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EDITORIAL

150 years of anaesthesia—a long way to perioperative medicine: the modern role of the anaesthesiologist

The term 'anaesthesia', implying insensitivity to touch and therefore to surgical trauma, was suggested by Oliver Wendell Holmes, a Boston anatomist and famous author, in a letter to William Thomas Morton. Morton was the first to demonstrate, in 1846, the administration of ether for surgical operations. Shortly after that event, John Colins Warren, the distinguished surgeon who performed the first operation with ether in Boston, wrote 'I think it probable . . . that so powerful an agent may produce other and even alarming effects. I therefore would recommend that it should never be employed except under the inspection of a judicious and competent person'. This introduction of surgical anaesthesia was the first major impetus that allowed surgery subsequently to flourish and expand; none of the recent advances in a wide range of surgical practice would have been possible without the benefits of anaesthesia.

Administration of ether and chloroform was undertaken many years ago by a variety of physicians. However, in the intervening period, the complexity of anaesthesia and the extensive specialist knowledge required, particularly in applied physiology and pharmacology, has led to the formation of anaesthesia as an independent specialty in medicine. Furthermore, the skills and knowledge required in the practice of anaesthesia have led anaesthetists to extend their sphere of influence outside the operating theatre, and anaesthetists (or anaesthesiologists) no longer confine themselves to activities relating solely to surgical anaesthesia. It is appropriate, therefore, to describe the training undertaken by modern anaesthetists and the skills they may be expected to possess.

The training of anaesthetists today often takes place in two phases: general training and subspecialty training. In Europe, the period of general training occupies a period of not less than 5 years and equips the anaesthetist to:

1 provide surgical anaesthesia and perioperative care for all surgical specialties;
2 provide all forms of anaesthesia and analgesia in obstetric practice;
3 provide an acute pain relief service after all types of surgery (although this is part of standard perioperative care, special provision and specialist techniques are required after major forms of surgery);
4 be involved in intensive care services.
5 play an essential role in the multispecialty services required for emergency medicine.

However, after the standard 5-year period of training in anaesthesiology, many may pursue 1 or 2 years of further training in order to undertake subspecialty training and obtain special experience in:

1 intensive care medicine at the level required to become a director of a large regional or multispecialty intensive care unit;
2 comprehensive pain management, which embraces not only all forms of acute pain, but also chronic intractable pain and cancer pain.

Fortunately, serious complications and death resulting directly from anaesthesia are relatively uncommon. Over the past 50 years, the rate of both morbidity and mortality has declined dramatically, despite a progressive increase in both the complexity of surgery and also the magnitude of the medical problems from which patients may suffer. Today, we anaesthetize many patients who would have been rejected as being unfit for anaesthesia 20–30 years ago because they were either too old or suffering from severe medical disease. The reasons for the decline in anaesthetic morbidity and mortality are partly related to improvements in the drugs available to the

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Correspondence: Dr H. Van Aken.

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anaesthetist but are mostly the result of enhanced skills, improved training and the setting of standards of practice. Forty years ago, the mortality related to anaesthesia was 3 per 10 000 administrations of anaesthesia, 10 years ago 1 per 10 000 and, today, it has declined to 1 per 250 000 anaesthetics [1–5].

Although anaesthesia is now generally regarded as safe, it is still the objective of anaesthetists to reduce even further the present, very low, mortality rate associated with anaesthesia. In 1948, Sir Robert MacIntosh wrote 'no patient has to die of anaesthesia', and that goal still remains as true today, as it did in 1948 [6]. Much effort is being expended at the present time to reduce what were previously thought to be 'unavoidable' causes of anaesthesia-related death by: enhanced training, institution of management protocols and even the development of simulators similar to those used in pilot training, in order to allow anaesthetists to respond appropriately to sudden unexpected emergencies that fortunately now arise very rarely in anaesthetic practice.

In addition to anaesthetic safety, anaesthetists also concentrate their attention on the many undesirable effects of anaesthesia, ranging from those that may be regarded as trivial, e.g. nausea and vomiting, to techniques that have an influence on surgical outcome including, for example, the duration of stay in hospital, surgical infection or even the patency of grafts used in vascular surgery, many of which may be affected by the choice of anaesthetic technique.

The side-effects of anaesthesia, which have been regarded as minor, are often not considered trivial by patients themselves. Many patients list nausea and vomiting as the only complications of their anaesthetic, and these may be severe enough to inhibit early discharge from hospital. In addition, shivering, dizziness and pain are also common after anaesthesia and may be affected by both the anaesthetic and surgical techniques. Considerable research is being undertaken in many anaesthetic departments around the world at the present time, to reduce such 'minor' adverse effects to a minimum.

It is still of great concern that inadequately treated pain remains a common complication after all forms of surgery. Most hospital audits indicate that inadequate pain relief is reported by 13–80% of patients, and even the development of newer synthetic opioids and improved methods of administration of opioids by sophisticated techniques have failed to improve this situation significantly [7]. In addition to striving to improve analgesia from a humanitarian point of view, it is important to provide the best quality pain relief possible, because we know that pain also plays an important role in the pathophysiology of tissue injury and may reduce the rate of recovery from surgical trauma [8,9]. In order to improve the quality of post-operative pain relief, many anaesthetic departments have now established an 'acute pain service'. By improving the logistics and organization of pain relief services, it has been possible to improve the quality of analgesia but, in addition, administration of opioids may be associated with serious side-effects such as respiratory depression, and it is important that a trained and skilled on-call team is available for the recognition and management of serious side-effects produced by analgesic techniques [10].

In addition to producing pain, surgical trauma also produces marked neuroendocrine changes with the release of a variety of mediators such as catecholamines, corticoids, vasopressin, cytokines and endothelial factors, all of which cause an increase in metabolism [8,9]. These mediators can also lead to immunosuppression and multiple organ dysfunction [11]. Many of these changes are implicated in the development of post-operative complications [12,13], and it is important that anaesthetists understand the pathophysiology of the so-called 'stress responses', so that they may attempt to prevent such changes taking place. One method that has been described is the use of continuous epidural analgesia, both in the intraoperative period and also in the post-operative phase. This has been shown to improve post-operative gastrointestinal function after abdominal surgery and improve the patency of vascular grafts and the cardiovascular state of patients who are at a higher risk of developing cardiac complications. It may be important to extend the use of epidural analgesia into the post-operative period for several days [14]. In turn, this demands a higher level of post-operative monitoring by trained nurses, which has lead to the development of high-dependency units in which anaesthetists are heavily involved.

Another vital role of the anaesthetist is in pre-operative evaluation of the patient in order to assess fitness for anaesthesia and surgery. During surgery, it is very important to control stress responses induced

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by surgical stimulation, as these responses may be harmful in many patients. The anaesthetist with the necessary physiological and pharmacological knowledge is well placed to assess how extensive are these responses in an individual patient and how to control them. Thus, it is important that anaesthetists assess the patients preoperatively in order to gain insight into the way in which the patient may respond to surgery and to plan the most appropriate anaesthetic technique for dealing with problems that may arise. Such preoperative evaluation cannot be undertaken by physicians in other specialities. In order to improve the efficiency of evaluation of large numbers of patients, many anaesthetic departments have developed preoperative assessment clinics to which surgeons or physicians refer patients who are at high risk, e.g. those suffering from concomitant lung, heart or metabolic diseases.

The importance of careful preoperative evaluation, tailoring of the anaesthetic to meet the individual patient's medical problems and surgery and appropriate post-operative management of the patient has been well illustrated by clinical investigations. During the last decade, numerous studies have shown that many factors have a decisive influence on post-operative outcome, including the timing of surgery, preoperative preparation of the patients, choice of anaesthetic technique, maintenance of physiological homeostasis and post-operative management including adequate pain therapy [15–18].

It has been shown that not only the technical and intellectual skills of the anaesthetists but also their attitudes are important in patient outcome. Recent studies in the USA have examined patients' recognition of the anaesthetists' role in the perioperative period. It has been shown that, in addition to the quality of the anaesthetist's pre- and post-operative visits, it is the behaviour of the anaesthetic staff and the way in which they deal with patients that is particularly relevant for patient satisfaction [19,20].

Because of their skills in the management of patients undergoing artificial ventilation for major forms of surgery, anaesthetists have always been involved in intensive care units. Over the last few decades, the increasing complexity of patient conditions and the increasing availability of new drugs and highly specialized techniques has lead to intensive care medicine becoming a subspecialty or speciality in many countries in the world. However, in nearly all operative specialities, there has also been a continuous increase in the duration and complexity of surgery, and this has confronted anaesthetists with problems of maintaining physiological homeostasis under continually changing surgical conditions. Thus, the ability of anaesthetists to maintain 'intraoperative intensive care' has extended their ability to keep up to date with the problems inherent in intensive care medicine. Furthermore, it seems logical that intraoperative intensive care, which is started and maintained by anaesthetists, should be continued post-operatively in an intensive care unit headed by an anaesthetist or colleague from another speciality trained with an extensive knowledge in anaesthesiology. Shapiro, in his distinguished lecture to the annual ASA Meeting in Atlanta in 1995 and Rosenthal in an editorial [21] stated that the future of anaesthesiology is inevitably linked with intensive care and with the quality of post-operative care. Such is the complexity of modern intensive care today that it is inevitably a multidisciplinary speciality but, with his basic training, the anaesthesiologist is well placed to undertake a leading role in intensive care medicine.

There are other roles for which the anaesthetist's basic training are well suited; for example, in the prehospital phase of managing traumatized or severely ill patients who require basic resuscitation and in the pre- and in-hospital emergency management of patients requiring cardiopulmonary resuscitation.

From what has been described above, it is clear therefore that anaesthetists play a vital role in the total perioperative management of patients. In response to this extensive involvement of anaesthetists outside the operating theatre, the Department of Anesthesiology of the Medical University of South Carolina has now changed its name to the 'Department of Anesthesia and Perioperative Medicine' [22]. This perioperative integrated role of anaesthesiology demands adjustment in the personnel and organization of departments (establishment of preoperative anaesthesia consultation clinics, appropriate post-operative anaesthesia care units or high-dependency units, acute pain services, obstetric analgesia services, chronic pain services, intensive care units, etc.). The level of training and skills required in anaesthesia are therefore clearly equal in duration and complexity

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with those required for the majority of other specialities in medicine. The days when anaesthetists simply 'put a patient to sleep' ceased several decades ago, and it is now time to recognize fully the speciality of anaesthesia as one embracing total perioperative care.

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H. Van Aken
Klinik und Poliklinik für Anaesthesiologie und operative Intensivmedizin, Westfälische Wilhelms-Universität, Albert-Schweitzer-Str. 33, D-48149 Münster, Germany
D. Thomson
Institut für Anästhesiologie und Intensivbehandlung der Universität, Inselspital, 3010 Berne, Switzerland
G. Smith
University Department of Anaesthesia, Leicester Royal Infirmary, Leicester LE1 5WW, UK
J. Zorab
Holmray Cottage, Park Street, Iron Acton, Bristol BS17 1UJ, UK

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