



Original Article

Anaesthetic and Surgical Experience from Joint Replacement Therapy in a Teaching Hospital in Makurdi, Nigeria

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ABSTRACT

Joint replacement therapy (JRT) commonly performed in advanced countries is being introduced in some developing countries. The objective of this study was to assess anaesthesia used and the outcome of the first 17 cases performed at a young teaching hospital in Nigeria. This was a cross-sectional descriptive study of patients for JRT at Benue State University Teaching Hospital, Makurdi, Nigeria from 23/6/2014 to 31/8/2016. Data analyzed from the anaesthetic/surgical records included age, sex, ethnicity, ASA classification, Ficat and Arlet classification of avascular necrosis, Gardens classification of fracture neck of femur, indication/type of surgery, packed cell volume (PCV), anaesthesia type, estimated blood loss, transfusions, duration of surgery and hospital stay, post-operative PCV, pain management, complications and surgical outcome. Results were summarised as means, median and percentages using SPSS version 21.0 for Windows®. One-way test of ANOVA was used for statistical significance ($p = 0.05$). Seventeen patients aged 27-90 years (mean 54.71 ± 19.69). Indications were femoral neck fracture (47%), chronic osteoarthritis (35%), avascular necrosis (18%). The commonest procedure was hemiarthroplasty (41%), total hip replacement (35%), and total knee (24%). All were under regional anaesthesia with spinal (53%) and combined spinal-epidural (47%). Multimodal post-operative analgesia was used. There was no significant difference between pre and post-operative PCV ($t = 0.708$, $p = 0.05$). Mean duration of hospital stay was 19.44 ± 9.61 days. The outcome was good in all. JRT can be established in a new center with proper planning. Regional anaesthesia with multimodal analgesia is recommended. With relevant surgical skill, patient outcome is good.

Keywords: Anaesthetic, joint replacement, management, regional anaesthesia, surgical, experience.

INTRODUCTION

Total joint replacement therapy is one of the advanced surgical techniques offered in modern day surgery. It is usually carried out as the last resort on patients with chronic joint disorders unresponsive to all other non-operative management strategies.¹ It involves the total replacement of the joint capsule and surrounding structures with prosthesis that allow the patient to return to a normal use of the joint.²

Although joint replacement surgeries have been practiced for some time now in advanced countries with the United States

performing over 600,000 annually,³ many centres in the less developed parts of the world are yet to resume this service to patients. This is due to reasons bordering on developmental challenges. Salihu *et al*,⁴ reported early efforts at total joint replacement therapy in Dala Kano involving 10 cases with severe osteoarthritis of the hip in 2008, but three of the patients had severe adverse outcome that necessitated revision surgery. Ekere *et al*,⁵ in 2008 reported two cases of total hip

2018 Journal Impact Factor: 1.10

Print ISSN: 2636-7378 | Online ISSN: 2651-5865

replacement in patient with sickle cell disease in Port Harcourt. Nwadinigwe *et al*,⁶ reported that the National Orthopaedic Hospital, Enugu took an initiative in 2008 to establish joint arthroplasty after the first effort in Nigeria in 1974 failed due to infrastructure decay. Their preliminary report shows 52 patients had arthroplasty between November 2008 and November 2010.

The Benue State University Teaching Hospital, Makurdi, a young university teaching hospital has recently inaugurated a unit to carry out the therapy. Adequate anaesthesia service including expertise is required for a successful conduct of such high tech surgeries. This study was aimed at auditing the anaesthesia and surgical techniques used for the joint replacement therapy in our hospital and to share the experience towards making joint replacement therapy available for more patients in need of it in the sub-Region.

MATERIALS AND METHODS

Study Setting

This study was conducted at the Benue State University Teaching Hospital, Makurdi, Benue State, North-Central region of Nigeria. Located by the bank of the river Benue, along kilometer 3, Makurdi Gboko Road, the hospital was established in 2012 as a teaching hospital for the College of Health Sciences of the Benue State University which lies just adjacent the hospital. It is a 350-bedded facility with practice covering a wide range of medical, surgical, pathological and allied medical practices like Physiotherapy.

It is the first teaching hospital established by a State Government in the Northern Region of the country. Though a young teaching hospital, it has obtained accreditations of the National Postgraduate College of Medicine of Nigeria and the West African Colleges of Surgeons and Physicians for several of its programmes like Anaesthesia, General Surgery and Orthopaedic Surgery. Others are Internal Medicine, Paediatrics and the Laboratory Medicine. The Radiology department of the hospital is equipped with a CT-scan, but there is no MRI. There are five operating suites though none is specifically dedicated to implant surgeries. The theatres are equipped with anaesthetic machines fitted with piped gas delivery system and suitable anaesthetic monitors. Basic general and orthopaedic surgical instruments are available with a CSSD unit to sterilise them. The implant materials are usually acquired from outside in a ready-to-use, sterile packages that are opened for single use

during the operation. The department of Anaesthesia has an Intensive Care Unit which receives completed post-operative cases for stabilisation before discharges to the wards.

Study Design

This was a prospective descriptive study of all the patients who had joint replacement therapies at the hospital covering a period of twenty six months from the inception of joint replacement surgery on 23 June, 2014 to 31 August, 2016. The medical records of patients operated on during the period of the study were reviewed and analyzed after they were discharged from the surgical ward. All patients who had any form of joint replacement treatment during the period were recruited into the study. Specific joint therapies looked out for were the shoulder, hip and knee joints. Those who had surgeries on joints but did not have implant replacements were excluded from the study. Data extracted from the records included the age, sex, ethnicity, religion, American Society of Anesthesiologists' (ASA) classification, Ficat and Arlet classification of avascular necrosis, Gardens classification of fracture neck of femur, indication for and type of surgery done. Others were pre-operative packed cell volume (PCV), type of anaesthesia given, estimated blood loss, transfusions given and duration of surgery and hospital stay. The post-operative PCV, pain management, intra-operative complications and general surgical outcome were also recorded. Outcome was assessed as good if patient tolerated the procedure well and was fit for home discharge and bad if patient did not tolerate the procedure or died. The antibiotics and anticoagulation agents used were also documented.

Data Analysis

The data were fed into and analyzed using the statistical package SPSS version 21.0 for Windows® (Chicago, Illinois, USA) and were expressed as mean { \pm standard deviation}, median, mode and percentages. One-way test of ANOVA was used for test of statistical significance with p-value <0.05 accepted as significant.

RESULTS

Seventeen cases of joint replacement surgeries were done during the period under review. The mean age of the patients was 54.71 ± 19.69 years. The youngest patient was 27 while the oldest was 90 years old. Nine (53%) were males while eight

(47%) were females. Sixteen (94%) were of the Tiv ethnic group whereas one (6%) was of Idoma ethnicity. All the patients were of the Christian faith. The mean ASA class of the patients was 2.29 ± 0.69 . Three patients had avascular necrosis with Ficat and Arlet classification stage IV. The patients who had total hip replacement were of Garden's classification stage 4. Table below shows the age distribution of the patients alongside the indication for surgery.

Table: Age distribution alongside the indications for joint replacement surgery

Age group (years)	AVN 2° SCD* n (%)	FNF n (%)	COA n (%)	Grand (%)	Total
20-29	-	-	1 (5.9)	1 (5.9)	
30-39	3 (17.6)	-	1 (5.9)	4 (23.5)	
40-49	-	1 (5.9)	-	1 (5.9)	
50-59	-	1 (5.9)	2 (11.8)	3 (17.6)	
60-69	-	1 (5.9)	2 (11.8)	3 (17.6)	
70-79	-	3 (17.6)	-	3 (17.6)	
80-89	-	-	-	-	
≥ 90	-	2 (11.8)	-	2 (11.8)	
Total	3 (17.6)	8 (47.1)	6 (35.3)	17 (100)	

*AVN 2° SCD = Avascular necrosis secondary to sickle cell disease; FNF= fracture neck of femur; COA = chronic osteoarthritis

Four (24%) of the patients had total knee replacement, 6 (35.3%) had total hip replacement. One patient had conversion of girdle stone excision arthroplasty for failed hemiarthroplasty to total hip replacement. The rest had hemiarthroplasty. The mean pre-operative packed cell volume (PCV) was $33.69 \pm 10.39\%$ while the mean post-operative PCV was $26.15 \pm 5.58\%$. A one-way ANOVA comparison of the means showed a non-significant relationship ($t = 0.708$) ($p = 0.05$). Nine (53%) of the cases were done under subarachnoid block while eight (47%) were under combined spinal epidural anaesthesia. Intra-operative sedation was achieved with intravenous midazolam, a benzodiazepine. The mean duration of surgery was 158.59 ± 33.22 minutes. The mean estimated blood loss was 606.53 ± 415.31 ml. Intra-operatively, a mean of 0.53 ± 0.51 unit of blood was transfused while post-operatively 1.18 ± 1.07 unit was transfused. The difference was not significant ($t = 0.339$) ($CI = 95\%$).

Combination analgesia therapy was used with 3 (17.6%) of the patients receiving post-operative epidural analgesia (PEA). Eleven (64.7%) received pentazocine (IM/IV) and 5 (29.4%) had intramuscular diclofenac. Majority of the patients received intravenous ceftriaxone as antibiotics. The anticoagulant used in the management of the patients was enoxaparin (clexane®) 40mg subcutaneously. Intra-operative complications were few

with 2 (11.8%) of the patients having hypotension and bradycardia. The mean duration of hospital stay was 19.44 ± 9.61 days while the outcome was good in all of the patients.

DISCUSSION

Most joint replacement therapies are done in elderly patients.⁷ Those performed on the young in the Western hemisphere are often due to obesity, rheumatoid arthritis and severe osteoporosis. However, in our study, the mean age of patients was 54 years. This figure falls outside the elderly. About a third of the total number of the procedure was done on patients younger than forty years old. Majority of the patients were those in the 30 - 39 age group. See table. A particular condition was responsible for the contribution of the younger age group to the population of patients seen; that was sickle cell anaemia. Avascular necrosis secondary to sickle cell anaemia was the commonest indication in the younger age while fracture neck of the femur and severe osteoarthritis were the indications in the elderly.

Sickle cell anaemia (drepanocytosis) results from the inheritance of two haemoglobin S gene from the parents. The parents could be both carriers, one carrier the other homozygous or both homozygous.⁸ The gene results from a single point replacement of glutamine by valine on position 6 of the β - globin chain of the short arm of chromosome 11. The result is that when subjected to hypoxia, the red cells bearing this gene undergo sickling and are unable to meander through small capillaries to deliver oxygen to tissues. The phenomenon results in several complications one of which is chronic avascularisation. The avascularisation leads to necrosis of the femoral and humeral heads with the femoral more commonly undergoing progressive joint destruction as a result of the heavier weight it bears compared to the shoulder.⁸ For the purpose of surgical management, the Ficat and Arlet classification is commonly utilised.⁹

This classification uses three parameters: plain radiography, magnetic resonance imaging (MRI) and clinical features of the joint. The classification has five stages (0 to IV). In stage IV, the plain x-ray and the MRI usually show same feature (evidence of secondary degenerative changes in the joint) and the clinical symptoms are pain and limping. The similarities of MRI and plain x-ray findings in stage IV allows centres that lack MRI facility (like our centre at the time of the study) to

make a valid Ficat and Arlet classification of avascular necrosis. All the patients included in the study had stage IV Ficat and Arlet classification. Stage IV is the most severe stage. Sickle cell disease (SCD) presents unique challenge to safe anaesthesia and surgery. The anaesthetic considerations in SCD are numerous and are often multisystem.¹⁰ They include strokes in the central nervous system, left ventricular hypertrophy, high output cardiac failure due to anaemia and non-coronary artery myocardial infarctions in the cardiovascular system. In the respiratory system acute chest syndrome (ACS), restrictive lung disease (lung fibrosis), pulmonary hypertension and cor pulmonale are common. Renal infarctions and sequestration crises in the spleen can worsen outcome. Perioperative stimulations can worsen acute pain crises and acute chest syndrome. Chronic blood transfusions in response to chronic haemolytic anaemia could result in alloimmunization, iron overload and viral transmission. The patients tend to have opioid tolerance from chronic use of opioids to treat their pain. Some may even be opioid dependent. Preoperative preparation should target specific goals of avoiding anything that may precipitate sickle cell crises. Hypoxia, hyperviscosity and vascular stasis should be avoided. Patients should be well covered to prevent hypothermia. Liberal infusions are given to prevent hypovolaemia and hyperviscosity. Adequate analgesia to prevent acute pain crisis is recommended. Proper monitoring for signs and symptoms of acute chest syndrome, vaso-occlusive crisis, aplastic or splenic sequestration should be practiced. All SCD patients for joint replacement therapy should be optimized before surgery. Adequate planning and peri-operative optimization are keys to successful management. Optimization includes adequate hydration to decrease the viscosity of blood. Control of infection and raising the pre-operative haematocrit to between 30 and 35% are essential.¹¹ Arrangement should be put in place for possible post-operative care in an intensive care unit.

Chronic osteoarthritis has remained a prominent indication for joint replacement therapy globally.¹² Our study agrees with this finding as over 35% of our patients were operated upon because of this indication. When joint replacement therapy was originally introduced, it was deployed as interventions of last resort.¹² However, studies have shown that patients operated upon later in the course of functional depreciation tend to have poor recovery of joint functions after the replacement therapy.^{13, 14}

Thus, it is now recommended that joint replacement therapy be offered to patients earlier in the course of the disease for more functional recovery of the limb. Nearly half (47%) of patients in our study had fracture of the neck of the femur as the indication for the surgery. This agrees with other studies that found that fracture of the femoral neck is common mostly in the elderly especially after simple falls.^{15,16} In a study at Mkar, 92km kilometer south east of Makurdi, Mue *et al* found that fracture of the head of femur was found mostly within the age range of 60-90 years with trivial fall accounting for majority of the mechanism of injury. However, in that study, only hemiathroplasty was offered the patients, and not total hip replacement.¹⁷ In our study, Gardens classification was used for fracture neck of femur.¹⁸ In elderly patients with stage 4 fracture neck of femur with degenerative changes in the acetabula cup, total hip replacement was preferred method of treatment.

While the majority of femoral neck fractures in the elderly occur due to osteoporosis and weakened joint ligaments due to degenerative changes, the few occurring in the young are due to road traffic accidents. In the locality of this study, many of these road crashes involve motor bikes used in commercial transportation.¹⁹

All the cases in this study were performed under regional anaesthesia. They were almost equally shared between spinal anaesthesia and combined spinal epidural anaesthesia.

The result agrees with the general observation that regional anaesthesia seems to be the anaesthesia of choice for total hip and total knee replacement surgeries.²⁰ In centres where high quality regional anaesthesia cannot be performed either due to lack of skill or unavailability of adjuncts like opioids which can increase quality of the block and prolong analgesia, then total intravenous anaesthesia along with opioids can be done. A study by Harsten *et al*,²¹ which compared anaesthesia used for total knee arthroplasty between general anaesthesia and spinal anaesthesia had demonstrated a superior quality of pain scores in favour of the general anaesthesia patients. However, while the general anaesthesia group received the state-of-the-art general anaesthesia utilizing opioid analgesics – remifentanyl at induction, and oxycodone 20mg twenty minutes to the end of surgery - the spinal anaesthesia group received only the basic subarachnoid block – local anaesthetic agent bupivacaine 15mg, without opioid or any other adjunct.

The result was that after two hours when the effects of the local anaesthetic agent wore off, the patients in the spinal group

reported higher pain scores. This emphasizes the need to add opioid analgesics or other adjuncts that prolong analgesia to the regional anaesthesia solution to be used. Alternatively, the opioid can be given via another route. This will improve patients' pain scores and promote higher comfort levels. Pre-emptive analgesia practice is encouraged in the management of anaesthesia for this group of patients.²²

Regional anaesthesia offers a lot of advantages compared to general anaesthesia for joint replacement therapy. These include the reduction of blood loss thereby decreasing the need for banked blood and its associated risks. Many patients who need blood in the developing countries of the world do not have access to it.²³ According to the World Health Organization (WHO), 47% of blood collected by donation is in the developed world which is home to 19% of the world population.²³ The immediate implication of this is that the choice of anaesthetic technique that reduces the need for blood transfusion is encouraged. In the study, mean estimated blood loss was 606ml and intra-operatively, a mean of 0.53 unit of blood was transfused implying that one of two of the patients studied was not transfused. Katchy *et al*,²⁴ reported average blood loss of 814 ml and average post up transfusion of less than 2 units.

Regional anaesthesia induces hypotension and this decreases bleeding at the surgical site thereby improving cement bonding and reducing total duration of surgery. Reduction in surgical duration offers other advantages to the patient. Incidence of deep vein thrombosis and pulmonary embolism following hip and knee arthroplasties are less when regional anaesthesia is the anaesthetic technique utilized.²⁵ Sedation is often employed after a successful regional block because of the duration of the surgery and to reduce the discomfort occasioned by patients positioning. Patients placed in lateral position may become uncomfortable and restless from pain that may arise from the dependent hip and shoulder. The short acting benzodiazepine midazolam 1mg intravenous was used intermittently for sedation in the study as it was available.

The advantage of the combined spinal epidural technique over the spinal only is the potential for prolongation of the anaesthesia, should the surgery last longer than the effective duration of spinal. The anaesthesia practitioner in choosing which technique of regional anaesthesia to use should take into cognizance the experience and speed of the surgeons and the other surgical team members in getting the surgery to start after a successful spinal block.

Duration of spinal anaesthesia is fixed. If the surgical operation does not end within this time limit, the risk of conversion to a general anaesthesia is the only option available in the absence of an indwelling epidural catheter. Returning the patient to general anaesthesia would expose the patient again to all the risks of general anaesthesia including the challenge of airway control and management, deep venous thromboses (DVTs), pulmonary embolisms (PEs), multiple drug use and increased cost of anaesthesia.²⁶ The mean duration of the surgery during the study was 158 minutes and none of the patient was converted to general anaesthesia. This was a result of proper assessment of the team members and balancing their projected speed based on previous experience and using that in determining, along with the patient habitus, whether to institute a spinal or a combined spinal epidural.

Post operative pain management in modern surgical practice follows a trend of multimodal approach which combines the benefits of smaller doses of different drugs while minimizing their individual side effects.²⁷ The study utilized a combination analgesia model with IM diclofenac, IV pentazocine, and epidural bupivacaine. Post operatively, the PCV of patients in the study was not significantly different from their pre-operative PCV. This was mostly contributed to by the anaesthetic technique of regional anaesthesia used for the procedure.

CONCLUSION

Joint replacement surgeries offer opportunities to patients to resume an improved quality use of their limbs. This service can be established with appropriate training of surgical, anaesthetic, nursing and other support staff for the benefit of patients. We found that regional anaesthesia techniques, spinal and combined spinal anaesthesia, was effective in successful execution of this high tech surgical procedure with minimal blood loss and reduced need for blood transfusion. Common post operative pain management with NSAIDs, synthetic opioids and epidural local anaesthetics were effective.

RECOMMENDATIONS

Joint replacement surgeries have proven to be safe and led to a significant improvement in the quality of life of patients needing them. It is therefore recommended that if these surgeries are to occur seamlessly in our settings, an enabling

environment, well trained professionals, equipments should be readily available.

LIMITATIONS

The limitation of this study is the small size of the sample. This is possibly due to the cost implication of the therapy as implants are costly to acquire. After 26 months of data collection, we decided to publish the study. We hope research into the subject matter shall continue into the future.

ACKNOWLEDGEMENT

The authors wish to acknowledge Nana Jella who helped in proof reading of the work.

Conflict of Interests

None declared

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