

Patient safety in anaesthesia

Introduction

In 1998, 100,000 deaths in the United States of America were attributable to medical error. Seventy percent were deemed to have been avoidable^[1].

Anaesthesia is recognised as being at the forefront of patient safety^[2]. It is a medical specialty in which patients, who may be fit and well, are exposed to varying degrees of risk from different sources, such as medications and procedures^[3]. The well-known maxim 'primum non nocere' (first, do no harm) is used to emphasise the need to weigh up risks against benefits for any intervention or procedure. Although relevant to all specialties, this is especially pertinent to anaesthesia which, of itself, yields no therapeutic benefit. As the largest hospital specialty in the National Health Service (NHS), acknowledged for its association with a range of hazards, anaesthetists aspire to a safety culture not dissimilar to that found in other high-risk professions such as aviation^[4,5]. Numerous comparisons have been drawn between them, owing to the similarly unacceptable nature of actual or potential harm. In addition to an inherent desire to reduce the likelihood of negative outcomes, the economic impact of errors should also be considered. Litigation related specifically to medication errors alone in anaesthesia over a twelve year period cost the National Health Service (NHS) nearly £5 million^[6].

In order to understand the patient safety issues being faced in anaesthesia, it is helpful to classify causes of error into human factors, equipment and organisational or system issues.

Human factors

Elaine Bromiley, a 37-year-old, was listed for routine sinus surgery in 2005^[7,8]. Following induction of anaesthesia, multiple attempts to secure her airway and to provide mask ventilation failed. Such a situation, known as 'can't intubate, can't ventilate', should have led to a well-rehearsed drill culminating in cricothyroidotomy. However, fixation on the task of intubation led three consultants to disregard the overarching requirement to ventilate the patient. Nursing staff

recognised this, but felt unable to express their concerns sufficiently forcefully. This allowed Mrs Bromiley to become severely hypoxic for a period of up to twenty minutes and, ultimately, resulted in her death^[9].

Human factors in patient safety are those which are attributable to the individual^[5,10], and may be classified as either technical skills or non-technical skills (NTS)^[11]. Technical skills, such as intubation or central venous access, are taught and assessed, with procedural competency forming a major part of anaesthesia training. Equally important, but less well-recognised, are the non-technical skills, including situational awareness, decision-making, leadership, teamwork and communication^[5] which are vital components of an effective response to difficult clinical scenarios. The anaesthetist's non-technical skills (ANTS) system was devised in 1999 to allow NTS to be formally assessed^[12]. Many aspects of ANTS are mentioned by the Royal College of Anaesthetists (RCoA) as part of the programme for the certificate of completion of training in anaesthesia^[13].

Adapted from Crew Resource Management (CRM)^[4,5] techniques seen in aviation training, Anesthesia Crisis Resource Management (ACRM) has been used alongside simulation training and assessment of anaesthetists^[14,15]. There is currently no definitive proof of the efficacy of simulation compared with less active, didactic teaching methods, and it is accepted that simulators are costly and can never fully replicate real-life scenarios^[14,16]. However, the exceptional safety records of industries which use CRM provide a compelling motive to emulate their training methods.

Standard operating procedures (SOPs), another concept used in aviation, are transferable to medicine^[5]. When implemented appropriately, SOPs provide trainees with evidence-based protocols to follow in specific situations, such as failed intubation. However, their purpose is to assist safe practice, not to take precedence over the clinical judgement of an experienced anaesthetist.

In 2000, James Reason described different methods of studying error^[10]: the person approach and the system approach. Whilst seeking to assign blame to individuals

may seem the most obvious way of analysing incidents, it prevents consideration of the context in which they occurred, thus lessening the positive impact to be gleaned from their scrutiny. The system approach aims to determine why certain circumstances lead to mistakes and how they can be overcome. The 'Swiss cheese model' demonstrates how defects in several defensive layers, such as hospital protocols, equipment alarm systems and optimal team performance, occurring in synergy, engender adverse events^[10]. Failings may be due to active errors or latent conditions^[10,17]. Latent risk factors encompass environmental issues such as equipment design and maintenance, communication, planning and teamwork^[17]. This model has been adapted as the 'Health Care Error Proliferation Model'^[18], taking into consideration aspects of health care which can precipitate unsafe working conditions.

Although human error may be difficult to accept, focusing on it as the single cause of adverse outcomes is futile. Recognising that it is inevitable, and a certain level must be anticipated and tolerated, may prove more expedient. This approach necessitates the search for new ways to improve the strength of other defences within the system itself, thereby minimising the impact of these errors.

Equipment

Wayne Jowett, an 18 year old in remission from acute lymphoblastic leukaemia, was to receive chemotherapy as part of the maintenance phase of his treatment in January 2001^[19]. He was wrongly given intrathecal vincristine, a drug which should only be used intravenously, and died as a result. The official report that followed^[20] indicated that a combination of factors including human error, communication failure and the design flaws of a universal Luer connector led to his death. Considerable media coverage of this incident generated a great deal of interest in the topic of procedural and equipment safety relating to drug administration. Following this, minibags were introduced for intravenous vinca alkaloids^[21].

Wrong-route drug errors have been a longstanding issue^[22], with the first death from accidental administration of intrathecal vincristine in 1968^[19]. A number of deaths

have also resulted from enteral feeds and epidural local anaesthetics given intravenously^[23]. Safety alerts released by the National Patient Safety Agency (NPSA) resulted in the introduction of purple reverse-Luer connectors for nasogastric tubes throughout the NHS, which has proved very successful^[24]. In April 2009, wrong-route chemotherapy was included in a list of eight ‘Never Events’ produced by the NPSA^[25]. Such an event is defined as ‘a serious, largely preventable patient safety incident that should not occur if the available preventative measures have been implemented by healthcare providers’^[25,26].

The NPSA released an alert on safer spinal (intrathecal), epidural and regional devices in November 2009^[21]. It proposed the introduction of devices with connectors incompatible with intravenous equipment, in stages, from early 2011. Luer connectors should be eliminated from equipment used for intrathecal boluses and lumbar puncture samples by 1 April 2011^[27]. The purpose of this initiative is to make wrong-route neuraxial drug administration physically impossible^[28].

Safety in anaesthesia has developed alongside advances in equipment and technology. The availability of real-time monitoring of patients enables anaesthetists to anticipate and identify problems more rapidly, and the addition of equipment, such as fiberoptic laryngoscopy, allows potential problems to be avoided^[2]. However, introducing new equipment requires sufficient training to ensure appropriate use. Additionally, having access to and using monitoring equipment is no substitute for the expertise required to make sense of the information it provides^[29].

Organisation

Ms D was listed for endoscopic carpal tunnel surgery in her right wrist, under general anaesthetic^[30]. On the day of her operation, another patient (Ms C), scheduled immediately before her, was removed from the list. Ms C had been listed for open release surgery on her left hand. Failure to ensure that theatre staff were aware of this change, together with inadequate patient identity checks, led to the surgeon commencing the incorrect procedure on Ms D. Despite the surgeon being alerted to this error, and the operation stopped at an early stage, Ms D was left with painful

scarring. Adequate patient checks, marking of surgical sites and effective communication should be routine, preventing incidents of wrong-site surgery^[31,32].

This is another example of a patient safety incident included on the core list of Never Events^[32].

In addition to human factors and problems with drugs and equipment, a culture of safety is influenced by the systems, or environment, surrounding them^[33]. In 2000, the Department of Health produced a report on systematic failure and ways of documenting and learning from mistakes. ‘An organisation with a memory’^[34] identified key objectives for quality improvement, including the need for a unified reporting and analysis system, an open reporting culture, and adoption of a systems approach rather than focusing on the individual. However, this should not remove accountability from those responsible for error. The idea of learning from mistakes is not new in medicine: the Centre for Maternal and Child Enquiries (CMACE) began as CEMD more than fifty years ago^[35] and as a result, anaesthesia for caesarean section, the majority of which is provided by neuraxial blockade, is more than thirty times safer now than in the 1960s, when the majority were performed under general anaesthesia^[36].

In order to understand the scale and nature of the issue of patient safety, a reliable system of collecting data is required, allowing incidents to be properly monitored and lessons to be learned. The notion of critical incident reporting in anaesthesia was adapted from aviation by Cooper^[37], following the example of high-reliability organisations operating non-punitive methods of accounting for adverse events^[5,38]. This was introduced in the NHS by the NPSA (formed in 2001), which developed the National Reporting and Learning System (NRLS), at a cost of more than £5 million^[39], with the intention of capturing data on shortcomings in the healthcare system. It was to become the first comprehensive reporting system of its kind^[40], collecting and categorising over 12,000 incidents in anaesthesia between 2004 and 2006^[39].

The Safe Anaesthesia Liaison Group (SALG)^[41], consisting of members from the RCoA, the Association of Anaesthetists of Great Britain and Ireland (AAGBI) and

the NPSA, was founded to analyse the data and produce anonymised reports to be made available to practitioners^[42,43]. Regular alerts, similar to the ‘glossies’ produced by the AAGBI, inform practitioners of notable incidents^[44]. Recurrent incidents can be investigated using root cause analysis to facilitate the formulation of recommendations. In November 2009, the NPSA launched the anaesthesia e-reporting system^[45,46], making the rapid reporting of specialty-specific incidents more readily accessible.

The World Health Organization (WHO) created a surgical safety checklist^[47] in 2008, as part of the ‘Safe Surgery Saves Lives’ campaign, and subsequently demonstrated a reduction in complications^[48]. This was adapted by the NPSA for use in England and Wales, as part of the two-year project ‘Improvement through partnership’ in collaboration with the RCoA^[49,50]. The rationale behind the checklist is to encourage open communication within operating theatre teams, including anaesthetists, surgeons, nurses and operating department practitioners (ODPs).

Another part of the ‘Improvement through partnership’ project was a recent study into potential methods of confirming drugs in anaesthesia^[51]. Two different techniques were used: double-checking with a second person, both when drawing up a drug and prior to administration, and the use of bar codes and electronic readers which, when the bar code is scanned, ‘speaks’ the drug details out loud. Results have been favourable for both, with the risk of drug errors reduced^[52]. The electronic barcode method appeared to be more acceptable as it was less time-consuming, but implementing the system nationally could prove challenging and costly.

The role of anaesthetists in promoting patient safety was recognised in the Helsinki Declaration on Patient Safety in Anaesthesiology^[53], in June 2010. This endorsed a range of principles, including compliance with standards expected of anaesthetists by the European Board of Anaesthesiology (EBA)^[54], the use of the WHO surgical safety checklist and the systematic collection of data which contributes to critical incident reporting systems.

It is also the remit of the anaesthetist to identify those who are at increased risk of complications, such as patients with underlying cardiorespiratory disease, through

pre-operative assessment^[55,56]. Anaesthetists, in collaboration with surgeons and primary care teams, are in an ideal position to make judgements about peri-operative risk. This enables them to obviate potential difficulties through careful planning of optimal intra-operative and post-operative care^[55].

Conclusion

Anaesthetists are instrumental in driving forward the patient safety agenda. Incident reporting systems provide ideal opportunities to learn from the mistakes of others, whether classed as actual incidents or, more frequently, near misses. Non-events are a vital resource from which clinicians can reflect upon their own practice.

As both frequency and quality of incident reporting improves, patient safety data will become more reliable and more beneficial to anaesthetists as learning opportunities. Most significant is the drive to improve the detail documented for each incident, rather than the number of reports. This would enable better pattern recognition for the causation of undesirable events.

Human factors are often contributory in safety incidents. The performance of individuals can be maximised by practising technical skills and emergency drills using manikins in complex simulations before they are required in real patient care. Video recording, debriefing and emphasising the value of teamwork encourages reflection and active learning. In future there may be compulsory formal assessment of both the technical and non-technical skills of trainee anaesthetists and, potentially, as part of revalidation throughout a doctor's career.

However, it must be accepted that a degree of human error is inevitable, since humans are fallible. Acknowledging this encourages the search for improved equipment and systems to minimise the impact of these errors. Such technological advances may prove controversial and costly to implement, while ultimately being very effective.

The introduction of new medical practices and changes to culture is often regarded negatively. Despite the evidence supporting the efficacy of checklists in improving patient safety, they may be seen, by some, as simply additional bureaucracy rather

than a beneficial development. It is essential to ensure that such systems are streamlined to ensure more ready acceptance, then made mandatory.

There has been a noticeable shift in the management of patient safety from a reactionary to a more proactive approach, both in anaesthesia and in healthcare as a whole. Previous reports on quality of care have identified areas of systematic or organisational weakness, many of which have seen improvement. However, there is still a great deal which can be done to create a safety culture, as demonstrated by other high-reliability organisations.

Medical care is complex, with several factors usually contributing to a single adverse event. It is therefore imperative to continue to develop the best performing individuals, using appropriate quality equipment, within an organisation which supports their safe practice.

In July 2010, a government white paper outlined plans to abolish arms length bodies, including the NPSA^[57,58]. The future structure of incident reporting and the timeline for the implementation of these changes is not yet certain.

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