient safety in anaesthesia—such as the virtual disappearance of hypoxic brain damage and death from inadequate ventilation—have been achieved by the actions of practicing anaesthetists, not by bureaucrat fiat. We have the information sources and the means for deconstructing, collating and analysing the information of rele-

vance to anaesthetists. There are great opportunities for anaesthetists to enhance the safety of their patients not only during the actual process of anaesthesia, but well into the postoperative period. Over 14% of all the adverse events in the QAHCS are amenable to management according to best practice at the time of pre-operative assessment and planning[24]. Initiatives in anaesthesia will not come from "government", but will need driving as part of the professional responsibility of practising anaesthetists. Clinicians set the standards which paved the way for some major advances in patient safety 15 years ago[25], and the College ensured they were adhered to. It is time to again assert control over how we practise and ensure that all the best evidence and available information we need to enhance the safety of anaesthesia is collated and made available, so that practical tools can be developed to allow all anaesthetists to ensure that their patients are as safe as the most recent knowledge allows.

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Conflict of Interest: Professor Runciman is President of the APSF, a not-for-profit research organisation. He is on the Board and has a financial interest in Patient Safety International, the for-profit subsidiary of APSF which markets the AIMS software.

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