

Observational Study

Early outcome of resection and endoprosthetic replacement of tumors around knee

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Juxtaarticular tumors around knee especially Giant Cell Tumors are common and pose a special problem in their reconstruction and management. Amputation is no longer the sole contribution of orthopaedic surgeon to its management. Improvement in design of endoprostheses and surgical reconstruction techniques together with advances in chemotherapeutic regimens have made limb salvage a viable alternative. The aim of the study was to evaluate the early results of endoprosthetic replacement around knee in terms of functional outcome and complication. In this case series we are here by presenting data of eight patients (five female, three male) with primary tumors around knee who were treated with wide local excision and megaendoprosthetic replacement. Functional evaluation was done using the MSTS (Musculoskeletal Tumor Society) Scoring system. Complications if any were also analysed. The mean follow up period was 12 months (6-20 months). The final mean functional score was 79%. There were no instances of deep tissue infection, recurrence, aseptic loosening or death. Megaprosthesis reconstruction in limb salvage provides good functional outcome in patients with tumor around knee. The early results from patients have been encouraging.

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Key words : Tumors around knee, endoprosthesis, functional outcome.

The knee is the most frequent site of primary bone tumor¹. For almost two decades extremity amputation was one of the viable options for patients with bone tumor in the region of knee and hip, but with advances in implant technology, surgical reconstructive technique and adoption of new chemotherapeutic protocols, more onco surgeons are opting for limb salvage procedures.

Success in limb salvage approach depends upon understanding of tumor biology and assessment of tumor aggressiveness. The majority of tumors arising in the knee can be treated now with limb sparing surgery and results in good early and late functional outcomes¹⁻⁵. Reconstruction methods include allograft, prosthetic composites, arthrodesis with intercalary bone graft, rotational plastic procedures and segmental endoprosthetic replacement. All methods excepting endoprosthetic replacements have functional restrictions and can be applied in exceptional cases and in specific centres with bone banking facility.

Endoprosthetic replacement on the other hand provides numerous advantages, including immediate weight bearing, maintenance of joint mobility and early return to activities of daily living²⁻⁴.

MATERIALS AND METHODS

This prospective study was performed between Feb 2012-July 2013. A total of 8 patients (3 males & 5 females) diagnosed with primary malignant and aggressive benign bone tumors of proximal tibia and distal femur were included. Distal femur was involved in 3 patients (2 males & 1 Female), and Proximal tibia in 5 (1 male & 4 Females) (Fig 1) with tumor diagnosed as aggressive variety of GCT with soft tissue involvement in 6 patients and Osteosarcoma in 2 patients. Out of 8 patients, 6 presented with pathological fracture at time of admission. The average age group was 32 years (25-40years).

Inclusion criteria were : (1) Tumor with extensive bony lysis & soft tissue involvement.

(2) Primary malignant bony tumour necessitating wide excision of Joint

(3) Patient giving informed consent for availing an Endoprosthetic replacement.

The most common complaint was pain followed by swelling and subsequent inability to bear weight. The mean duration of symptoms was 10 months (6-12 months). Routine radiology (radiography of the involved extremity, chest radiography, CT Angio, MRI) was performed. The diagnosis was based on Histopathological features noted on core biopsy.

All patients underwent definitive wide local resection of tumor with implantation of modular cemented Endoprosthesis (Fig 2). For distal femur, the technique of

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sleeve resection of quadriceps musculature was used retaining the functional rectus femoris tendon which achieved adequate surgical margin while preserving enough musculature to provide soft tissue cover for the prosthesis and retaining adequate extension power. For proximal tibial lesions resection of the tumour bearing part with a medial gastrocnemius rotation flap was used (Fig 3).

Rehabilitation protocol was slightly modified for distal femoral & Proximal tibial group. Non weight bearing on Crutches/Walker was allowed at week 4 for distal femoral group and at week 6 for proximal tibial group. Knee bending & Quadriceps Strengthening protocol under supervision of physiotherapist was started after 3 days for distal femoral group and after 6 weeks for proximal tibial group till goal of around 100° was achieved. Progressive weight bearing was started simultaneously. Functional outcome using the Musculoskeletal Tumour Society (MSTS) scoring system (Table 1). 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 were graded according to the following scale : Excellent – 75% to 100%; good – 70% to 74%; moderate – 60% to 69%; fair – 50% to 59% and poor – <50%.

RESULTS

The mean follow up period was 12 months (range 6 mths-20 mths). There were no intraoperative complications. There were no instances of aseptic loosening of implant, tumor recurrence deep infection or death.

Minor complication in the form of superficial skin infection in 1 patient and superficial marginal flap edge necrosis in 1 patient were encountered which was successfully managed with dressing change and antibiotics. No patients were lost to followup.

Mean degree of knee flexion for distal femoral endoprosthesis patients



Fig 1 — Preoperative X-Ray of one of the patients showing GCT over proximal tibia



Fig 2 — Postoperative X-Ray showing proximal tibial cemented endoprosthesis



Fig 3 — Intraoperative photograph showing medial gastrocnemius rotation flap covering endoprosthesis in region of proximal tibia

was 110 deg. Compared to 95deg in the proximal tibial group. The mean extension lag for PT reconstruction was 22 deg (range 20-30 deg)

Functional outcome as measured by MSTS functional assessment were good with mean pain relief score 5 (range 4-5), Mean functional score 3.3 (range 3-4), Mean emotional acceptance of the procedure and outcome 4.7 (range 4-5), Mean lower extremity score for support use was 3.5 (range 3-5), for walking ability was 3.9 (range 3-5), and for gait was 3.3 (range 3-5), with total mean score of 23.7 (79% MSTS Score).

DISCUSSION

The knee is the most common site for primary bone tumours and a majority are in the distal femur¹⁻⁷ with Osteosarcoma being the most common type of malignant bone tumour in the region of the knee¹⁻⁶. Limb salvage surgery is an accepted treatment modality for tumors around the knee with the use of limb preserving Endoprosthesis method of choice to restore function and optimal patient satisfaction. These should be considered not only in patients with malignant tumors around the knee but also with aggressive Stage 3 giant cell tumour requiring wide resection for local control for replacing the resected bone segment. It has been well documented that 5 year survival rate is not different in patients treated with proper surgical excision and endoprosthetic replacement compared to those treated with amputation for malignant tumors around knee.

Endoprosthetic replacement has many advantages over other forms of limb salvage procedures as it provides immediate stability which enables early rehabilitation with early weight bearing, maintenance of Joint mobility and early return to activities. We used the modular variety of Endoprosthesis which

Table 1 — Detailed description of Musculoskeletal Tumour Society Scoring System (MSTS)

No	Pain	Function	Emotional	Support	Walking	Gait
5	No Pain	No Restriction	Enthusied	None	Unlimited	Normal
4	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
3	Modest/ Nondisabling	Recreational Restriction	Satisfied	Brace	Limited	Minor Cosmetic
2	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
1	Moderate/Disabling	Partial Restriction	Accepts	One cane or crutch	Inside Only	Major Cosmetic
0	Severe Disabling	Total Restriction	Dislikes	Two canes or crutches	Not Independently	Major Handicap

allowed for incremental prosthetic replacement in response to length of resected bone.

Functional outcomes were generally good to excellent with MSTTS functional score of 23.2 (range 20-26) and good range of knee motion for activities of daily living (mean flexion of 100°).

Megaprosthesis have known complications such as polyethylene wear in rotating hinge types and fatigue fracture of yoke and base of intramedullary stem at junctional region but improvements in implant materials & design have enhanced dispersion of joint stress during motion leading to increased durability of modern Endoprosthesis. The long term survival rate has been reported as 90% at 5 years and 80% at 10 years^{8,9}.

The proximal tibia region is more difficult for wide resection and subsequent reconstruction, due to the close proximity of the tumour to major neurovascular bundles and inadequate soft tissue coverage. Reconstruction of the extensor mechanism is a weakness in reconstructions involving proximal tibia resection; in fact, failure is common for this procedure¹⁰⁻¹³. Proximal tibia replacement results in poorer functional outcome compared to distal femur replacements. The risk of infection and early reoperation is higher and final survival of prosthesis is shorter for proximal tibia replacements, and rates for secondary rupture of the extensor mechanism range from 4%-15%^{10,11}. The use of a medial gastrocnemius flap dramatically lowers the infection rate and improves resultant knee extension¹⁴, but the outcome is still poorer compare to distal femur procedures, as the patella tendon reattachment is not biological and there is a tendency to slip, avulsion it causes extension lag. Furthermore, late rehabilitation and extensive surgical procedures associated with the flap lead to fibrosis that limits knee range of motion. We used a medial gastrocnemius flap as part of extensor mechanism reconstruction and repaired soft tissue in 90° flexion for all proximal tibia reconstruction patients. All patients were braced in full extension for 6 weeks before starting knee range of motion rehabilitation.

Infection is the most common complication in most studies from 4% to 24%. In our series there was one case of superficial skin infection which was treated successfully with dressings and antibiotics. None of the patients in our series had deep infection, implant breakage, loosening or periprosthetic fracture.

The major dilemma with implantation of endoprosthesis is when the patients outlives the prosthesis. In malignant lesions the longevity of implant has been reported as fair to poor^{14,15} with even more debate with regards to patients with benign bone tumour like GCT, as their life expectancy is long and revision of the prosthesis may be necessary during their lifespan¹⁶. However the results of endoprosthesis replacement in comparison to excision and

knee fusion, curettage, cauterisation and bone grafting are definitely superior in terms of functional outcome and recurrence rate.

In spite of obvious limitations of this study in the form of small subset of patients, early functional and Oncological outcomes were satisfactory. Long term follow up is required to confirm whether endoprosthesis replacements of tumors around the knee should become the treatment of choice in selected patients.

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