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Full Length Research Paper

Scientific Communication: Who wants to be an Anaesthesiologist?

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There is great improvement in the practice of anaesthesiology in the 21st century when compared with the past. Anaesthesiology can only be studied after obtaining a medical qualification. The knowledge and appropriate skills are acquired during a specialist or fellowship training programme; while the duration of study may vary from country to country and is programme-specific. The innovations, high monitoring standard and technology available in modern times has made the delivery of anaesthesia to surgical patients very safe. Anaesthesiology remains a stressful medical profession but it provides diverse opportunities. It offers an exceptionally wide career prospect outside the operating room, as well as skills for team management and leadership positions.

Key words: Anaesthesiologist, anaesthesia history, training programme, skills, career diversity.

INTRODUCTION

The development of anaesthesiology as a career has evolved from the days of narcotics or alcohol administration and the use of inhaled nitrous oxide, diethyl ether and chloroform. Today, modern anaesthetic drugs and equipment including anaesthetic machines and ventilators are available to the anaesthesiologist. Balanced techniques using a combination of different pharmacological agents, as well as regional anaesthetic techniques with or without an adjuvant are now available. Therefore, anaesthesiology training is more intense. The scope of work is wider and reflects the anaesthesiologist's soft spot and area of interest. The prospect of anaesthesiology is diverse, influenced by technological developments, as well as surgical sub-specialization. Besides the practice of anaesthesia in the operating room, anaesthesiologists play important roles in pain medicine, critical care medicine, advance life support, as well as, provide the leadership for applying anaesthesia skills and services outside the operating room.

The objectives of this article are 1) to review relevant literature on the history of anaesthesia in order to highlight the past, 2) to briefly present the training programmes in selected parts of the world so as to obtain the requirements for specialization in anaesthesia, 3) to inform anaesthesiologist aspirants of the scope of study and present the general views of anaesthesiologists concerning current practice, 4) to show how technological advancement has influenced anaesthesia and hopefully 5) reflect the diversity of anaesthesia practice without omitting the associated challenges.

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MATERIALS AND METHODS

Published articles for this paper were sourced by using Google scholar for the years 1990 – 2013. Key words used included Anaesthesiologist, training programme, history of anaesthesia, anaesthesia specialization, stress in anaesthesia. The Internet websites for postgraduate training and fellowship programmes were searched for relevant information. In addition, the Internet site for the National Library of Medicine Pub Med (http://www.ncbi.nlm.gov/pubmed) was also searched using the above key words. Bibliographies of the included studies or articles were also searched for additional references (reference dredging).

Past and Present

At the beginning of creation, when God made man (Adam), did he give him some form of anaesthesia to

make him fall into a deep sleep? In the book of Genesis, Adam was said to be unaware when God removed his rib to form Eve, an operation which today can be called "ribectomy". Before becoming a medical specialty, anaesthesia was performed to render a patient unconscious by administering narcotics or alcohol to the patient prior to the operation. Significant progress has been made today when compared with studies documented by Rose (1996) and Wawersik (1998), referring to the days of inhaled nitrous oxide, diethyl ether and chloroform. The drugs used for anaesthesia have expanded to include sedatives, anxiolytics, antiemetics, analgesics, muscle relaxants and reversal agents. With the advancement made with anaesthetic machines and lung ventilation, the prevention of intra operative awareness, commonly associated with lower concentrations of inhalational anaesthetic agents has also become necessary (Avidan and Mashour, 2013). Intra operative awareness was associated with the use of a muscle relaxant (Scott, 1972), whereas as far back as 1950, Winterbottom, in his correspondence, drew attention to insufficient anaesthesia. Indeed, general anaesthesia has become a balanced technique using a combination of pharmacological agents.

The first spinal anaesthesia for surgery in humans was administered by August Karl Gustav Bier in Kiel, Germany, in 1898 (Maltby et al., 2000; Bier, 1899). The use of spinal anaesthesia has increased over the years and the associated risks have reduced with the introduction of appropriately-designed, optimal spinal needles (Arendt et al., 2009; Calthorpe, 2004). Interestingly, the desire to avoid the poly-pharmacy associated with general anaesthesia, while maximizing the simplicity of using one agent that is, the local anaesthetic agent such as bupivacaine and ropivacaine, encouraged the use of spinal anaesthesia. Furthermore, other benefits of regional anaesthetic techniques that facilitated its widespread acceptance include ultrasound guided regional anaesthesia for precision placement of needles and catheters thereby lowering the doses and avoiding possible complications (Gray, 2006; Marhofer and Chan, 2007), the addition of an adjuvant to help prolong or potentiate the overall effect of local anaesthetic agents (Wiles and Nathanson, 2010);as well as, the exploration of new delivery systems for local anaesthetic agents (Shipton, 2011).The next generation of active delivery technologies will be electrical methods such as iontophoresis and electroporation; and also energy related technologies such as sonophoresis and needless injection. Sonophoresis, the application of ultra sound to the skin, increases its permeability and enables the delivery of various substances into and through the skin. Transdermal monitoring and phonophoresis (sonicated transdermal drug transport) promises an attractive alternative to the conventional injection and oral administration of drugs, therefore according to Escober-Chavez et al., (2009), patches may soon become the name of the game.

Training Programme

Presently, anaesthesiologists, also referred to as anaesthetists, are medical doctors, specialized in anaesthesia practice. Therefore, having completed medical school education and the required house job (internship), the anaesthesia training period, referred to as residency, is on the average six years. During this training period, the anaesthetist is expected to increase in knowledge, skills and competency, as well as be successful at the various levels of examinations. Different countries run specific national fellowship or training programmes but may also endorse a regional programme. For example, the fellowship programme in Nigeria, directed by the National Postgraduate Medical College of Nigeria (NPMCN) leads to the award of the Fellowship of the Medical College in Anaesthesia (FMCA). The regional programme, directed by the West African College of Surgeons (WACS), leads to the award of the Fellowship in Anaesthesia of the West African College of Surgeons (FWACS). In the United States, doctors must complete a 4-year intensive residency programme which makes them eligible for board certification by the American Board of Anesthesiology (Strang and Ball, 1996). Whereas, in the United Kingdom, residency is a 7-year programme which consist of two years of core training and five years of higher training. The trainees must pass the required diploma examinations of the Fellowship of the Royal College of Anaesthetists. On completion of specialist training, doctors in the UK are awarded the certificate of completion of training. For some countries such as Canada, Japan and Italy, the training programme is five years; while some spend six years for example, Netherlands and Hong Kong. Overall, the programme is intense irrespective of the country.

The scope of anaesthesiology

The scope of study of the anaesthetist covers anatomy, physiology, pathology, medicine, pharmacology, physics, biotechnology and critical or intensive care. The terrain of the anaesthetist is the operating room (OR) or theatre and ICU (Figures 1 and 2). An ideal OR, in addition to having all that is required for surgery, must have anaesthetic machines, breathing circuits, supply of medical gases, scavenging systems, suction machines, monitors and equipment for resuscitation. The national member societies of the World Federation of Societies of Anaesthesiologists (WFSA) agree with the American Society of Anesthesiologists (ASA) on the minimum monitoring standard for patients undergoing general anaesthesia. This standard includes the use of non-

Figure 1. A simple operating room for accident and emergencies showing basic modern equipment.

Figure 2. An intensive care unit bed, ventilator, multimodal monitor and nurse station.

invasive blood pressure and electrocardiograph monitor for the circulation; inspired gas monitoring and pulse oximeter monitor for the patient's oxygenation; capnography with clinical assessment for monitoring carbon dioxide clearance and ventilation; as well as thermometer for temperature monitoring. The monitoring of central venous pressure and intra-arterial blood pressure depends on the type and extent of surgery. Other monitors increasingly being used are the nerve stimulator (twitch monitor) for the degree of muscle relaxation and the bispectral index monitor for the state of the nervous system and level of awareness. The use of a multi-parameter monitor facilitates the monitoring of multiple parameters and these are displayed as waves and numerical values on the screen. The work of the anaesthetist is team-based and over the years the team has developed to include the nurse anaesthetists in some hospitals, and operating room assistants or technicians who are non-medical staff members that take care of the machines, prepare accessories and render assistance as required by the physician anaesthetist.

Anaesthesiologists are popularly referred to as the surgeon's physicians because they render a necessary service to the surgeons by facilitating favourable operating conditions in the patients undergoing surgery, thereby fulfilling the WHO's goal of safe general anaesthesia for all patients. Nevertheless, both surgeons and anaesthesiologists have the same level of responsibility to their patients and must partner in ensuring patient safety. The work of the anaesthetist is traditionally perioperative (Hepner and Bader, (2001), therefore the practice of anaesthesia includes preoperative visit, review and premedication of the patient scheduled for a surgical intervention; intra operative management which involves the induction of a patient with sedative-hypnotics/narcotic drugs; maintenance of the state of anaesthesia; monitoring of the patient's physiological status; as well as the recovery of the patient from anaesthesia and immediate post-operative care including pain management.

Diversity and High Technology

The anaesthesia service can be as varied as the available surgical teams. Anaesthetists can subsequently focus their career on any subspecialty of their choice e.g. obstetrics, gynaecology, paediatric surgery, general surgery, urology, neurosurgery, orthopaedics, ophthalmology, otolaryngology, cardiothoracic and/or maxillofacial surgery. Anaesthesia is now very "high tech". Recently, anaesthesiologists' interested in gadgets have become involved in product design and feedback. Janossy et al. (2010), studied the pilot balloon in relation to tracheal tubes cuff pressure, Beringer and Eltringham (2008) contributed to the design of the Glostavent anaesthetic machine for developing countries while

Ovadje, (1989), a Nigerian invented the Emergency Auto Transfusion (EAT) set. As a result, there are now various equipment and accessories that makes the delivery of anaesthesia precise and safe.

Some of the skills traditionally exclusive to anaesthesia are increasingly required outside the operating room. These skills include procedural sedation, tracheal intubation and regional anaesthesia. Souter and Davies (2012), suggested that anaesthesiologists can explore how to access the opportunities created by diversification of anaesthesia care; and that the anaesthesiologist's specialized knowledge can be translated into best practices while they serve as advocates of patients' safety and educational leaders to non-anaesthesia specialists and care providers.

Furthermore, the rate at which many innovative and intelligent anaesthesia machines are being manufactured and released into the market is impressive. An example is the Zeus by Draeger, an all-in-one anaesthesia machine. Integrated in this anaesthesia machine are ICU-quality ventilation, automated therapy, full-range monitoring and comprehensive information management. Airway management in the 21st century is safer. There are many types of supraglottic devices including the i-gel laryngeal mask airway available for all age groups (Sinha and Misra, 2005; Gasteiger et al., 2010), as well as, various fibreoptic instruments. Rigid bronchoscopes, for example, BONFILS intubation endoscopes; and the video laryngoscopes such as the C-MAC^{R} video laryngoscope from KARL STORZ have been tried and proven to be efficient for securing the difficult airway (Meininger et al., 2010). The laryngeal mask airway (LMA) provides an alternative to intubation of the fasted elective patients where airway protection is not mandatory.

Available as well to the anaesthesiologist of the 21st century is the ultrasound technology, which offers precision for location of nerves and of spinal spaces during regional anaesthesia, as well as localization of vessels for catheterization during invasive monitoring. Other areas of innovation include the warming of patients with radiant warmers, hot air convection systems and fluid warmers for intravenous fluids making neonatal, paediatric and geriatric anaesthesia a pleasure to practice. Also, near-infrared spectroscopy technology (NIRS) used in the InSpectra^{TM} StO2 Tissue Oxygenation Monitor, can continuously and noninvasively monitor tissue oxygen saturation (StO_2) in muscles. This offers precision and real time trend monitoring, which is important for decision making and treatment in trauma and critical care patients (Cohn et al., 2007; Ikossi et al., 2006). In addition, the Masimo noninvasive and continuous total hemoglobin (SpHb^{TM}) monitor provides accurate estimates of hemoglobin concentration (Berkow et al., 2011; Park et al., 2012).

Paradigm Shift

The anaesthesiologist is no longer confined to the classic operating theatre (OT). This is because anaesthesia services are increasingly being required in other places like the radiology suites for interventional radiological procedures in children, for example, magnetic resonance imaging (MRI). Anaesthesiologists can work in the outpatient clinics where preoperative assessment of surgical patients ensures their fitness for surgery. The likely investigations are therefore completed before admission thus minimizing late cancellation or rescheduling of surgery. Anaesthesiologists provide sedation in the dental clinics; are important members of acute pain management teams; and in the accident and emergency departments they are involved in advanced airway management and resuscitation. Anaesthesiologists have also become more involved in the obstetric suite where they provide epidural service for a pain free labour. The anaesthesiologist is a valuable team member in cardiac centers and burn's unit. They can use their skills in catheter laboratories alongside the renal physicians where insertions of central lines are performed for patients who require renal dialysis. The anaesthesiologist has become part of the chronic pain management team where local anaesthetic and analgesic agents are administered to patients with chronic pain under fluoroscopy guidance.

A career in day case surgical practice is possible because day case anaesthesia has been enhanced with sophisticated low flow anaesthetic machines. In addition, the available choice of short and ultra-short acting drugs produces insignificant side effects while syringe pumps are used for the delivery of accurate drugs dosages. Generally, patients should not have a hangover from modern day practice of anaesthesia. As the anaesthesiologists becomes older and their career becomes more defined and focused on a particular area of the specialty, they can create time for other interests, for example sport medicine, politics or business which may not necessarily be health care. Fortunately, anaesthesia offers a quick come back into active practice after a break. The adventurous anaesthetist can travel as a member of the military or the civilian medical evacuation team in planes (air ambulance), ships (ship or boat ambulance) or mobile clinics. Anaesthesiologists occupy top management positions in many hospitals and organizations, and they are gradually becoming involved in national health policy formulation or may decide to focus on private practice.

Academia

Anaesthesiologists can also be lecturers or college tutors in medical schools. Because of the scope and wide application of the knowledge of anaesthesia, the anaesthesiologist can easily relate with several aspects

of medicine and can work in any pre-clinical or clinical specialty. The anaesthesiologist in academia can rise to the level of professor of anaesthesiology. They provide valuable training for medical students and postgraduate doctors. They are involved in clinical research, drug trials and laboratory experimental research. The field of anaesthesia has produced many national, regional and international journals.

Stress in Anaesthesia

Anaesthesiology is considered a highly stressful medical profession. According to Gurman et al. (2012), anaesthesiologists are permanently tensed despite the team-work practiced because their work requires perfect cooperation with other specialists. In addition, their work entails great responsibility for the patient's life, the daily use of blind invasive techniques and OR activity-associated pressures. The study carried out by Nyssen et al. revealed a moderate mean level of stress among anaesthesiologists which is comparable to other professional groups surveyed. However, the highest rate of emotional exhaustion was reported in resident less than 30 years of age. Although Nyssen et al. (2003), reported that anaesthesiologists have high levels of empowerment, work commitment, job challenge, and job satisfaction, Gazoni et al., (2008) showed that anaesthesiologist suffer from high rates of drug and alcohol addiction and suicide (Alexandra et al., 2000; Gold et al., 2005; Booth et al., 2002), which suggested that they may be less prepared to handle stress. Gazoni et al. (2008), therefore recommended the education of anaesthesiologists on how to handle the aftermath of perioperative catastrophic events and the provision of formal support structures.

Chronic Toxic Effects and Genotoxicity

A few studies have suggested that occupational exposure to nitrous oxide and halogenated agents may be associated with general and genotoxic risk (Schifilliti et al., 2011; Hoerauf et al., 1997a, 1997b; Baden and Kundomal, 1987). These include spontaneous abortions, congenital abnormalities and decreased fertility. However high concentration of these agents are said to be required since there appears to be no risk associated with brief acute exposures as might occur during anaesthesia (Aldridge and Tunstall, 1986; Lampe et al., 1990; Rosen et al., 1987).

CONCLUSION

In conclusion, anaesthesiology has a wide career application in all forms of operative anaesthesia, critical care, biotechnology, policy making, academics and the military. Modern technology has enhanced the practice, while the skills and knowledge can be exported outside the operating room. Anaesthesiologists have a leadership role to play and there is room for everyone, whatever their area of interest. Do you still want to be an anaesthesiologist?

Conflict of interest

The authors declare that they have no conflict of interest. The authors did not receive any financial support or sponsorship for this study.

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