

Endoprosthetic replacement of distal femoral tumors in Nigeria: A case series

OK Idowu, SU Eyesan¹, HD Badmus², SO Giwa³, KB Badmos⁴, FB Abdulkareem⁴

Department of Orthopedics and Trauma Surgery, National Orthopedic Hospital, Igbobi, ¹Department of Surgery, Clinical Sciences, Bowen University, Ogbomosho, ²Department of Orthopaedic Surgery, Cedarcrest Hospitals, Ikeja, Lagos, ³Department of Orthopedics, Lagos University Teaching Hospital Lagos, ⁴Department of Anatomic and Molecular Pathology, Lagos University Teaching Hospital, Lagos, Nigeria

Abstract

In this observational study, three consecutive patients who were treated for distal femur tumours using endoprosthetic replacement between June 2013 and June 2014 were studied. The patients were within the ages of 28-47 years at the time of surgery. All three patients had modular endoprosthesis fixation and were evaluated using the Musculoskeletal Tumour Society (MSTS) Scoring System. Numerical values from 0 to 5 points were assigned for each of the following 6 categories: pain, function, emotional acceptance, use of supports, walking ability and gait. These values were added and the functional score was presented as a percentage of the maximum possible score. The results for each patient were graded according to the following scale: Excellent – 75-100%; good – 70-74%; moderate – 60-69%; fair – 50-59% and poor - <50%. Of the 3 patients evaluated, 2 had a diagnosis of Giant Cell Tumour (GCT) of the distal femur; the third patient was diagnosed to have plasmacytoma. All underwent wide local resection with modular endoprosthetic distal femur reconstruction. The MSTS functional scores calculated were 70%, 78%, and 52% respectively. Complications noted included wound dehiscence in two patients and thrombosis of the Pulmonary artery needing an arterial embolectomy in one of these two patients. The same patient also had a post-operative loss of motor and sensory function below the level of the ankle

Key words: Bone tumors, distal femur, endoprosthesis, resection

Date of Acceptance: 12-Aug-2015

Introduction

Primary bone tumors are a rare category of tumors, but important to the developing economy due to the age related incidence of primary bone tumors occurring in the second to fourth decades of life which is also the largest population group in our county.^[1] Tumors within this

category commonly occur around the knee. Limb-saving surgery has become the treatment of choice in primary bone tumors during the past decades,^[2] reconstructive procedures as part of a multidisciplinary treatment concept have abolished primary amputation without compromising survival and local recurrence-free survival.^[3,4] The mode of presentation of benign bone tumors in this group of black African patients is heterogeneous, demanding various surgical options. Limb sparing is a largely feasible option, but the recurrence rate is particularly higher for giant cell tumors (GCT). The increase in the number of patients

Address for correspondence:

Dr. OK Idowu,
Department of Orthopedics and Trauma Surgery, National Orthopedic Hospital, Igbobi, Lagos, Nigeria.
E-mail: ashikoashiko@yahoo.com

Access this article online

| | |
|--|--------------------------------------|
| Quick Response Code:  | Website: www.njcponline.com |
| | DOI: 10.4103/1119-3077.183295 |
| | PMID: 27251980 |

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Idowu OK, Eyesan SU, Badmus HD, Giwa SO, Badmos KB, Abdulkareem FB. Endoprosthetic replacement of distal femoral tumors in Nigeria: A case series. Niger J Clin Pract 2016;19:567-72.

presenting with GCT raises the possibility of an increase in the incidence of this condition in the black African population.^[5] Reconstruction of a large bone defect after resection of a tumor with a wide margin remains a major challenge. The options for reconstruction after resection of a tumor around the knee joint include implantation of the prosthesis, osteoarticular allograft, allograft-prosthesis composite, and arthrodesis with intercalary bone grafting or conversion to a rotationplasty.^[6] Prosthetic replacement after resection of a bone tumor around the knee joint has been demonstrated to provide a good function in many cases. However, unfortunately, prosthesis-related complications still remain an unresolved problem. Improvement in patient survival has led to subsequent surgical revisions of the prosthesis as a result of an increase in prosthesis-related complications. These include periprosthetic infections, aseptic loosening, and wear of the joint components, dislocations, breakage of the prosthesis, and fatigue fractures.^[7] We prospectively studied the first three cases of modular endoprosthetic reconstruction in the distal femur at the National Orthopedic Hospital, Igbobi-Lagos, observing

their early functional outcome using the Musculoskeletal Tumor Society (MSTS) scoring system and attendant complications.

Materials and Methods

Between June 2013 and June 2014, 3 patients underwent limb salvage surgery. All patients were still undergoing follow-up at the time of this report. The patients' medical record, surgical notes, radiographs, and pathologic records were retrospectively reviewed. Written informed consent was obtained from all of the patients included in this study.

Details of the patient characteristics

The patients included two males and a female, with a mean age of 35 years (range: 28–47 years) at the initial treatment. The anatomic location of the bone lesion was the distal femur in all the patients [Figures 1-12].



Figure 1: Postoperative X-ray of patient O.O.

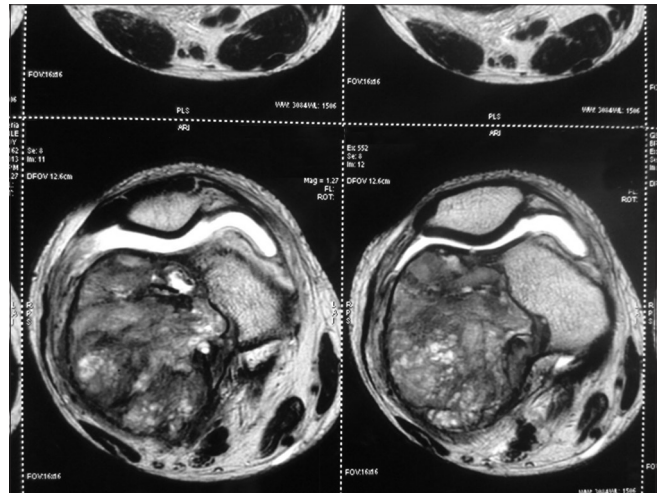


Figure 2: Magnetic resonance imaging of patient O.O. showing extent of tumor

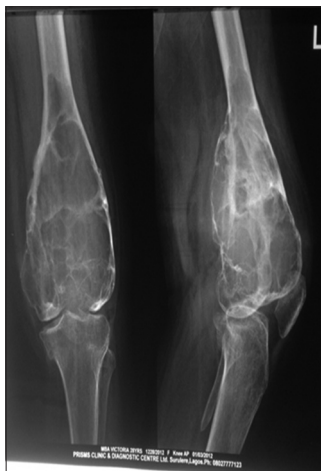


Figure 3: Preoperative X-ray of patient V.M.



Figure 4: Intra-operative picture for patient V.M.

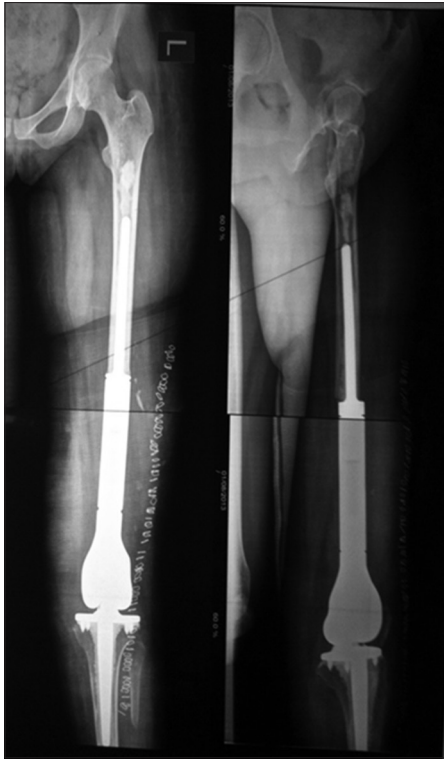


Figure 5: Postoperative X-ray of patient V.M.



Figure 7: Postoperative X-ray of patient K.I.

There was 1 patient with Plasmacytoma and 2 patients with GCT. According to the Enneking staging system for benign bone tumor, all 3 patients were categorized as Stage III.^[6-10]



Figure 6: Preoperative X-ray of patient K.I.



Figure 8: Preoperative X-ray of patient O.O.

The surgical excisions were performed with wide margins in all cases. The patient with plasmacytoma underwent chemotherapy pre- and post-operatively. The chemotherapy was performed using a combination of 2–4 chemotherapeutic drugs, including cisplatin, doxorubicin, cyclophosphamide, ifosfamide, and methotrexate. Postoperative chemotherapy was started 3 weeks after surgery.

Surgical technique

The distal femur resection with endoprosthetic reconstruction was achieved in three steps: Tumor resection, endoprosthetic reconstruction, and soft tissue reconstruction.

Tumor resection

The patient was placed in the supine position on the operating table, and a long anterolateral incision made from the mid-thigh, across the knee along the para-patellar area and distal to the tibial tubercle. The biopsy site was included, with a 2 cm margin in all directions. This incision enabled wide exposure of the distal ½ of the femur, sartorial canal,



Figure 9: Patient V.M. preoperative



Figure 10: Patient V.M. postoperative



Figure 11: Patient V.M. postoperative standing

knee, popliteal fossa, and proximal $\frac{1}{2}$ of the tibia. Distal extension of the incision allowed the use of a gastrocnemius flap, where necessary.

The popliteal space was approached by detaching and retracting the medial hamstrings. This exposed the popliteal vessels and sciatic nerve. The interval between the popliteal vessels and the posterior femur then was developed by ligation and transection of the geniculate vessels.

The distal femur was approached via the interval between the rectus femoris and vastus lateralis, leaving the intact vastus intermedius over the distal femur. A portion of the vastus medialis was left over the medial soft tissue extension of the tumor. The joint capsule was then opened longitudinally along its anterolateral border and ligaments and menisci were removed.

Distal femur osteotomy was performed at the appropriate location as determined by the preoperative imaging studies, approximately 3 cm beyond the point of proximal tumor extension. A tibial osteotomy was performed to allow the



Figure 12: Patient K.I. postembolectomy

introduction of the prosthetic tibial component. This was done in the same manner as a standard knee arthroplasty; approximately 1 cm of the bone was removed. The osteotomy was perpendicular to the long axis of the tibia.

Endoprosthetic reconstruction

The largest possible stem diameter was used. The canal was reamed 2 mm larger than the chosen stem diameter. Trial articulation initially was done; the device used for this step in the procedure included a femoral stem, body, condyle components, axle and polyethylene bushings, and tibial bearing and plug components [Figure 4].

The definitive modular prosthesis was then assembled; the exact orientation of the prosthesis was achieved using the linea aspera and tibial tuberosity as the remaining anatomic guidelines. The femoral and tibial components were placed in line with both reference points. The cementing technique involved pulsatile lavage, use of an intramedullary cement restrictor, reduction of the cement by centrifugation, use of cement gun, and pressurization of the cement. Patellar resurfacing was not performed as the patients were young and without significant degenerative changes in the patella.

Soft-tissue reconstruction

Special attention was given to covering the prosthesis completely with muscle tissue. The remaining vastus muscles

Table 1: Clinico-pathological data

| | Age | Sex | Histological diagnosis | Symptom interval before presentation | No. of previous surgeries | Resection length | Type of prostheses | Complication | Msts score (%) |
|------|-----|-----|------------------------|--------------------------------------|---------------------------|------------------|--------------------|--|----------------|
| V.M. | 28 | F | GCT | 5 years | 1 | 17cm | Restor® | Superficial surgical site infection | 70 |
| O.O. | 32 | M | GCT tendon sheath | 6 months | 0 | 15cm | Impol® | Nil | 78 |
| K.I. | 47 | M | Plasmacytoma | 8 years | 2 | 24cm | Impol® | Wound dehiscence + Pulmonary artery embolism | 54 |

F=Female; M=Male; GCT=Giant cell tumour; V.M=Case 1; O.O=Case 2; K.I=Case 3

were sutured to the rectus femoris. The sartorius muscle was mobilized and rotated anteriorly for the additional closure of the remaining medial soft tissue defect where necessary.

Postoperative treatment

The lower extremity was elevated for 3 days, until the first postoperative wound check, to prevent wound edema. Continuous suction was instituted for 5 days, [Figure 12] and prophylactic intravenous antibiotic therapy was continued until the drainage tubes were removed. Knee motion was restricted in an immobilizing brace for 2–3 weeks to allow healing of the surgical flaps and until the extensor mechanism is functional. During that time, isometric exercises and weight-bearing were allowed [Figures 1,5 and 7].

Assessment

The functional results and complications were investigated. A functional evaluation was performed using the scoring system of the MSTs which consists of six parameters (pain, function, use of walking aids, walking activity, gait, and emotional acceptance).^[7,9] The 28-year-old woman with GCT had an MSTs score of 70% (good); [Figures 9-11] The 32-year-old man with GCT also had a score of 78% (excellent); however, the 47-year-old man with Plasmacytoma had a score of 52% (fair).

Complications

The first patient had a minor complication of wound dehiscence, which required a secondary closure following which she had an adversely uneventful recovery; the second patient managed for GCT did not have any significant postoperative complication noted; the last patient who had chemotherapy before and after surgery developed a loss of motor and sensory function to the limb below the level of the ankle, he also developed a popliteal artery stenosis secondary to thrombus formation for which he had catheter embolectomy. He also had wound dehiscence requiring a flap cover by the plastic surgeons.

Discussion

Different options have been proffered in the treatment of distal femur and proximal tibia. Bajracharya *et al.*^[11] described the treatment of a malignant GCT in the distal femur with resection of the tumor mass en block with acute docking of

proximal and distal end and fixed with long K-nail across knee from femur to tibia. After complete consolidation/union of the ends, removal of K-nail was done followed by corticotomy along with distraction osteogenesis with the help of Ilizarov ring fixator. The length was achieved with this process. The end result was very good. Grimer *et al.*^[12] performed endoprosthetic replacement after resection of tumors of the proximal tibia on 151 patients over a period of 20 years. During this period, limb-salvage surgery was achieved in 88% of patients with tumors of the proximal tibia, they observed an initial infection rate of 36%, which was reduced by the use of medial gastrocnemius flaps, and they also reported that the probability of further surgical procedures being required was 70% at 10 years and the risk of amputation, 25%. It was therefore, concluded that Limb salvage for tumors of the proximal tibia was fraught with complications, but the good functional outcome in successful cases justifies its continued use.

In this report, the 2 patients with the better functional outcome by the (MSTS scores) were patients with the smaller lesion, shorter duration of symptoms, and benign histological diagnosis. The third patient who was managed for plasmacytoma a long standing disease, with significant bone destruction had a poorer outcome. This particular patient also had previous open biopsies and chemotherapy prior to endoprosthetic replacement [Table 1].

All 3 patients, however, preferred the option of the endoprosthetic reconstruction to the options of amputation. Cultural and religious orientations significantly influence patients' decisions in our environment, with most patients requiring amputation for life-saving indications declining such treatment options. Limb salvage has, however, been shown to be cost-effective in comparison with amputation^[13] and patients generally prefer limb salvage.

This has placed an increased demand for more advanced surgical options for treatment of bone tumors in our clinics. These tumors were hitherto treated with arthrodesis or amputation of the affected extremity which resulted in unfavorable functional and psychological outcomes.^[14]

In this case series, 2 patients had complications of wound dehiscence, one of whom had other complications of popliteal artery thrombosis requiring an embolectomy. He subsequently developed loss of sensory and motor function

below the level of the ankle. This poor outcome may be attributable to several factors including the patient's clinical condition prior to surgery having undergone several sessions of chemotherapy for a recurrent disease thus affecting his physical status, and partial encasement of the vascular bundle in the mass requiring close dissection. Hence, the needs for risk assessment for patients being offered limb reconstruction for malignant bone tumors.

This report being an early review of our first few endoprosthetic surgeries will form a fulcrum for the enhancement of limb salvage surgeries for tumors in the sub-Saharan Africa. This will hopefully generate further research into the factors affecting the outcome and methods of reducing complications associated with this procedure.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Eyesan SU, Obalum DC, Nnodu OE, Abdulkareem FB, Ladejobi AO. Challenges in the diagnosis and management of musculoskeletal tumors in Nigeria. *Int Orthop* 2009;33:211-3.
- Kinkel S, Lehner B, Kleinhans JA, Jakubowitz E, Ewerbeck V, Heisel C. Medium to long-term results after reconstruction of bone defects at the knee with tumor endoprostheses. *J Surg Oncol* 2010;101:166-9.
- Batta V, Coathup MJ, Parratt MT, Pollock RC, Aston WJ, Cannon SR, *et al.* Uncemented, custom-made, hydroxyapatite-coated collared distal femoral endoprostheses: Up to 18 years' follow-up. *Bone Joint J* 2014;96-B: 263-9.
- Rubio D, Serrano M, Wang E. Tumour endoprosthetic reconstruction for primary aggressive and malignant bone tumors of the distal femur. *Malays Orthop J* 2013;7:1-5.
- Eyesan SU, Idowu OK, Obalum DC, Nnodu OE, Abdulkareem FB. Surgical consideration for benign bone tumors. *Niger J Clin Pract* 2011;14:146-50.
- Lindner NJ, Ramm O, Hillmann A, Roedel R, Gosheger G, Brinkschmidt C, *et al.* Limb salvage and outcome of osteosarcoma. The University of Muenster experience. *Clin Orthop Relat Res* 1999;358:83-9.
- Rougraff BT, Simon MA, Kneisl JS, Greenberg DB, Mankin HJ. Limb salvage compared with amputation for osteosarcoma of the distal end of the femur. A long-term oncological, functional, and quality-of-life study. *J Bone Joint Surg Am* 1994;76:649-56.
- Enneking WF, Dunham W, Gebhardt MC, Malawar M, Pritchard DJ. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. *Clin Orthop Relat Res* 1993;286:241-6.
- Niimi R, Matsumine A, Hamaguchi T, Nakamura T, Uchida A, Sudo A. Prosthetic limb salvage surgery for bone and soft tissue tumors around the knee. *Oncol Rep* 2012;28:1984-90.
- Jawad MU, Scully SP. In brief: Classifications in brief: Enneking classification: Benign and malignant tumors of the musculoskeletal system. *Clin Orthop Relat Res* 2010;468:2000-2.
- Bajracharya S, Khanal GP, Nepal P, Shrestha BP, Singh M. Giant cell tumor of the femoral distal end: A challenge in treatment. *Acta Orthop Bras* 2009;17:58-61. Available from: <http://www.scielo.br/aob>. [Last accessed on 2015 Sep 12].
- Grimer RJ, Carter SR, Tillman RM, Sneath RS, Walker PS, Unwin PS, *et al.* Endoprosthetic replacement of the proximal tibia. *J Bone Joint Surg Br* 1999;81:488-94.
- Grimer RJ, Carter SR, Pynsent PB. The cost-effectiveness of limb salvage for bone tumors. *J Bone Joint Surg Br* 1997;79:558-61.
- Enneking WF, Shirley PD. Resection-arthrodesis for malignant and potentially malignant lesions about the knee using an intramedullary rod and local bone grafts. *J Bone Joint Surg Am* 1977;59:223-36.