

**A REVIEW OF ANAESTHESIA FOR ORTHOPAEDIC
SURGERY IN THE UNIVERSITY TEACHING
HOSPITAL, ILORIN, NIGERIA (MARCH 2001 –
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Abstract

A retrospective study was made on all patients who had orthopaedic surgical procedures between March 2001 and February 2002 at the University of Ilorin Teaching Hospital (UITH) Ilorin, Nigeria. The aim of this study was to review the various anaesthetic techniques offered to orthopaedic patients, the procedures done, perioperative adverse events and to suggest areas of improvement. Data were obtained from anaesthetic record charts, case files, theatre, recovery room, intensive care unit records and the Department of Health Records of the UITH. Statistical analysis was carried out using the Chi square test. A P value of less than 0.05 was considered significant. The results showed that a total of 178 patients had 203 orthopaedic surgical procedures within the study period. There were 121 (68%) males and 57 (32%) females. Intercurrent medical illness was found in 11.8% of the patients. The most commonly performed orthopaedic surgical procedure was open reduction and internal fixation (30%), followed by sequestrectomy (12.3%). General anaesthesia was the most commonly performed technique (69.7%), followed by subarachnoid block (21.3%). Perioperative adverse events occurred in 16.9% of the patients, shivering occurring in 30% hypotension in 23.4% and hypertension in 16.7% of those who had adverse events. There was no significant association between American Society of Anaesthesiologists' (ASA) grading and occurrence of perioperative adverse events. Availability of appropriate anaesthetic drugs of choice and reduction in homologous blood use are advocated.

Keywords: Orthopaedic surgery, anaesthetic techniques, adverse events.

Introduction

Orthopaedic surgical patients have constituted between 20.5 – 38.8% of patients operated annually at the General Hospital wing of the UITH in the last 5 years (Table 1). These figures appear high when viewed against the backdrop of eight other competing subspecialties, namely; general surgery (35.0-46.7%), ophthalmology (4.1-7.2%), cardiothoracic surgery (0.2-2.2%), urology (2.9-6.5%), paediatric surgery (12.4-27.8%), otorhinolaryngology (4.2-6.1%), neurosurgery (0.2-2.2%), and, burns and plastic surgery (0-4.8%). This is because the UITH receives large numbers of victims of road traffic accidents, which occur on the major Federal highway linking the northern and southern parts of this country. These patients form the bulk of orthopaedic surgical patients seen at the UITH. On the average, patients in this surgical subspecialty have prolonged hospital stay due to the nature of their surgical conditions. The average length of stay (LOS) of all orthopaedic patients admitted during the study period ranged from 3 – 186 days (mean 41.5 days). The cost of surgery including anaesthesia and prolonged hospital stay may be high. The cost of anaesthetic drugs during surgical procedures have been calculated to be between 1-4% of the total cost of the procedure (Rowe and Kasnowski, 1995; Churnside *et al* 1996). Carefully planned and chosen techniques of anaesthesia have been associated with reduction in perioperative complications³. Anaesthesia techniques must be planned in such a way as to reduce cost, morbidity and mortality, and to avoid late cancellation of cases. The aim of this study is to review the various anaesthetic techniques offered to orthopaedic surgical patients, highlighting the various procedures done, perioperative adverse events, areas of deficiencies and to suggest areas of improvement in the future. No such study had been carried out in this centre in the past.

Materials and Methods

Hospital records of 240 patients scheduled for orthopaedic surgical operations between March 2001 and February 2002 were reviewed retrospectively. Their demographic data including sex, age, and other information such as hospital number, diagnosis on admission, surgical procedure performed, anaesthetic techniques and perioperative adverse events were reviewed. Data were obtained from anaesthetic record charts, case files, theatre, recovery room and intensive care unit records, and, the Department of Health Records of the UITH.

Statistical analysis was carried out using the Chi-square test to find out whether any association existed between American Society of Anaesthesiologists' (ASA) grading and the occurrence of each

perioperative adverse events. A P –value of less than 0.05 was considered significant. Data were analyzed on the EPI info version 6.0.

Results

A total number of 240 patients were scheduled for orthopaedic surgery during the period of study. However, 178 patients made up of 121 (68%) males and 57 (32%) females were actually operated on and these formed the study population. There were 142 (79.8%) elective and 36 (20.2%) emergency cases. Sixty two (34.8%) patients had their operations cancelled for various reasons (Table 2). Their ages ranged between 1 and 87 years with a mean age of 33.2 years \pm 20.1 years. The American Society of Anesthesiologists' (ASA) physical status of the patients showed that over half of the patients, 106 (59.9%) were in ASA I category, while 55 (30.9%), 14 (7.9%) and 3 (1.7%) were in ASA II, III and IV categories respectively. There were no patients in ASA V category.

The packed cell volume (PCV) of the patients ranged between 17% - 47% with a mean PCV of 35.4 \pm 5.8SD. Twenty one (11.8%) patients had intercurrent medical disease with diabetes mellitus (DM) accounting for the highest number 8(4.5%). This was followed by hypertension (HBP) 7 (3.8%) sickle cell anaemia (SCA) 3 (1.7%) 3 patients each with cerebral palsy (CP) 1 (0.6%), rheumatoid arthritis (RA) 1 0.6% and tetanus. 1 (0.6%) patient (see table 3).

A total of 203 orthopaedic surgical procedures were carried out. Open reduction and internal fixation (ORIF) was the commonest procedure performed, accounting for 61 (30.0%) followed by sequestrectomy, 25 (12.3%) and wound debridement, 18(8.9%) (Table 4).

General anaesthesia (GA) was the technique of anaesthesia in 124 (69.7%) patients while subarachnoid block (SAB) was used in 38 (21.3%) patients. Local anaesthetic technique was used in 14 (7.9%) patients and ketamine only in 2(1.1%) patients. There were five cases of failed spinal, which were later converted to general anaesthesia.

Premedication with oral diazepam (i.e agents administered 1 – 2h before induction of anaesthesia) was carried out in only 12 (6.7%) patients. At induction of anaesthesia, other premedicants were administered as follows: atropine 59 (33.1%) patients, pentazocine, 14 (7.9%) patients and tramadol, 1(0.6%) patient. Over half of the patients, 92 (51.7%) did not receive any premedicant drug.

Induction of anaesthesia was with sodium thiopental in majority of patients. Of the 126 patients who had GA (and ketamine only anaesthetic), 104 (82.5%) were induced with thiopental, 17 (13.5%) with halothane and 3 (2.4%) were induced with ketamine. Endotracheal intubation was carried

out in 100 (80.6%) of the 124 patients who had general anaesthesia while anaesthesia was administered using face mask in 19 (15.3%) and the laryngeal mask airway in 5 (4.1%) of these patients. Suxamethonium was used in facilitating endotracheal intubation in majority of the patients while pancuronium was used in some cases with concomitant head injury. Majority of the intubated patients, 81% had controlled ventilation, while 19% were allowed to breathe spontaneously.

The commonest agent used for intraoperative analgesia in patients who had general anaesthesia and ketamine only anaesthetic (126) was pentazocine in 89 (70.6%), followed by ketamine in 12 (9.5%) and tramadol in 9 (7.1%) patients.

Subarachnoid block was the technique of anaesthesia in 38 patients, with the use of 0.5% hyperbaric bupivacaine in 34 (89.5%) patients and 5% hyperbaric xylocaine in 4(10.5)%.

Perioperative adverse events were recorded in 30(16.9%) patients (Table 5). The commonest adverse event was shivering in 30% of these patients and all had subarachnoid block. This was followed by hypotension in 23.4% and hypertension in 16.7%. There was no significant association between ASA grading and the occurrence of perioperative adverse events (see Table 3). In the post-operative period, 97.8% of the patients had stable and satisfactory conditions and were discharged to the ward. The remaining 2.2% were admitted into the intensive care unit for further management due to poor immediate post-operative condition. One (0.6%) death was recorded in this study. This patient who refused blood transfusion on religious convictions died on the operating table due to excessive and uncontrollable blood loss during a hip surgery.

Table 1: Number of Patients Operated Under Anaesthesia by the various Surgical Subspecialties in the General Hospital Wing, UITH. (1997-2001)

SUB SPECIALTIES	1997	1998	1999	2000	2001
General Surgery	280 (46.7%)	198(37.1%)	218(37.3%)	215(34.8%)	283(35.0%)
Orthopaedics	123(20.5%)	207(38.8%)	165(28.2%)	141(22.8%)	183(22.6%)
Paed. Surgery	74(12.4%)	75 (14.1%)	104 (17.8%)	172(27.8%)	171(21.2%)
Ophthalmology	43 (7.2%)	24(4.5%)	29 (5.0%)	33 (5.3%)	33 (4.1%)
E.N.T.	30 (5.0%)	28 (5.3%)	25 (4.2%)	31 (5.0%)	49 (6.1%)
Neurosurgery	0 (0%)	0 (0%)	0 (0%)	1 (0.2%)	18 (2.2%)
Urology	39 (6.5%)	0 (0%)	29 (5.0%)	18 (2.9%)	24 (3.0%)
Burns, plastics	0 (0%)	0 (0%)	0 (0%)	0 (0%)	39 (4.8%)
Cardiothoracic	10 (1.7%)	1 (0.2%)	15 (2.5%)	7 (1.2%)	8 (1.0%)
Total	599 (100.0%)	533 (100.0%)	585 (100.0%)	618 (100.0%)	808 (100.0%)

Source: Department of Health Records and Biostatistics University of Ilorin Teaching Hospital, Ilorin, Nigeria.

Table 2: Reasons for cancellation of cases

Reason	No of cases cancelled
Time constraint	32 (51.6%)
Lack of bed space/materials/blood	7 (11.3%)
Financial constraints	6 (9.7%)
Patient refusal/not available	6 (9.7%)
Surgeon indisposed	5 (8.1%)
Uncontrolled intercurrent diseases/electrolyte imbalance	4 (6.4%)
Staff auditing	2 (3.2%)
Total	62 (100%)

Source: Field survey (March 2001-Feb 2002)

Table 3: Intercurrent medical disease in patients operated

Intercurrent disease	No of patients (% of total)
Diabetes mellitus	8 (4.5%)
Hypertension	7 (3.8%)
Sickle cell anaemia	3 (1.7%)
Cerebral palsy	1 (0.6%)
Rheumatoid arthritis	1 (0.6%)
Tetanus	(1 (0.6%))
Total	21 (11.8%)

Source: Field survey (March 2001-Feb 2002)

Table 4: Orthopaedic procedures performed

Orthopaedic procedures	Frequency
Open reduction and internal fixation	61 (30.0%)
Sequestrectomy	25 (12.3%)
Wound debridement	18 (8.9%)
External fixation	13 (6.4%)
Skin/bone grafting	12 (5.9%)
Excision/incision biopsy	11 (5.4%)
Amputation	11 (5.4%)
Muscle/tendon repair	7 (3.4%)
Osteotomy	7 (3.4%)
Wound exploration	7 (3.4%)
Removal of implant	6 (3.0%)
Hemiarthroplasty	5 (2.5%)
Cortical drilling/incision and drainage	5 (2.5%)
Closed reduction	5 (2.5%)
Other	10 (5.05)
Total	203 (100%)

Source: Field survey (March 2001-Feb 2002)

Table 5: Perioperative adverse events

Events	No of patients (%)	P value (Association with ASA grading)
Shivering	9 (30.0%)	> 0.05
Hypotension	7 (23.4%)	> 0.05
Hypertension	5 (16.7%)	> 0.05
Failed subarachnoid block	5 (16.7%)	> 0.05
Bradycardia	1 (3.3%)	}
Nausea	1 (3.3%)	}
Failed intubation	1 (3.3%)	}
Death on the table	1 (3.3%)	}
Total	30 (100%)	> 0.05

Source: Field survey (March 2001-Feb 2002)

Discussion

Orthopaedic surgery presents the anaesthetist with a great variety of anaesthetic techniques when compared with other surgical subspecialties. This is because, apart from general anaesthesia, many orthopaedic procedures may perhaps be better managed under regional techniques such as central neural axial blockade and other nerve blocks of the upper and lower limbs.

This study showed that general anaesthesia was the commonest technique of anaesthesia used (69.7%) while subarachnoid block was the technique used in about one-fifth of the patients. In most cases, the choice of regional or general anaesthesia in orthopaedics depends on the following factors: patient's preference, state of health of the patient, expertise of the anaesthetist, duration of the procedure, availability of facilities and the surgeon's preference. In general, longer and more complicated operations are usually performed under general anaesthesia.

In this study, 55.7% of all lower limb procedures were done under general anaesthesia, while 35.7% were done under subarachnoid block. Regional anaesthesia has marginal advantages over general anaesthesia for hip fracture in terms of early mortality and risk of deep vein thrombosis (Urwin et al, 2000). Other reported advantages of regional anaesthesia include attenuation of hyperglycaemic response to surgery (Houghton et al, 1978), maintenance of cognitive function in the elderly (Bukley, 1993) and reduction in intraoperative blood loss (McLaren et al, 1978).

The commonest intercurrent disease in this study was diabetes mellitus and all these patients presented with surgical lower limb conditions. Regional anaesthesia, by attenuating the hyperglycaemic response to surgery is a technique of choice in diabetic patients where this is practicable. In our environment, the cost of subarachnoid block is about

40% the cost for general anaesthesia although lower cost may not translate to better outcome. The technique is simple and frees the anaesthetist's hands to other tasks, particularly where there is shortage of manpower as in our environment. The specific problems encountered in this study with subarachnoid block was shivering, intraoperative hypotension and failed procedure. Also, patients became distressed when they remained awake and assumed a particular operative position for a long period.

General anaesthesia is suitable for prolonged and complicated procedures. The technique has been associated with a small but statistically significant reduction in the length of the operation (Mckenzie et al, 1984). A reduction in cerebrovascular accident in the intraoperative period during general anaesthesia has been said to be probably due to a more stable perioperative blood pressure (Urwin et al, 2000). This is beneficial for hypertensive patients who constituted 3.8% of all patients operated in this study. However, a very serious constraint in managing our patients under general anaesthesia is the unavailability of a wide variety of anaesthetic agents from which suitable choices can be made to suit the patient's condition.

Sodium thiopental remains the most commonly used intravenous induction agent in our environment as it was used in 82.5% of patients who had general anaesthesia. Sodium thiopental is the gold standard against which other intravenous induction agents have been measured, but other agents may be preferred in some patients. Propofol is the agent of choice where rapid recovery is desired in ambulatory anaesthesia. It is not readily available for use in our centre because it is expensive. Ketamine is a suitable induction agent of choice in asthmatics or in hypotensive patients such as may occur following severe hemorrhage.

Succinylcholine is still commonly used in our practice without adverse effects such as raised intracranial pressure, hyperkalemia, cardiac arrhythmia and malignant hyperthermia. It remains the drug of choice when rapid endotracheal intubation is required (Lee, 1984). Newer neuromuscular blocking agents such as rapacuronium, rocuronium, atracurium and mivacurium with fewer adverse effects are slower in their onset of action and more expensive for our developing society. However, pancuronium at 1.5 times the paralyzing dose was used for intubation in orthopaedic cases with concomitant head injury and raised intracranial pressure. The only available agent in this centre for prolonged neuromuscular paralysis is pancuronium, which may not be suitable for hypertensive or cardiac disease patients.

Pentazocine was the commonest agent used for intraoperative analgesia while ketamine and tramadol were used in some patients. Pentazocine, an agonist-antagonist opioid causes increases in pulmonary

capillary wedge pressure, blood pressure and heart rate with consequent increase in cardiac work load (Zola and Mcleod, 1983). These effects appear to make the drug unsuitable for hypertensive and cardiac disease patients. It has limited use in the United States of America because of limited analgesia, undesirable cardiac and psychomimetic effect (Bailey and Stanley, 1990). At the time of this study, it was the only opioid available in our center. There was no adverse event associated with its extensive use in this study. The availability of stereoisomer ketamine and improved understanding its pharmacology have increased non-anaesthetic use of ketamine as an adjunct analgesic (Sneyd, 2004). It is useful in subhypnotic doses provide intraoperative analgesia as was done in some cases in this study. Tramadol is a centrally acting analgesic, which possesses opioid agonist properties and activates monoaminergic spinal inhibition of pain. It has just been recently introduced into our anaesthetic practice which explains why it was used in 0.5% of the patients in this study for intraoperative analgesia. Because of its favourable safety profile, such as its low respiratory depressant effect, it may be useful in patients with poor respiratory function e.g. the elderly patient. The overall incidence of adverse events with the use of tramadol has been found to be low in a study population scheduled for day-case surgery (Viitamen and Annila, 2001).

The most common perioperative adverse event in this study was shivering in patients who had subarachnoid block. A fall in body temperature by 1-3°C has been shown to occur during spinal anaesthesia probably due to heat loss from vasodilated extremities and loss of cutaneous thermosensory input in the anaesthetized area (Roc and Cohn, 1972). The cold environment of the operating room is also a contributing factor. Mild hypothermia (1-2°C) causes numerous serious complications such as morbid myocardial outcomes, wound infection, reduced drug metabolism, which may result in prolonged hospitalization. Pethidine, clonidine, doxapram, ketanserin and alfentanil have been shown to abolish short-term postoperative shivering (Sessler, 2003).

Hypotension seen in some of these patients was due to sympathectomy following subarachnoid block. This can be prevented by adequate prehydration with crystalloid solutions or in the event of its occurring, it can be treated with rapid infusion of crystalloid with or without the administration of a vasopressor agent. Also, hypotension in some patients resulted from excessive blood loss, which is not uncommon in major orthopaedic procedures. In our practice, excessive blood loss is treated with infusion of crystalloid and/or homologous blood transfusion. The complications of homologous blood transfusion include transfusion reactions and transmission of diseases especially the acquired immuno

deficiency syndrome (AIDS). Perioperative complications of homologous blood transfusion did not occur in this study population. Ways to circumvent these complications have earlier been reported (Sharrock and Savarese, 1990; Ovadje, 1996). Since there was no significant association between the ASA grading (physical fitness) and the occurrence of adverse events, it can be inferred that all patients had optimum perioperative anaesthetic management. This study recorded a death on the table due to excessive and uncontrollable haemorrhage during hip surgery on a patient who refused blood transfusion on religious grounds. Roure et al (1998) reported two cases of haemorrhagic surgery in children whose parents were opposed to preoperative blood donation on religious convictions but accepted intraoperative blood salvage. In these patients, erythropoietin and intravenous iron were administered preoperatively to increase red cell mass. Intraoperative blood salvage, including normovolaemic haemodilution and intraoperative autologous transfusion avoided homologous blood transfusion in these children. Human recombinant erythropoietin has been used for the treatment of acute anaemia in the perioperative period (Boursas *et al*, 1997). Successful management of a Jehovah's Witness who had a life-threatening postoperative massive blood loss following resection of ovarian cancer, using a high i.v.dose of erythropoietin to induce haematopoiesis has been reported recently (Schalte *et al*, 2005). However, Bonhomme *et al* (2002) conclude that these techniques require a heavy set up and still need to be evaluated extensively. In our environment, the facilities for these techniques are not available. Patients who refuse blood transfusion should not be denied surgery. Deliberate efforts should be made to build up their haematocrits with adequate nutrition and haematinic supplements in the preoperative period. Attention to detail and meticulous intraoperative techniques to reduce blood loss should be observed in such patients.

Reduction in the use of homologous blood transfusion techniques can be summarized as follows:

- i. Pre-operatively: Iron, re-combinant erythropoietin, decompression, synthetic erythrocyte substitutes, acute pre-operative normovolaemic haemodilution, autologous blood donation.
- ii. Intra-operative: auto transfusion, controlled hypotension.
- iii. Post-operative: Auto transfusion of blood drained; fresh frozen plasma/platelet concentrate (in cases of bleeding tendencies).

Conclusion

Many orthopaedic surgical procedures can be done under a variety of anaesthetic techniques from which a suitable option can be chosen. The ideal technique chosen depends on such factors as patient's preference,

state of health, availability of expertise and facilities, and, duration of the procedure. General anaesthesia was the most commonly used technique in this study. However, a worrisome problem was the unavailability of ideal drugs of choice to suit patient's condition. Most major orthopaedic procedures require blood replacement therapy and a case is made here for methods that reduce the use of homologous blood and its consequent complications.

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