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Case Report

Revision arthrodesis in a failed knee arthrodesis for a giant cell tumor excision of distal femur: a case report

Aman Rai*, Sundar Suriyakumar, J. K. Giriraj Harshvardhan

Department of Orthopaedics, SRIHER, Chennai, Tamil Nadu, India

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***Correspondence:**
Dr. Aman Rai,
E-mail: aman.rai1992@gmail.com

ABSTRACT

Giant cell tumor is a benign tumor with locally aggressive behaviour. It is common in 20–40 years of age group. Common location of the tumor includes distal end of femur, proximal end of tibia. It is slightly more common in females than males. We present a case of forty-four years-old lady with a persistent swelling over her left knee and was diagnosed with a distal femur giant cell tumor. After a wide excision, dual free fibula grafting and arthrodesis of the knee with a long nail was performed. However, she experienced pain and progressive deformity three years after surgery. X-rays revealed the failure of union of the free fibula graft to the residual femur and the breakage of the nail at that site. A revision arthrodesis was performed with removal of implant and stabilizing the non-united ends with dual plating with bone grafting from lateral tibial condyle and bone graft substitutes. She was discharged with left side non weight bearing mobilization with walker support and was started on full weight-bearing mobilization after one year with satisfactory union on X-rays.

Keywords: Revision arthrodesis, Non-vascularised fibular graft, Giant cell tumor

INTRODUCTION

Cooper and Travers first described giant cell tumors (GCTs) of the bone in 1818.[1] Histologically, the tumor is characterized by multinucleate giant cells against a backdrop of mononuclear spindle-like stromal cells with other monocytes. The name osteoclastoma was originally used to refer to the multinucleate giant cells because they resemble osteoclasts.[2] These tumors are most common in young adults, between the ages of 20 and 40, and affect females slightly more often than males. GCTs are benign but locally aggressive. They seldom metastasize but they can destroy adjacent bone structures. However, because they are active, they can occasionally weaken the bone and cause severe bone damage, resulting in a pathological fracture. Pain resulting from mechanical instability caused by bone resorption is the most common presentation of a GCT. Due to their frequent location near joints, GCTs can occasionally result in synovitis, joint effusion, and a restricted range of motion.[3] We describe a case of a GCT of the distal femur treated by a resection arthrodesis with dual free fibular grafting and a long intramedullary interlocking knee arthrodesis nail which failed resulting in breakage of the intramedullary nail and non-union of the fibular graft to the residual femur. It was treated by removal of the nail and revision arthrodesis with anterior and lateral plating with bone grafting from the left lateral tibial condyle and artificial bone substitute. The goal of the surgery was to provide a stable knee joint and a functional lower limb for the patient's normal regular activities.

CASE REPORT

Forty-four years old lady presented to an outside hospital with a history of swelling over her left knee which was insidious in onset and gradually progressive for 4 months. Radiographs and magnetic resonance imaging (MRI) revealed an expansile lytic lesion involving the distal femur metaphysis and epiphyseal region. Based on a biopsy, she was diagnosed to have giant cell tumor. Wide excision of the tumor, dual free fibula grafting (harvested

from both sides) and stabilisation with a long knee arthrodesis nail was done elsewhere. She presented to us with complaints of pain and a progressive deformity at the surgical site 3 years after surgery. X-rays revealed the failure of the union of the fibula graft to the residual femur and the breakage of the nail at that site (Figure 1).

Figure 1: Pre-op radiograph of bilateral lower limbs with broken implant in situ.

The fibular graft had united well to the residual tibia. All routine blood investigations and serum biochemistry were normal. A thorough pre-operative planning was done. The available option was to remove the residual nail and do a revision arthrodesis of the knee.

Under spinal with epidural anaesthesia, the patient was initially positioned supine. The distal medial to lateral locking screw was removed under C-arm guidance through an incision through the previous scar. The patient was then turned to the right lateral position and the left lower limb was repainted and draped. An anterolateral lazy S incision was made extending from the proximal tibia to the middle third of the femur. Incision over tibia was made approximately 1 cm lateral to tibial crest, extended proximally and curved posteriorly to a lateral approach to femur. The site of non-union was identified. Site of broken ends of nail in the femur was identified. The distal part of the nail was removed using a guide wire with a hook introduced through the nail. The proximal part of the nail was removed after removing bolts through a proximal incision using universal nail extraction device. The lateral tibial condyle was excised to serve as a bone graft. The non-united ends were freshened, reduced and stabilised with two plates - titanium 16-holed broad 4.5 mm locking compression plate placed laterally and 14-holed narrow 4.5 mm locking compression plate placed anteriorly. Bone graft harvested from lateral tibial condyle was mixed with artificial bone substitute (10 cc of tricalcium phosphate) and 1 gm of vancomycin was packed at the site of nonunion. After a thorough wound wash and haemostasis, the wounds were closed. Post-operative wound check and check X-rays were done and found to be satisfactory (Figure 2).

Figure 2: Immediate post op X-ray of bilateral lower limb with revision arthrodesis.

She was initially mobilised non weight bearing left side with walker support. Regular follow-up was done with X-ray. She was started on full weight-bearing mobilisation after 4 months after satisfactory union was observed on radiographs (Figure 3). She has an apparent shortening of 2 cm of the left lower limb. She is followed up for 1 year with satisfactory union on X-ray (Figure 4) and good functional outcomes (Figure 5).

Figure 3: Four months follow up X-ray of left knee.

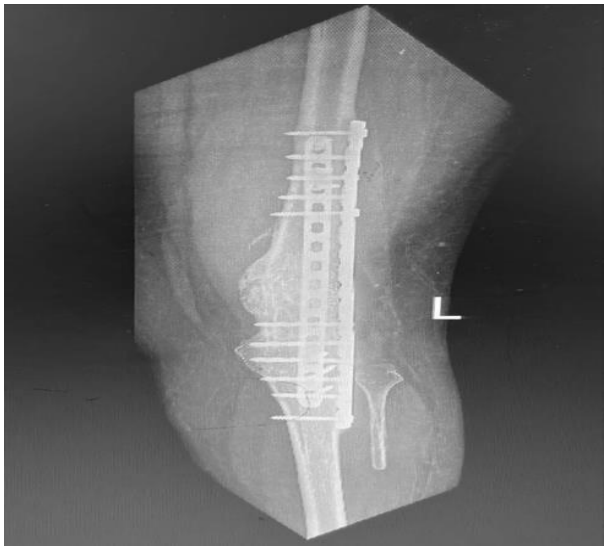

Figure 4: One year follow up X-ray.

Figure 5: Clinical outcome after one year (a) healed surgical scar, (b) ankle in neutral position with active straight leg raise, (c) ankle in plantarflexion, and (d) ankle in dorsiflexion.

DISCUSSION

Being the most important joint in the body for supporting weight, the knee joint presents treatment challenges for GCTs, which are frequently seen around the knee. GCTs surrounding knee joints frequently show cortical thinning and expansile development, and they frequently manifest as pathological fractures.[4,5] These tumors at the knee joint impair knee function even though they hardly ever extend into the articular cavity. Therefore, to prevent recurrence and maintain knee function and aggressive nature of the tumor surgical resection might be the best course of action.

Attempting to preserve bone, intralesional operations run a higher risk of recurrence than wide excision and could significantly degrade the mechanical qualities of the bone. Reconstruction is required in original and recurring cases, particularly when the tumor involves the end of a long bone and produces a large amount of joint surface dysfunction. Mega prosthetic joint replacement, biologic reconstruction with an autograft or allograft, arthrodesis with internal/external fixation and distraction osteogenesis are among the alternatives available for these instances. Following tumor resection, arthrodesis is a common choice because of its minimal risks of implant loosening, infections, malignant lesions, or death, as well as its affordability and early postoperative mobilisation.[6] Once a solid fusion occurs, there would be no requirement for future revision procedures unlike the use of custom mega prosthesis. The use of autologous bone transplants and knee arthrodesis in GCTs has shown that these procedures are effective.[6] There are various alternatives available for fixing a knee arthrodesis, including external fixators, long or short intramedullary nails and internal fixation using a plate or a combination of plates. Long bones and defects up to 25 cm can be bridged with a bone graft and nail. Using long intramedullary nails needs more time to operate on patients and is linked to higher blood loss.[8,9] Additional possible side effects include nail migration, breakage, neurovascular damage, iatrogenic femur or tibia fractures and delayed union or non-union. Usui et al in their series of 17 patients achieved successful union in 16 patients using a vascularised fibular graft.[8] Augmentation of the fixation with bone graft also strengthens the construct. Non-vascularized fibular grafts have been used since the beginning of 20th century, especially for biological reconstruction following the removal of musculoskeletal tumors. Initial animal studies concluded that vascularised fibular grafts are better than non-vascularised fibular grafts in terms of bone integration, rigidity, resistance to bacterial infection and hypertrophy in response to loading but now there are evidences that even non-vascularised bone grafts are capable of remodelling and integrating into host bone.[10] Lenze et al concluded that non-vascularised fibular graft is recommended for hemicortical reconstruction or patients with segmental defects of less than 12 cm in which no additional neo-adjuvant chemotherapy is to be administered.[11] Non-vascularised fibular graft is known to have higher incidence of recipient site non-union/delayed union when compared to vascularised fibular graft.

Another modality of arthrodesis at the knee joint is by using a plate or a combination of plates. It has also been attempted to use one or two plates following the preparation of the femoral and tibial segments for arthrodesis. This approach has the advantage of being able to achieve compression at the arthrodesis site and combining fixation and debridement with the same incision. Six of the 26 patients in the series by Pritchett et al underwent unsuccessful knee arthroplasties and underwent knee arthrodesis employing a single anterior tension band compression plate.[12] All of the patients

experienced solid osseous union after at least a two-year follow-up period. Munzinger et al used a single big plate applied laterally to successfully union 27 out of 34 knees.[13] Dynamic compression plates were put to both the medial and lateral sides of the structure using a dual plating technique developed by Nichols et al attaining union in all 11 patients in an average of 5.6 months.[14]

CONCLUSION

Arthrodesis of knee with intramedullary nailing provides low rotational stability and has a higher chance of failure when compared to plates. Non-vascularized fibular graft similar to segmental fractures can be complicated by non-union/delayed union at the recipient site at one end which can lead to failure of fixation. Compression arthrodesis with a plate and use of a cancellous bone graft mixed with an artificial bone substitute may improve the chances of union.

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