

Anaesthetic accidents: an experience in sub-saharan Africa

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Abstract

Anaesthetic accidents as a cause of morbidity and mortality are beginning to cause great concern in developing countries, where there is still a dearth of reporting of critical incidents. A case of a 55-year-old Nigerian woman who developed signs of cerebral hypoxia following osteotomy under general anaesthesia delivered through a draw-over Portable Anaesthetic Circuit (PAC) unit is reported. She was resuscitated and had intensive care therapy following this critical incident. This case highlights human error, and possibly technical failure as predisposing factors leading to anaesthetic accidents. It also emphasizes the need for anaesthetists to address safety issues more seriously. Reported critical incidents in our operating rooms should be audited, analysed and discussed in departmental quality assurance meetings, in order to indicate the potential causes and management of those incidents that are attributable to anaesthesia. A multi-disciplinary approach to the management of critical incidents is advocated to prevent future occurrences.

Keywords: Anaesthetic: accidents; Equipment: portable anaesthetic circuit (PAC) unit

Introduction

Accidents caused by anaesthesia are relatively uncommon, but are a source of morbidity and mortality in developing nations. When it occurs, there is a traditionally poor prognosis. Although litigation instituted by patients arising from anaesthetic mishaps is rare in these countries, accidents are beginning to cause great concern within the medical profession.

It is, however, difficult to assess the frequency of these accidents, partly due to lack of relevant communication, as well as a paucity of data reported from these developing countries. In addition, different criteria for factors affecting morbidity and mortality have been used in different reported series, especially in the developed countries. We present the case of a Nigerian patient who suffered cerebral injury during a general anaesthetic, to highlight the importance of human error in the causation of anaesthetic accidents. We also review some of the factors pertaining to critical incidents in anaesthesia.

Case report

A 55-year-old Nigerian woman presented with right genu valgum in a private hospital and was scheduled for right osteotomy. She had a history of essential hypertension controlled with aldomet, but had otherwise been well. There was no other known systemic affection or symptomatology. The patient was a Jehovah's Witness who had never had a blood transfusion, nor any exposure to general anaesthesia. She also had no allergies.

Physical examination revealed a severe right genu valgum and a blood pressure of $140/80$ mmHg. There was no other abnormal systemic finding. Her packed cell volume (PCV) was 31% (Hb=10g/dl) and haemoglobin genotype was AS. The electrolytes, urea level and chest radiography were within normal limits. At the time of pre-anaesthetic consultation, she was extremely reluctant to undergo a regional technique of anaesthesia, because of a perception that she might "feel" the surgery.

General anaesthesia was thus planned, using a PAC unit with oxygen supplementation. She was given intravenous pentazocine 30mg and atropine 0.6mg as premedication at induction. Following pre-oxygenation, induction was commenced with intravenous thiopentone 250mg. Intravenous suxamethonium 100mg facilitated laryngoscopy and smooth intubation. This was followed by pancuronium 6mg, while anaesthesia was maintained with 0.5-1% halothane in air with

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supplementary 4l/min of oxygen through an inlet in the PAC unit. The patient was ventilated manually. An esmarch bandage was then applied as a tourniquet up to the right thigh, before commencing surgery.

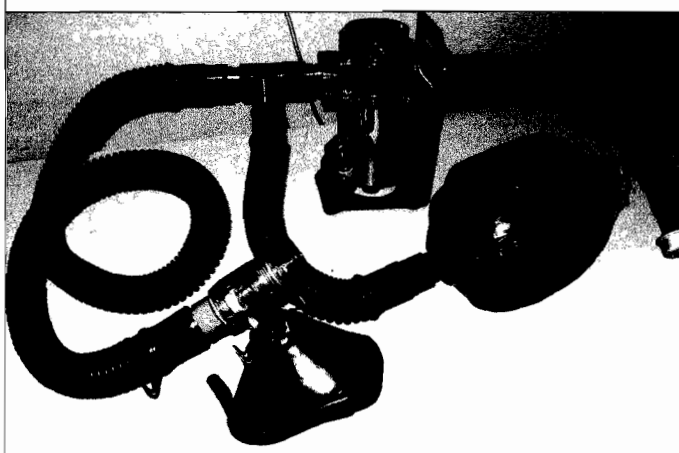
The pulse and blood pressure were monitored and these remained within normal limits until about 20 minutes into surgery when the oxygen supply through the PAC inlet was exhausted. The cylinder was replaced but it was noticed that this cylinder was half-full following a hissing leak through the port. The patient was thereafter ventilated with only halothane-in-air, as there was no reserve cylinder of oxygen in the operating suite. The patient developed intra-operative hypertension (highest B.P. reading of $180/110$ mmHg recorded) and intravenous hydralazine 5mg was titrated at intervals to control the blood pressure. Another dose of pentazocine 30mg was slowly administered for intra-operative analgesia. A total of 8mg of pancuronium was administered intra-operatively.

At the end of surgery, which lasted $1\frac{3}{4}$ hrs, anaesthesia was terminated with reversal of neuromuscular blockade by intravenous administration of an initial dose of neostigmine 2.5mg and atropine 1.2mg. After about 3mins, a repeat dose of reversal agents was given when the patient could not respond to commands to lift her head. Following this, she resumed spontaneous respiration but still did not respond to commands.

Another dose of hydralazine 5mg was slowly administered intravenously when the blood pressure was noted to be high ($180/110$ mmHg). She was extubated and very thick secretions accompanied the tip of the endotracheal tube (ETT). The patient was then transferred to the recovery room while awaiting further oxygen therapy. However, poor breathing post-operatively despite good analgesia and adequate reversal, in the presence of continued unconsciousness necessitated re-intubation. Humidified oxygen was introduced via the ETT about 2 hrs later and this was continued for a further 48 hrs.

When there was no appreciable improvement in her clinical condition, she was transferred to another hospital with facilities for intensive care therapy. She subsequently made slow but appreciable progress, becoming conscious and responding to commands, and was extubated. The patient, however, developed bronchopneumonia and overwhelming septicaemia and she died on the 30th post-operative day.

Fig. Ohmeda Portable Anaesthesia Circuit (PAC) unit incorporating a Draw-over Vaporizer System



Discussion

It is regrettable that anaesthetic accidents do happen but it is rather fortunate for both anaesthetists and patients that these are uncommon. A critical incident in anaesthesia is defined as a preventable and untoward mishap, which leads to or could have led to undesirable patient outcomes that may range from prolonged hospital stay to permanent disability or death.¹ While there is no doubt that the number of deaths attributable to anaesthesia has decreased in recent times in developed countries, one cannot say the same in developing countries.^{2,3} In a study of deaths associated with anaesthesia and surgery in 1954, Beecher and Todd⁴, estimated the risk of death to be 1: 2,680, while the CEPOD study in 1987 found anaesthesia to be responsible for death in only 3 of 555,258 anaesthetised patients.⁵ In developing countries, studies on anaesthetic accidents are not well documented, but it is generally believed that the incidence is greater, because of a lack of modern anaesthetic and monitoring equipment, amongst other reasons.

Reasons adduced for anaesthetic accidents can be broadly grouped under technical failure and human error. It seems that in many of these accidents, there are always two common procedures, endotracheal intubation and neuromuscular paralysis. The ETT may be displaced, misplaced or not even placed at all. Patients that are paralysed may not be ventilated, inadequately ventilated or suffer from inadequate reversal of paralysis. The treatment of concomitant diseases, especially cardiovascular disease, may predispose further to avoidable mortality.

Equipment malfunction, which results in technical failure, is less common in advanced countries. However, in this environment not all surgical centres have a standard anaesthetic machine (e.g. Boyle's). Thus anaesthetists resort to different techniques of delivering anaesthesia, such as the use of the PAC system, or possibly manual ventilation with air via an Ambu bag, using a continuous intravenous technique with occasional supplementary oxygen while the patient is paralysed.

Human error has been found to be the major culprit in anaesthetic mishaps.^{6,7} Cooper et al⁸, sub-divided human error into 3 categories: technical, errors of judgement and failure of monitoring or vigilance. In developing countries, it will be pertinent to add lack of monitoring equipment in this sub-classification. Examples of technical errors when skill is deficient or equipment design is poor include drug overdose, disconnection or misconnection, incorrect gas flows and oesophageal intubation.

Error of judgement occurs when the anaesthetist makes a bad decision, through inexperience, ignorance or a lapse in skill. Lack of 'well-trained' physician anaesthetists is a factor that plays a part in the increasing incidence of error of judgement in the delivery of anaesthesia in developing countries. Failure of monitoring or vigilance takes place when the anaesthetist fails to act upon or to correctly recognize data presented that needs urgent response.

In this case, there was both error of judgement on the part of the anaesthetist as well as a lack of adequate monitoring equipment. Although the anaesthetist failed to ensure that there was reserve oxygen supply before the procedure commenced, a pulse oximeter would have shown inadequate saturation levels immediately when the oxygen

supplementation ceased. As in this patient, unrecognised hypoventilation was the commonest intra-operative anaesthetic accident leading to severe patient injury in the report by Eichorn.⁹

Other factors that may affect performance during delivery of anaesthesia include fatigue, carelessness and lack of attention to detail. Anaesthesia is perceived to be a stressful specialty, with the 'middle years' being a danger period.⁶ Minor degrees of professional impairment may place patients at risk of anaesthetic accidents. No matter how conversant an anaesthetist is with protocol, failure to perform normal checks or failure to pre-operatively assess the situation can lead to accidents.¹⁰ A junior anaesthetist in private practice may, for economic reasons, take on a case for which he/she is inadequately trained, and may be unwilling to request help until it is too late. Unfamiliarity with equipment is also a factor that may have come into play in our reported case. It has been shown that anaesthetic delivered through a draw over apparatus like the PAC may result in low arterial oxygen tension if used without oxygen supplementation.¹¹ This patient most probably suffered from intra-operative cerebral hypoxia, which was compounded by her pre-operative hypertensive status.

Anaesthetic accidents may be prevented with the use of monitoring equipment when available, through correct interpretation of data presented. Management of anaesthetic mishaps actually starts with prevention of such accidents. This cannot be over-emphasised considering the huge humanitarian and financial involvement that could be associated with anaesthetic accidents. According to Cooper and Gaba¹², the individual anaesthetist should undertake proper preparation of the patient and labelling of all drugs before the anaesthetic is administered. Resuscitation equipment should be checked and arranged within reach. It has been shown in studies of critical incidents that the time of highest risk is during maintenance of anaesthesia.^{1,13} Thus, monitoring facilities when available, should be used to the maximum. In developing nations, for most cases, minimum monitoring should include pulse, blood pressure and pulse oximetry, whilst capnography is desirable. However, if all these are not available, it must be emphasised that merely palpating the pulse could alert the anaesthetist of any mishap. Fatigue, illness and tiredness of the anaesthetist should be detected and decision-making optimised.

Anaesthetists should not attribute anaesthetic mishaps as a random, act-of-God incident. Safety issues must be addressed more seriously with anaesthetic departments organising in-house clinical morbidity and mortality meetings to discuss and analyse reported critical incidents. A simple, low-cost critical incident monitoring technique which has the added advantage of identifying trends and selecting issues to be discussed in departmental quality assurance meetings has been described for developing countries.¹⁴ An anaesthetic incident reporting programme was also advocated by Short

et al¹⁵, to improve anaesthetic safety in practice. It should be noted that anaesthetic accidents seldom result from a single cause. A multi-disciplinary approach and partnership with 'concerned' professionals, such as lawyers, is recommended in the management of medical misadventures.

In conclusion, this case of an anaesthetic accident in a Nigerian woman is presented to highlight the importance of technical and human errors in the causation of anaesthetic accidents. Critical incidents in the hospital should be analysed, with a multi-disciplinary approach, to indicate the potential causes of anaesthesia-related mortality and morbidity. It is only through understanding past experiences today that we can prevent the disasters of tomorrow.

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