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Joint Salvage Surgery Using Sandwich Technique for Distal Femur Giant Cell Tumour in Young Male Patient – A Case Report.

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Abstract: ***Introduction:*** *Most common site for Giant cell tumour is knee, Where the tumour characteristically extends up to the subarticular bone plate. Extensive curettage with preservation of joint should be done where ever possible. The alternatives for filling the void left after curettage are either bone graft or bone cement. Curettage followed by cementation is a commonly accepted treatment modality for giant cell tumours of the bone. However, concerns regarding articular cartilage damage related to the exothermic reaction during polymerization and the change in stress distribution in the subchondral region have been reported to occur within 5 yrs following cementation. Sandwich technique uses the advantages of both, taking care to prevent damage to articular cartilage.*

Case report: *A 26 yr old male patient came with complaints of Rt. Knee pain and difficulty in walking. Patient was evaluated clinically and radiologically and underwent biopsy which confirmed diagnosis Giant cell tumour. Patient was planned for surgery and underwent Tumour Excision and cavity filled with Sandwich technique and followed him 1month, 3 months, 6months, 1yr and every 6months for 2 yrs.*

Results: *Patient had uneventful recovery and regained near normal motion in the knee. He didn't developed signs of articular cartilage degeneration at final follow up.*

Conclusion: *The "Sandwich Technique" of reconstruction of the subchondral bone after extended curettage produces good functional results with a low recurrence rate. Insertion of a corticocancellous bridge between the subchondral bone and cement layer may retard the progression of early cartilage degeneration. The intermediate outcome follow-up has been promising, but long-term follow-up is required.*

KeyWords: *Gaint cell Tumour, Curettage, Sandwich Technique, Bone cement*

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I. Introduction

The vast majority of giant cell tumours (GCTs) of bone tend to be peri-articular, with the distal femur and the proximal tibia accounting for over 50% (1). The next most common location is the distal radius. The lesions are epimetaphyseal in geographic location and thus offer management challenges due to their close association with articular surfaces. There remains no consensus as it relates to the management of this pathology. Various treatment options have been employed, ranging from the joint- preserving option of intralesional curettage to the more radical procedure of *en bloc* excision. Joint-preserving options offer a better quality of life and are associated with less morbidity than radical excision (2). For this reason, most surgeons prefer this option, but recurrence rates tend to be higher (2). To decrease the recurrence rate, intralesional curettage is often combined with adjuncts to increase the kill zone *ie* extended curettage.

Polymethyl methacrylate (PMMA) is most often employed as an adjunct with intralesional curettage because it also provides structural support (3). However, when PMMA is used in closed proximity to articular cartilage, there is the risk of inadvertent damage to the articular cartilage (4). The Sandwich technique provides a method of safeguarding against this by providing an insulating layer between the PMMA and the articular cartilage (5).

II. Case Report

A 26 yr old male patient, student came to Orthopedics OP department of Narayana Medical College and Hospital, Nellore complaining of pain and swelling over Rt. Knee and Difficulty in walking for 15 days. Patient had a history of trauma (fall from his bike on his leg) 6 months back. Later, Rt. Leg pain started with no swelling and pain subsided with in 2 days and able to do his regular daily activities. Since 15 days, patient noticed pain and swelling over Rt. knee not subsiding with Medication. Pain is dull aching type, progressive in

nature for past 4 days and unable to walk. Swelling present and not increasing or decreasing on exertion. History of fever on and off for past 5 days. Due to pain patient was unable to walk or climb stairs. No other joint involved. No history of Tuberculosis and Rheumatoid arthritis.

On Examination :

- Patient examined in supine position.
- **Attitude of the limb:** Hip in neutral, knee in neutral. Patella facing roof, ankle in neutral.
- **Inspection:**
  - Quadriceps muscle wasting present.
  - Swelling over anterolateral aspect of distal femur. Globular in shape.
  - engorged veins present.
  - skin over swelling is shiny in nature.
- **Palpation:**
  - Local rise of temperature present.
  - Tenderness over swelling present.
- **Swelling:**
  - Borders well defined of about 7x8cms.
  - Hard in consistency. Irregular surface.
  - Not mobile. Getting underneath the swelling is not possible.
- Extension of the swelling: Swelling present Anterolateral aspect of distal femur extending lateral condyle of femur proximally extending 8cms above lateral condyle.

Antero posterior: From the lateral border of patella till posterior cortex of the femur.

- **Movements of Rt. Knee:**
  - Flexion: 0-60degrees Active and passive flexion till 70 degrees further flexion painful.
  - Extension: 0 degrees.
- **Measurements:**
  - Quadriceps wasting of 2cms present.
  - No limb length discrepancies.

- **Special tests:** Unable to do due to pain.

Plain radiographs of the right knee revealed an eccentrically located 7 x 7 cm lytic epimetaphyseal lesion to his Rt. Distal femur with absence of a surrounding rim of sclerosis and a narrow transition zone (Fig. 1).

Fig. 1: Anterior posterior and lateral radiograph of the right knee showing eccentric lytic epimetaphyseal lesion.

Magnetic resonance imaging revealed a well-defined mass with decreased signal intensity with expansile nature of the lesion with evident of soft tissue extension in T1 sagital and coronal views of MRI Rt. Knee joint(Fig: 2).

Fig :2: T1 weighted magnetic resonance imaging, saggital and coronal views showing decreased signal intensity of the tumour with soft tissue extension.

A presumptive diagnosis of a GCT of bone was made. A biopsy of the lesion was undertaken which confirmed the presumptive diagnosis as Gaint Cell Tumour distal end of right femur and posted for Surgery.

III. Sandwich Technique

A bone window was created, and extended curettage with high-speed burr and PMMA applied for both its adjuvant property and structural support. An insulating area was then created using oxidized cellulose and subchondral cancellous allograft placed after the bone cement had completed polymerization(Fig: 3,4).

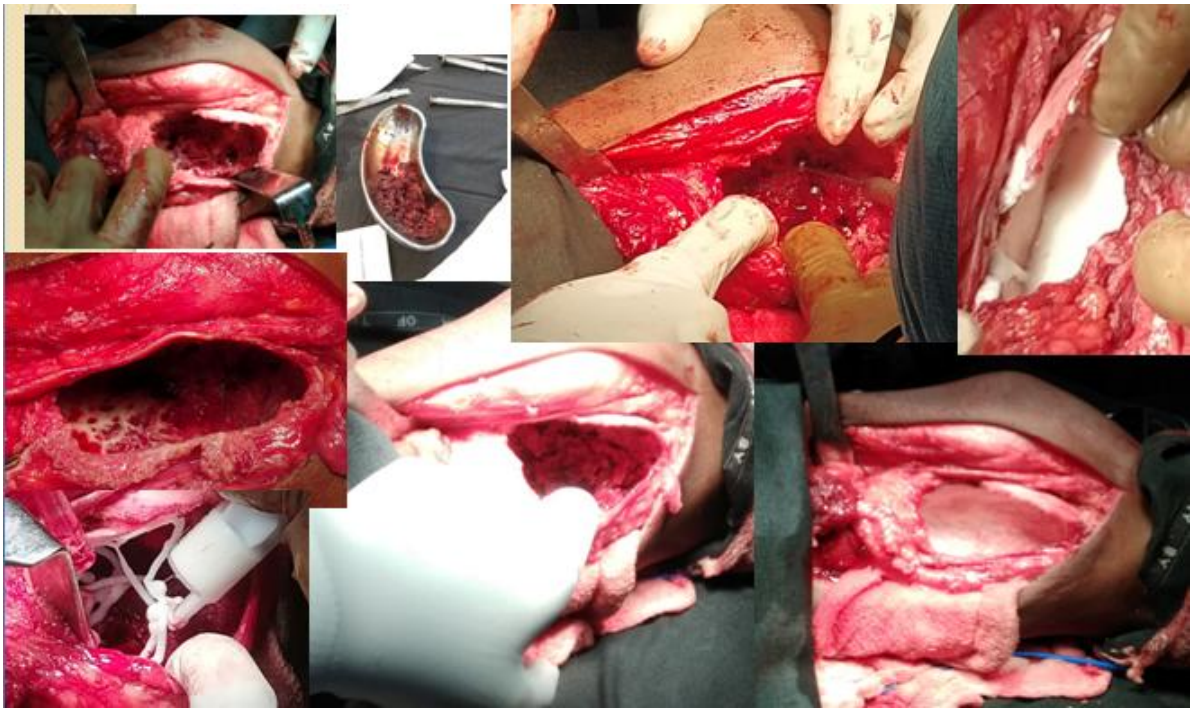

Fig: 3: Sandwich Technique

Post Op X-rays:

Fig :4 : Postoperative radiographs, anterior posterior and lateral views showing polymethyl methacryllate cementoma and subchondral grafting

Results:

His postoperative period was uneventful. Patient had uneventful recovery and regained near normal motion of the knee. He didn't developed signs of articular cartilage degeneration at final follow up.

IV. Discussion

Giant cell tumours of bone were first described by Cooper and Travers in 1818, and the term was subsequently coined by Bloodgood in 1923 (6). A GCT is a locally aggressive tumour with the potential to metastasize to the lungs, which occurs in about 1–4 % of cases (7, 8). Histologically, it is characterized by the presence of neoplastic mononuclear stromal cells, mononuclear histiocytes and multinucleated giant cells (9). The giant cells are responsible for the osteolytic activity of the tumour through the action of Cathepsin K. These giant cells are recruited by the neoplastic mononuclear cells through the expression of nuclear factor kappa-B ligand (9).

The relatively early age of presentation, geographic epimetaphyseal location of these tumours and the osteolysis produced by the giant cells present unique challenges to the orthopaedic surgeon. In the management of a GCT of bone, the surgical decision is based on the risk of recurrence, the morbidity associated with extensive procedures, the feasibility and the effect of joint-preserving procedures on the articular surface(2). Management options range from joint-preserving option of curettage with or without adjuncts (*i.e.* extended curettage) to the more radical procedure of *en bloc* resection with reconstruction. Radiotherapy is another treatment option that is reserved for unresectable tumours. The utilization of systemic adjuvant therapy to decrease the recurrence rate has also been advocated ranging from bisphos phonates to targeted therapy.

Curettage may be done in isolation or combined with adjuncts, with or without bone fillers. In their study, Hirn *et al* demonstrated that cavities less than 60 cm^3 in volume or 5 cm in diameter demonstrated satisfactory healing without bone fillers, whereas those greater than 5 cm were at an increased risk of pathological fractures (7). Curettage offers a joint-preserving option but tends. to have a greater risk of local recurrence in comparison to *en bloc* resection (10). Earlier studies even suggested that there was an increased risk of local recurrence with curettage in the presence of a pathological fracture (11). However, this has not been confirmed by more recent studies (12–14). Recurrences are most common within the first two years post-curettage and are decreased by the utilization of adjuncts, *ie* extended curettage (15). Extended curettage combines the mechanical effect of curettage with a chemical adjunct to extend the kill zone. The adjuncts include phenol, liquid nitrogen and bone cement/PMMA, which is the most widely used adjunct either in combination or in isolation. Polymethyl methacryllate is formed by an exothermic reaction and induces thermal tumour necrosis and also hypoxic tumour necrosis induced by its monomer (16). Balke *et al* showed that statistically the use of bone cement significantly decreased the recurrence rate by a factor of eight when compared to high-speed burring used in isolation (13). When compared to other bone fillers, it decreased the recurrence by over 50% (7).

Polymethyl methacryllate offers other benefits, such as providing a contrast on radiographs of the bone- cement interface, which allows for early detection of recurrence (17). When used as an adjunct, it also pro- vides structural support and allows for immediate weight-bearing (3). Despite its benefits, there are still concerns and contrasting reports about the effect of bone cement when used in close proximity to the articular

cartilage (18). In their 20-year retrospective study of 53 patients with a median follow-up of 86 months, Van der Heijden *et al* found a 17% radiographic incidence of Kellgren and Lawrence (KL) grade 3 or 4 osteoarthritis (19). However, the functional outcome and quality of life did not differ from those with KL grade 0–2. This represented an intermediate outcome study and required longer follow-up (19).

In their experimental study, Radev *et al* found that a minimum subchondral bone thickness of 2 mm was necessary to prevent articular damage induced by PMMA (20). To mitigate against the potential harmful effects of PMMA on the articular cartilage, the Sandwich technique may be employed. It involves the use of an insulating layer to protect against the thermal effect of PMMA and the addition of bone graft beneath the subchondral layer to improve bone stock. Thus, this facilitates the use of PMMA to achieve extended curettage by its thermal effect and hypoxic effect of its monomer while the articular cartilage degradation and subsequent sequelae are protected against.

In their review of 36 cases using the Sandwich technique, Saibaba *et al* reported a very low recurrence rate of 2.8% and a good functional outcome of 92.3% of their patients at a single institution (5). In their practice and utilization of the Sandwich technique, two adjuvants in the form of bone cement and phenol were utilized. Saibaba *et al* emphasized the importance of adequate exposure *via* a bone window and the importance of high-speed curettage and elimination of bony ridges. The importance of recognition and maintenance of the posterior periosteum to avoid spillage or escape of adjuvants and the potential complications were also highlighted. Unlike the index case, Saibaba *et al* did not use screw fixation because of the future hope of removing the PMMA and filling the defect with bone graft (5). In their prospective study of 26 patients with a GCT of the knee, Kundu *et al* found a recurrence rate of 8.3% and good functional outcome with a mean arc of motion between 123.52 ± 10.21 degrees (21). However, the mean follow- up was short, ranging from 2 to 6.5 years.

V. Conclusion

The Sandwich technique for management of the knee offers a joint-preserving option,

- The **"Sandwich Technique"** of reconstruction of the subchondral bone after extended curettage produces good functional results with a low recuurence rate.
- Insertion of a corticocancellous bridge between the subchondral bone and cement layer may retard the progression of early cartilage degeneration.

The intermediate outcome follow-up has been promising, but long-term follow-up is required.

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