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Spinal anaesthesia for Austin Moore's hemiarthroplasty in a geriatric patient with a right femoral neck fracture: A case report

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Abstract
NN, an 86-year-old retired headmistress with undiagnosed hypertension had Austin Moore's hemiarthroplasty of the right femur under spinal anaesthesia with sedation.
Subarachnoid block was achieved with 2 ml of 0.5% isobaric bupivacaine. Intraoperatively she suffered severe hypotension for which she was managed successfully. Postoperatively she had urinary tract infection, which responded to treatment. The anaesthetic challenges encountered in her management and the perioperative considerations for geriatric anaesthesia are discussed.

Keywords: spinal, anaesthesia, hemiarthroplasty, geriatric, fracture

Introduction
Hemiarthroplasty is a surgical procedure which involves the replacement of the head and neck of the femur with a prosthesis [1]. It is commonly done for fracture of the femoral neck in a patient above the age of 65 years. For patients below 65 years with femoral neck fracture, the surgery of choice is closed reduction followed by internal fixation. The reason for hemiarthroplasty for this age group is that the chance of nonunion or of avascular necrosis is substantial and the ability of the patient to withstand a second operation is slight. If the patient is above 65 years and has an associated intercurrent disease like rheumatoid arthritis or is on steroid medication, the treatment of choice is primary total hip replacement [2, 3].
The incidence of femoral neck fracture in Nigeria has been found to be 0.8 percent whereas it is 39 percent, 56 percent and 58 percent in Sudan, Singapore and Scotland respectively [2]. These fractures are commoner in elderly women above the age of 65 years due to weakening by osteoporosis [1, 3]. The World health Organization (WHO) traditionally uses the age group of 65 years and above to designate the elderly [4]. This definition is however arbitrary because chronological age is different from physiological age. However an elderly or geriatric patient is an individual whose chronological age is 65 years or above [4].
Recent advances in anaesthetic practice and surgical techniques including minimally invasive surgical approaches have greatly improved perioperative morbidity and mortality thus increasing the number of elderly patients presenting for surgery [5]. By the year 2040 people aged 65 years and above are expected to form 24% of the population and half of them will require surgery before death. Anaesthetists are now encountering increased challenges in the management of geriatric patients presenting for major surgery requiring lengthy and complicated operative and postoperative management [6]. The concern now is that because older and feebler patients are presenting for surgery, perioperative morbidity and mortality rates may be on the rise again. Consequently, a renewed interest has arisen in identifying factors associated with adverse postoperative outcomes in order to develop strategies to improve perioperative care and outcomes in elderly surgical patients [6]. The anaesthetic technique for right hemiarthroplasty should therefore take into consideration the physiological changes associated with aging including those of any co-existing medical condition.

Case Presentation
NN, an 86 year- old retired headmistress, was referred from Federal Medical Centre (FMC) Umuahia to University of Port Harcourt Teaching Hospital (UPTH) on account of inability to walk, pain in the right hip joint and bed sores. Six months prior to presentation at UPTH, she had a fall in her house. The patient also noticed that she was unable to move her right lower limb because of severe sharp pains in her right thigh. The pain was non-radiating and occurred only on the movement of the right thigh. There was no associated loss of consciousness. The left lower limb was unaffected. She was taken to a traditional bone healer where she spent one month during which time she developed bed sores on her left buttock and ankle joints. Her son took a decision to take the patient to FMC Umuahia from where she was referred to UPTH.
The patient was menopausal and had one son. She was neither a known hypertensive nor diabetic but blood pressure was elevated to 170/100 mmHg soon after she came into the ward at UPTH. Physical examination revealed a chronically ill looking elderly woman with persistent flexion and swelling of both knee joints. She was not pale, icteric, febrile nor cyanosed. She was conscious and well oriented. There was no neck stiffness. There was hypertonia with rigidity of the lower limbs especially on the right. There was also loss of muscle bulk especially on the right lower limb. Peripheral pulses were palpable in both lower limbs. She had contracture of joints and disuse atrophy of the muscles in the lower limbs. There were healed scars on the right buttock and both ankle joints. The upper limbs were grossly normal. Cardiovascular system examination revealed a pulse rate of 86 beats per minute, regular, of full volume, blood pressure of 150/95 mmHg and normal heart sounds. Respiratory rate was 16

breaths per minute and her breath sounds were vesicular. Other systems were essentially normal.

A diagnosis of fractured neck of right femur was made. She was reviewed by the physician and commenced on amlodipine 10 mg daily, moduretic one tablet daily, captopril 12.5 mg 12 hourly and aspirin 75 mg daily. The pelvic radiograph confirmed fracture of the neck of femur. She was booked for hemiarthroplasty with Austin Moore's prosthesis. She was put on skin traction and was also commenced on tramadol 50 mg 12 hourly and physiotherapy. Results of investigations were: full blood count- within normal limits, serum electrolytes, urea and creatinine- within normal limits, Urinalysis- no abnormality detected, Coagulation profile- within normal limits, Chest X-ray- heart size at the upper border of normal, aortic unfolding, clear lung fields, ECG- sinus rhythm.

Anaesthetic Management

At pre-anaesthetic review, history and physical examination findings were essentially as previously recorded. The results of investigations were reviewed and a request was made for ECG and chest X-ray. A request was also made for 2 units of blood for possible intraoperative transfusion of the patient. Her pulse rate was 78 beats per minute, full volume and regular. The blood pressure was 140/90 mmHg. The heart sounds were normal and there was no murmur. Her respiratory rate was 14 breaths per minute and breath sounds were vesicular and there were no transmitted sounds. She was classified as ASA II and airway assessment was Mallampati II. The patient was asked to stop oral feeds at midnight preceding the day of surgery.

The technique of anaesthesia was explained to both the patient and her son and informed consent was obtained from her. Premedication was with oral diazepam 5 mg the night before surgery. She also took amlodipine 10 mg with a sip of water on the morning of the surgery. Oral aspirin was withdrawn 7 days before surgery by the managing team. Prior to the arrival of the patient in the theatre, routine check was carried out on the anaesthetic machine, monitors, laryngoscope, and suction machine. Endotracheal tubes of various sizes were selected, lubricated and kept in place. Drugs for general anaesthesia were also selected and kept in place. Ephedrine and atropine were drawn up in labelled syringes.

On arrival in the operating theatre, the patient's identity was ascertained. Baseline vital signs were a pulse rate of 86 beats per minute, blood pressure 130/85 mmHg and respiratory rate 14 breaths per minute. The arterial oxygen saturation was 100% on room air. Patient was catheterized with size 16 Foley's urethral catheter and connected to the uribag, and intravenous fluids were warmed.

Asepsis was observed. Two millilitres of 2% plain Lidocaine was drawn up in a 5 ml syringe and diluted to 1%. Isobaric bupivacaine 0.5% 2 ml was also drawn up in a syringe. The patient was positioned in a left lateral position (knees drawn up to the chest as much as possible and neck flexed) by anaesthetic assistants. She was preloaded with 500 ml of normal saline over 30 minutes, and informed before the commencement of the procedure. The lumbosacral region was scrubbed with chlorhexidine and then with methylated spirit. Using the iliac crest as a landmark, the 3rd and 4th lumbar vertebrae were located and the skin overlying the interspace was infiltrated with 2 mls of plain 1% lignocaine. Using a 25-gauge Whitacre spinal needle which was passed through a 23-gauge hypodermic needle as introducer a lumbar puncture was performed. Correct entrance into the subarachnoid space was confirmed by the free flow of the cerebrospinal fluid from the hub of the needle and 2mls of bupivacaine was then injected. The spinal needle was withdrawn and the puncture site was dressed with sterile gauze. She was positioned supine. Precordial stethoscope was attached to the patient and vital signs were monitored every 5 minutes throughout the surgery. Intraoperative sedation was achieved with intravenous diazepam 2.5 mg and she received intermittent oxygen by face mask.

The surgical procedure started 10 minutes after the establishment of the spinal anaesthesia and lasted for 90 mins. Intravenous ceftriaxone 1gm was given as prophylactic perioperative antibiotic. Intraoperatively, she developed hypotension with blood pressure of 60 mmHg systolic, 40 mmHg diastolic and was infused rapidly with 250 mls of normal saline. Intravenous ephedrine 3 mg and 100% oxygen by face mask were also administered. Her arterial oxygen saturation was maintained between 99% and 100% throughout the intraoperative period. Pulse rate during the intraoperative period was 50 to 102 beats per minute. The blood pressure ranged between 60 mmHg and 140 mmHg systolic, 40 and 90 mmHg diastolic. The axillary temperature was between 36.7 and 37.10C. ECG showed normal sinus rhythm. The estimated blood loss was 350 mls. Total intravenous fluid of 1.5 litres was infused intraoperatively and urine output was 400 mls. No blood was transfused.

Surgery and Findings

With the patient in the supine position and the right buttock raised on sandbags, an anterolateral incision was made to expose the hip joint. A non-union intracapsular fracture neck of the right femur with proximal migration of the greater trochanter was found and the head of right femur was replaced with an Austin Moore's prosthesis.

Postoperative Management

She was transferred to the recovery room where she was monitored every 5minutes for 30 minutes. Thereafter she was transferred to the ward. She was nursed in the left lateral position. She received 5% dextrose saline 500 mls to alternate with 500 mls of normal saline at the rate of 1litre 8 hourly for 24 hours. Post-operative analgesia was achieved with 30mg of intramuscular pentazocine 6 hourly for the first 48 hours and thereafter oral ibuprofen (vitamofen) 400 mg 12 hourly for 5 days.

Metronidazole 500 mg 8 hourly and ceftriaxone 1gm daily were given for the first 48 hours and thereafter oral ciprofloxacin 500 mg 12 hourly and metronidazole 400 mg 8 hourly for 4 days. She was commenced on graded oral fluids on the first postoperative day and progressed to semi-solid diet on the same day. The urethral catheter was removed on the 1st post operative day. She resumed her normal diet on the 2nd postoperative day. PCV performed on the 2nd post operative day was 28%.

The patient's blood pressure was noticed to be elevated on the 3rd post operative day (150/100 mmHg) and she was recommenced on amlodipine 5 mg, vasoprin 75 mg and moduretic one tablet daily. She also had urinary frequency and suprapubic pain on the 3rd postoperative day. Urine microscopy culture and sensitivity yielded profuse growth of Escherichia coli sensitive to augmentin and cephalexin. She was commenced on cephalexin 500 mg 12 hourly for 5 days

with satisfactory response. Physiotherapy was started on the 4th postoperative day. She started walking with support on the 8th postoperative day, and skin sutures were removed on the 10th post operative day. She was reviewed by the physician before discharge on the 11th post operative day to be seen on outpatient basis.

Discussion

Fractured neck of femur is very common in elderly women and is often associated with seemingly trivial domestic accidents due to the weakness of the femoral neck by osteoporosis [1, 2]. Other causes of fractured neck of femur include osteoarthritis and rheumatoid arthritis. Fracture neck of femur may be associated with dislocation of the hip [2]. The blood supply of the head of the adult femur is chiefly from the extracapsular ring located at the base of the neck of femur and is formed from branches of the medial and lateral femoral circumflex arteries. Neglected dislocation of the hip compromises its blood supply, resulting in avascular necrosis.

Diagnosis was made from typical history/findings on examination and confirmed by pelvic X-ray examination. Chest X-ray, ECG, haemoglobin and renal function tests done here were in accordance with the current recommendations that elderly patients (> 60yrs of age) should be routinely tested for the above parameters [6]. Apart from the above recommendations, aging related arteriosclerosis in the aorta and small vessels is common. Total peripheral vascular resistance is increased as the rigidity of the vasculature is increased and its elasticity decreased. This predisposes the elderly patient to hypertension, cardiovascular diseases, ischaemia and infarction of the organs [6]. Preoperative chest-x-ray and ECG are therefore mandatory. However, the usefulness of preoperative laboratory assessment has recently been scrutinized because of escalation of health care costs. Recent finding have suggested that the present guideline for routine preoperative laboratory testing in geriatric patients needs re-evaluation. It has been recommended that the elimination of routine preoperative laboratory testing should be extended to geriatric surgical patients with few co-morbidities [7] such as the reported case. Specifically, the performance of preoperative laboratory tests should be based on the type of surgery, patient's co-morbidities and the likelihood that this test will change perioperative care.

Goldman has reviewed the utility of his multifactorial index of cardiac risk in non-cardiac surgery [8]. The only risk this patient has is her age which is over 70-year and this accounts for only 5 of 53 possible points on the Goldman's cardiac index. This has placed her in class 1 and at 0.2% risk of cardiac mortality when subjected to anaesthesia and surgery. A thorough cardiac risk assessment which included history, physical examination and relevant investigations is necessary. Preoperative assessment was aimed at evaluating the age-related changes in physiology and anatomy. One of the goals of pre-anaesthetic visit is to allay anxiety which is common in most patients coming for surgery, especially in geriatric patients who are outside their normal environment. In addition to reassurance; premedication is often indicated in patients intended for a central neuroaxial block because of some anxiety about the procedure which is usually uncomfortable. Popular premedicant drugs including benzodiazepines, temazepam and midazolam have been used in this regard [9]. The use of tranquilizers including benzodiazepines has been proposed as one of the causes of postoperative cognitive dysfunction (POCD) by Ramesh and colleague [10]. POCD is a decline in cognitive function for weeks or months after surgery. Due to its subtle nature, neuropsychological testing is necessary for its detection. POCD is common after cardiac surgery, and may also exist after major non-cardiac surgery, although at a lower incidence. Increasing age is the leading risk factor followed by the type of surgery [12]. There is a very low incidence associated with minor surgery. Regional anaesthesia does not seem to reduce the incidence of POCD. Rasmissen *et al*., in a multiple regression analysis considering age, duration of anaesthesia and blood concentrations of diazepam and desmethyldiazepam, only age was found to correlate with POCD [11]. The postoperative cognitive dysfunction found in elderly patients after operation could not be explained by benzodiazepine concentrations detected in blood. Tavakolian *et al.* concluded that both midazolam and diazepam cause significant reduction in early postoperative cognitive function of the elderly and this was more prominent with diazepam [12]. This patient did have POCD. The use of low dose diazepam was to avoid excessive sedation to facilitate early mobilization which is necessary after hemiarthroplasty. Elderly patients as said above are prone to hypertension, cardiovascular diseases and arrhythmias [6]. Preoperative continous ECG monitoring in a group of patients with fracture of head of femur has documented significant arrhythmia in 40 percent of them [2]. Arrythmias are due to fibrosis of the conducting system and loss of sinoatrial cells which are physiological changes that occur with aging. Approximately one half of the patients have history of ischaemic heart disease and about 20 percent have hypertension [6]. Uncontrolled hypertension increases preoperative morbidity and mortality, and predisposes patients to a higher incidence of silent myocardial infarction [8, 13]. The incidence of morbid events is three times higher in untreated hypertensive patients [8]. Preoperative stabilization of blood pressure before an elective surgery is therefore indicated and the antihypertensive should be continued up to the morning of surgery.

The pulmonary changes which occur during the aging process affect both the musculoskeletal supporting structure of the lungs as well as the parenchyma of the lungs itself. The chest becomes more kyphotic with gradual compression of the intervetebral discs. Muscle wasting reduces the effectiveness of the diaphragm and intercostal muscles. Maximum breathing capacity (MBC), total lung capacity (TLC), and vital capacity (VC) therefore decrease with increasing age. The closing volume (CV) increases as a result of age induced parenchymal changes in the lungs [13]. At the age of 45 years, closing capacity is higher than functional residual capacity (FRC) in the supine position and at 65 years and above closing capacity is higher than FRC even in the sitting position [13]. Airway closure therefore occurs during normal tidal ventilation, resulting in ventilation-perfusion mismatch and hypoxia. Supplemental oxygen as used here is thus indicated.

Mauermann *et al.* recommended regional anaesthesia as the anaesthetic technique of choice for elderly patients undergoing hemiarthroplasty because there is reduced blood loss, lower incidence of thromboembolism, and no airway manipulation [14]. Rodgers and colleagues submitted that regional anaesthesia has the extra advantage of giving the patient the ability to control her air-way thereby reducing the

risk of obstruction and aspiration [15]. Regional anaesthesia without excessive sedation helps early mobilization which is an important factor in minimizing morbidity [16].

Hepatic and renal function changes in the elderly are characterized by decline in metabolism, clearance and elimination of drugs. There is reduced renal blood flow and glomerular mass, impairment of sodium handling, concentrating and diluting ability leading to volume overload or dehydration in the elderly [13]. Preloading should therefore be carried out with caution. However, preloading does not have a consistent effect on the incidence of post spinal hypotension [17]. Central nervous system function also declines, primarily characterized by a lower requirement for anaesthetic agents and perhaps for pain medication. There is altered volume of distribution and elimination half lives of anaesthtic drugs; also an increased tendency to cephalad spread of local anaesthetic agents [13] therefore reduction in the dose of drugs is necessary.

The three primary positions that may be used for spinal anaesthesia include lateral decubitus, sitting and prone, each with advantages in specific situations. The lateral position was favoured in this patient because it allowed more comfort for the patient however, it required maximum patient cooperation and a trained assistant. Osteoporosis and arthritis are common among the geriatric patients and this predisposes to pathological fracture [1]. Positioning of the geriatric patients should therefore be carried out with caution. A report on major complications of central neuraxial block by Cook *et al.* showed that the autonomic nervous system is less effective in the elderly and disruption of the sympathetic function by regional technique is more likely to cause hypotension than in the young [18]. Post-spinal hypotension may complicate a pre-existing age-related reduction in renal blood flow, and therefore necessitates close monitoring of blood pressure [19]. Vasoconstrictors should be available for treatment of hypotension. Prophylactic intramuscular injection of ephedrine has been observed to decrease the incidence of post-spinal hypotension, but it is no longer advocated because of the variable absorption and potential to precipitating hypertension which may be hazardous in patients with pre-existing hypertension. Intraoperative hypotension may complicate both spinal and epidural anaesthesia but it occurs more slowly with epidural than with spinal anaesthesia [20, 21]. A smaller quantity of local anaesthetic drugs is required, onset of action is more rapid and failure rate is lower with spinal than with epidural anaesthesia. Davis *et al*. in their study found that spinal anaesthesia provides better operating conditions and requires less supplemental hypnotics to produce satisfactory condition during hemiarthroplasty than epidural anaesthesia [22]. Another advantage is that it results in less urethral instrumentation to relieve urinary retention [22].

Postdural puncture headache (PDPH) is a distressing experience, and is common in patients who had spinal anaesthesia. The use of small gauge Whitacre needle with conical tip has been associated with reduced incidence of PDPH [23]. The Whitacre and Sprotte (non cutting) needles pierce the dura by separation of the fibres thereby reducing the opening in the dura and leakage of cerebrospinal fluid. Small needles produce fewer headaches than larger needles of the same type while very small gauge cutting needles may be more difficult to use and may have a higher failure rate than larger non-cutting needles [18].

Deep vein thrombosis is common in elderly patients with hip fracture due to prolonged immobility. Preoperative prophylaxis usually with warfarin, asprin or low dose subcutaneous heparin is often indicated [24]. Patients on anticoagulant therapy are at increased risk of epidural haematoma following spinal or epidural anaesthesia [21]. It has been argued that the combination of low dose heparin and use of regional (spinal and epidural) anaesthesia is safe. There are also claims that some patients develop significant systemic concentrations of heparin within two hours of administration which may induce full anticoagulation, suggesting that some patients may be at risk of haematoma formation [25]. Withdrawal of low dose aspirin temporarily 7 days before surgery and recommencement on the first postoperative day is indicated. Elderly patients are prone to intraoperative hypothermia because of impaired thermoregulation by the hypothalamus and decreased basal metabolic rate causing decreased heat production [13]. The use of warm fluids to reduce heat loss and resultant shivering is often indicated. Although it is expected that warming of fluids might increase bleeding due to vasodilation, this is not the case. Elderly patients are at great risk of cardiovascular and other morbidity [26]. The effect of hypothermia and shivering on oxygen consumption are most relevant in these patients; it is therefore mandatory that elderly patients should have their temperatures monitored intraoperatively. Axillary temperature monitoring is not as accurate as nasopharyngeal or tympanic membrane (core) temperature monitoring. However, placement of a temperature probe at the latter sites in an awake elderly patient may be uncomfortable.

In order to increase safety, monitoring of the patient's cardiorespiratory function using the minimum monitoring standards which consist of pulse, blood pressure, precordial or esophageal stethoscope, 5 lead ECG, temperature and pulse oximetry is indicated for early detection and prompt correction of any haemodynamic changes. Although more sophiscated equipment may aid monitoring and increase safety, none of these supersede the vigilant, knowledgeable and skilled attention of an anaesthetist. Proper attention should therefore be focussed on the patient throughout the procedure by clinical monitoring and maintaining verbal contact. Maintenance of fluid balance may be guided by clinical monitoring of fluid input and output. Intraoperative estimation of blood loss and continous replacement of significant blood loss is also important in the elderly because they tolerate blood loss poorly.

Elderly individuals, both men and women, are more likely to harbour bacteria in their genitourinary system at any time [27]. Urethral catheterization may also predispose patients to urinary tract infection. These bacteria may be associated with symptoms and thus require treatment with an antibiotic [27]. Women are more prone to urinary tract infections (UTIs) than men because in females, the urethra is much shorter and closer to the anus than in males. Most uncomplicated UTIs can be treated with oral antibiotics such as trimethoprim, cephalosporins, nitrofurantoin, or a fluoroquinolone (e.g., ciprofloxacin or levofloxacin) [28].

Conclusion

Anaesthetic management of a geriatric patient for hemiarthroplasty is a challenge to the anaesthetist because of the anatomic and physiologic changes associated with ageing. Detailed attention to the management of these changes and choice of anaesthetic technique compatible with the patient's physical status and type of surgery will lead to a

satisfactory outcome.

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