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Dr. Nandkumar Sundaram
FRCS, M.SC (Ortho) (London), Director Department of Orthopedics, Senior Consultant Orthopedics and Joint Replacement Surgeon, Helios Hospitals PVT Limited, Chennai, Tamil Nadu, India

Dr. Ashok S
Senior Registrar, Department of Orthopedics, Helios Hospitals Pvt limited Velachery and Fortis Malar Hospital, Adyar, Chennai, Tamil Nadu, India

Dr. Selvin Prabhakar V
Senior Registrar, Department of Orthopedics, Helios Hospitals Pvt limited Velachery and Fortis malar Hospital, Adyar, Chennai, Tamil Nadu, India

Corresponding Author:
Dr. Nandkumar Sundaram
FRCS, M.SC (Ortho) (London), Director Department of Orthopedics, Senior Consultant Orthopedics and Joint Replacement Surgeon, Helios Hospitals PVT Limited, Chennai, Tamil Nadu, India

Navigation assisted primary total knee arthroplasty sixteen years after gaint cell tumor distal femoral cement augmentation

Dr. Nandkumar Sundaram, Dr. Ashok S and Dr. Selvin Prabhakar V

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Abstract
49 year old female who underwent curettage and cementation for distal femur Giant cell tumor (GCT) 16 years back, presented with severe knee osteoarthritis. She was managed with navigation assisted primary total knee replacement with cruciate retaining prosthesis. The possibility of cement augment loosening with drilling intramedullary canal was also ruled out when navigation system was employed.
Theoretical contamination of the femoral canal by residual tumor can be avoided by using navigation. Primary cementation during management of GCT and employment of navigation system provides optimal outcomes.

Keywords: giant cell tumour, primary knee arthroplasty, cement augmentation, navigation assisted

1. Introduction
Giant cell tumors (GCT) are aggressive benign tumors that typically affect the metaphysis of long bones and confined locally. They represent approximately 15% of benign bone tumors were initially mentioned by Jaffe *et al*. [1]. Various Treatment options mentioned are of intralesional curettage with or without chemical adjuvant and cavity filling with either allograft bone or bone cement. Some patients may develop degenerative changes of the adjacent joint surface following lesion treatment and will eventually require a later reconstructive procedure. We present a case of joint reconstruction performed with navigation assistance, 16 years after primary treatment of a GCT with curettage and cementation. We were able to utilize regular primary total knee replacement (TKR) prostheses with navigation assistance, avoiding the use of stems, augments or any mega prostheses. The patient consented to publication of the case.

2. Case report
A 49 years old patient presented with complaints of knee pain and restriction of movements over the past 2 years. 16 years back, she was treated for GCT of right distal femoral medial condyle with curettage and cementation (Figure-1, Figure-2). Patient was symptom free for till last two years, with almost full range of movements of the joint. Pain and restricted mobility has been progressive. She received intra-articular visco supplement in both knees with no benefit. Multiple opinions were sought from different orthopedic and oncology surgeons, and were commonly advised distal femur resection with employment of mega tumor prostheses.

Fig 1: Post GCT curettage and cementation – Xray images

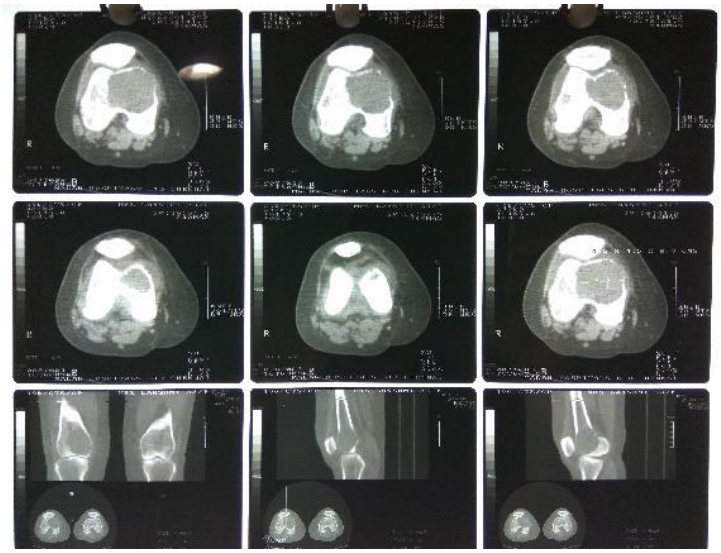

Fig 2: Post GCT curettage and cementation – CT images

Patient was not keen on mega prosthesis and returned to her primary orthopaedic surgeon who had treated her GCT. On clinical examination, she had a primarily healed anteromedial skin incision over the right knee. She was able to flex her knee from 0° to 95°. Weight bearing plain x-rays of both knees showed severe arthritic changes with large cement bolus at right distal medial condyle femur with no signs of loosening or tumor recurrence locally (Figure-3). CT of the knee showed good osteointegration of the cement and no evidence of loosening or any residual tumor. Considering the quality of cementation and cement osteointegration with the distal femur, she was advised navigation assisted total knee arthroplasty using routine primary total knee prostheses.

Fig 3: 16 years post index procedure – x-rays showing arthritic changes

Before the procedure, revision knee replacement instrumentation and prostheses were kept as back up. With tourniquet control, using midline incision and medial parapatellar approach, knee joint exposed. Severe degenerative changes of articular cartilage were noted. Patellar surface was intact. Anterior cruciate and menisci removed.

The accelerometer based navigation device was mounted onto distal femur with centre pin. The distal femoral cut was taken as per calculated measurements with the navigation device (Figure-4, Figure-5). The proximal tibial cut was also completed. The extension gap was found to be satisfactory. The distal femoral cutting block was mounted after appropriate sizing of the femur. The cuts were taken with utmost care so no loosening or fragmentation of bone cement (Figure-6, Figure-7, and Figure-8). We had to change to new blades twice when resistance was noted during the cuts at the cement mantle. After completion of the distal femoral cuts, the bone cement was seen well integrated to host bone and no signs of loosening or fragmentation noted.

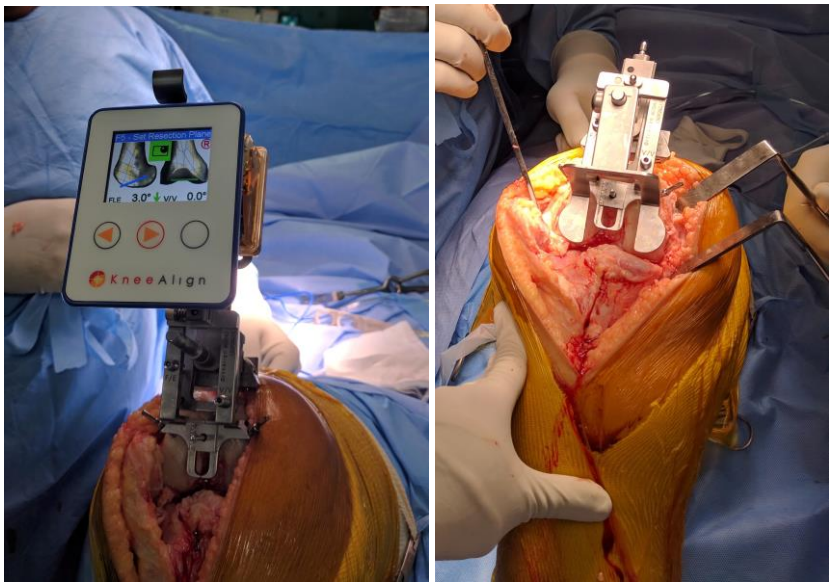

Fig 4: Navigation assisted distal femoral cuts

Fig 5: Intra op images post distal femoral cut

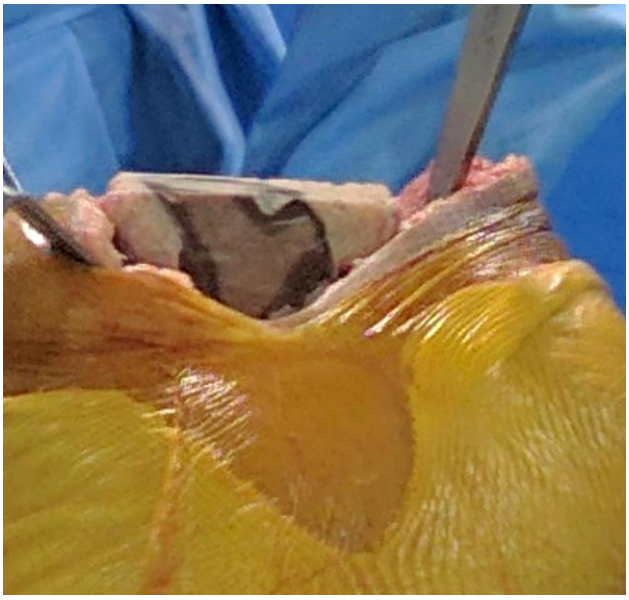

Fig 6: Distal femur after Bone cuts

Cruciate retaining trial was chosen to avoid further cuts into bone cement and distal femur. Standard tibia sizing and preparation was done. The trial implants were placed and checked for stability in full range of movements and found to

be satisfactory.

After trialing, size 4 Oxinium (Smith & Nephew) femoral prostheses and size 3 tibial base plate were fixed with gentamycin impregnated bone cement. 9mm CR insert was used and joint reduced. The joint was very stable in full range of motion intraoperativley.

The post operative x rays showed well placed prostheses with proper fixation and alignment (Figure-9, Figure-10). Patient was mobilized on 1st post op day and knee flexion upto 90* actively achieved on 3rd post op day.

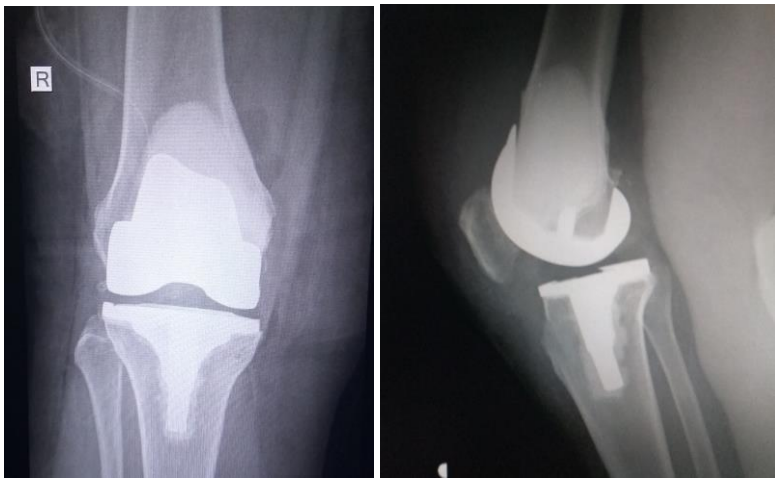

Fig 7: Post op Radiographs after Knee replacement

Discussion

Giant cell tumors (GCT) of bone are aggressive benign tumor but are potentially malignant lesions. It is one of commonest benign tumor comprising about 15% of all tumors. It commonly occurs at 2-3 decade of age and usually at distal femur and proximal tibia. It remains as one of the difficult and challenging problem for treatment because there are no absolute clinical, radiographic or histological parameters to predict the tendency of any single lesion to recurrence or metastasize [2]. Eighty per cent of the GCT have a benign course but the chances of local recurrence rate of about 10-50%; another 10% of GCT undergo malignant transformation through their recurrences and 1-4% give pulmonary metastases even in case of a benign pathology [3, 4].

The problem of selecting the line of treatment for GCT is complicated by the failure of its histological and radiological appearance to indicate its biologic nature [5, 6]. The management of giant cell tumors around the knee in young patients continues to be one of the most challenging areas in orthopedic oncology [7] and also in their long term follow-up when they might require joint reconstruction. Once the tumor has been adequately resected and curetted, structural support of the remaining bone is often necessary [5]. There is ongoing debate whether cement or bone graft is the best defect filler. Some studies report good results with bone graft [9, 10], although other groups support the use of cementation [11, 12, 13] or both graft and cement [14] .Wada *et al* [15]. Reported cementation to be safe choice for structural support with a low risk of osteoarthritis. Remedios *et al* [16]. Reported lower recurrence rates with the use of cement compared to bone grafting. This finding was supported by Kivioja *et al*. [17], who also reported lower recurrence rates with the use of cement. In a study by Fraquet *et al*. [18], they felt that not only was recurrence diminished, but also a recurrence could be more easily detected if cement was used instead of bone graft. Since the local behavior of giant cell tumors can be aggressive and they have a greater risk of local recurrence, some authors advocate en bloc resection and reconstruction with mega custom prosthesis from the point of view of preventing local recurrence rate and preserving joint [19, 20].

When we searched for any similar cases, we could find only one case was found to have been reported but with conventional TKR with intra medullary jig. It was a case report of 20 yrs GCT with cementation was done with conventional technique where they mentioned that use of navigation could have potentially made the case even easier by avoiding the need for an intramedullary femoral rod. Theoretical contamination of the femoral canal by residual tumor would have been prevented by using navigation [21].

This report presents the outcome of TKA performed using accelerometer based navigation for both the distal femoral and proximal tibial resections. Our result demonstrate that accelerometer based navigation is highly accurate for both tibial and femoral component alignment, was aligned within 3° of neutral to the mechanical axis. In recent reviews of TKAs performed with conventional IM femoral alignment jig and EM tibial alignment guides, only 73.3% were aligned within 3° of neutral to the mechanical axis. The accelerometer based navigation system provides intraoperativley, real-time feedback to the surgeon without having to consult a monitor outside of the operative field, as with most large conventional navigation systems. In addition, it is compatible with all TKA systems, making it more convenient for surgeons acclimated to the use of tibial extramedullary and femoral intramedullary alignment guides [22, 23]. This study demonstrates navigation to be a promising alternative to case where IM reaming to be avoided. It is also vital to use power saws with fully charged batteries and also use new cutting blades. During the cuts at the cement mantle, it is important to replace blades batteries or blades when resistance is encountered.

In conclusion, this case illustrates that TKR with navigation assistance as the choice of treatment for osteoarthritis of knee following GCT treatment when the primary treatment method was curettage and cementation, avoiding use of tumor mega prosthesis.

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