CASE REPORT

Incidental Finding of an Atypical Cartilaginous Tumor in an Adult Female with Recurrent Patellar Dislocation: Single-stage Extended Curettage using Freezing Nitrogen Ethanol Composite followed by Medial Patello-Femoral Ligament Reconstruction

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ABSTRACT

Atypical cartilaginous tumor (ACT) refers to a low-grade cartilaginous neoplasm microscopically identical to grade 1 chondrosarcoma, affecting the appendicular skeleton. Treatment with intralesional curettage has been found to provide sufficient local control with less morbidity compared to wide resection. This is the first reported case of a simultaneous medial patello-femoral ligament (MPFL) reconstruction with extended curettage for ACT on the ipsilateral femur. A 45-year-old female presented with chronic recurrent patellar dislocation of the right knee. Magnetic resonance imaging revealed a tear of the MPFL, with an incidental epi-metaphyseal chondroid lesion. After biopsy confirmed an ACT, single-stage extended curettage using freezing nitrogen ethanol composite (FNEC) and MPFL reconstruction was performed, followed by augmentation with bone cement and a distal femoral plate. Currently, the patient is independently ambulatory, with full range of motion about the knee. Following histologic confirmation of an ACT in the setting of a concurrent MCL tear, a single-stage procedure to address both conditions is a viable option that can reduce complications associated with multiple surgeries. Extended curettage using FNEC has been shown to produce good short-term oncologic outcomes while maximizing function.

Keywords: atypical cartilaginous tumor, freezing nitrogen ethanol composite, low grade chondrosarcoma, medial patellofemoral ligament tear

INTRODUCTION

Chondrosarcomas are a heterogenous group of cartilage matrix-producing tumors with variable malignant potential. The term "atypical" cartilaginous tumor (ACT) is used to denote cartilaginous neoplasms histologically identical to a grade 1 chondrosarcoma located in the appendicular skeleton.[1,2] Identification of these lesions has increased concomitantly with widespread use of MRI and CT scans.[2]

Incidental finding of an enlarging intramedullary chondroid lesion warrants further investigation for a possible malignant neoplasm.[2] Historically, chondroid tumors have presented surgeons with treatment dilemmas due to significant variations in surgical management depending on its histologic grade.[2] Identification of the intermediate malignant potential of ACTs has contributed to current recommendations regarding extended curettage for sufficient local control.[1,2]

A thorough electronic search of NCBI, EMBASE, Herdin, and Google did not reveal previously published

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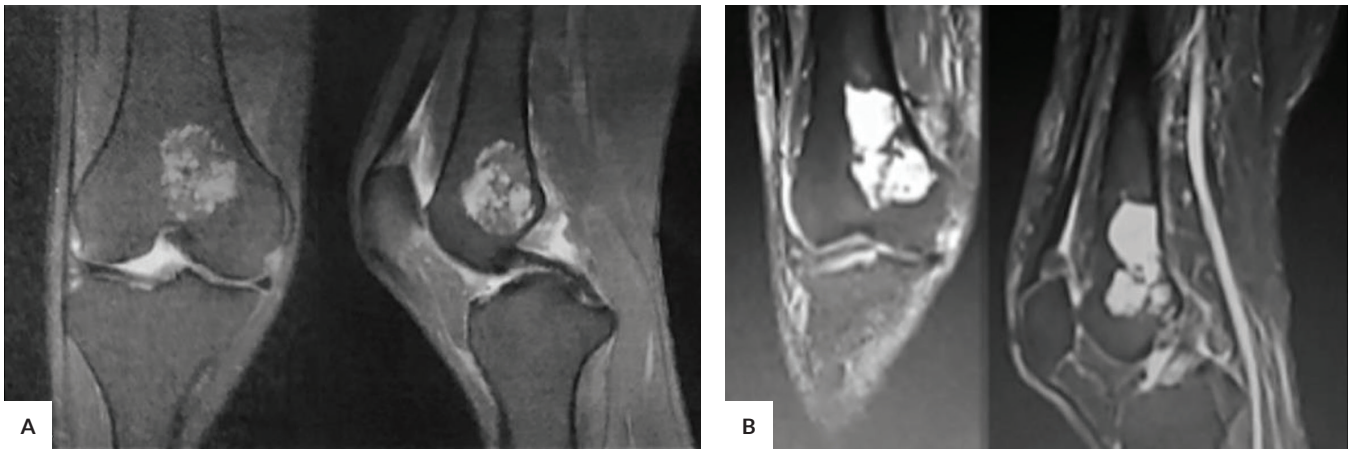

Figure 1. **(A)** Initial MRI revealing an MFPL tear and an incidental finding of a lobulated hyperintense lesion at the distal femur measuring 2.4 x 2.7 x 3.0 cm. **(B)** A repeat MRI 5 months later showed increase in the size of the lesion to 2.4 x 2.7 x 4.5 cm.

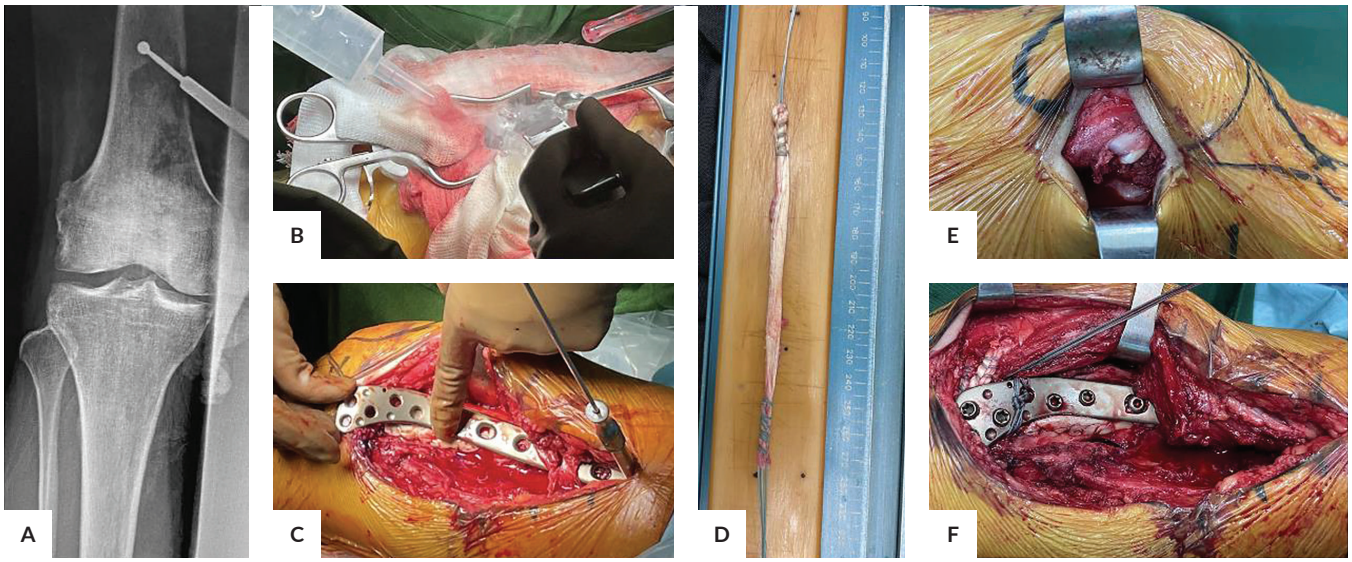

Figure 2. Extended curettage was done using **(A)** high speed burr and **(B)** application of FNEC, followed by **(C)** cement augmentation and application of distal femoral lock plate. MPFL reconstruction after harvesting **(D)** a hamstring graft, which was **(E)** looped through osseous tunnels in the patella and (F) secured through the plate with the knee in 30 degrees flexion.

reports of extended curettage performed simultaneously with a medial patello-femoral ligament (MPFL) reconstruction for recurrent patellar dislocations.

CASE PRESENTATION

A 45-year-old female sought consult for a 30-year history of recurrent patellar dislocation. Consult was sought at a local hospital, where magnetic resonance imaging (MRI) revealed an MPFL tear. A significant incidental finding was a lobulated hyperintense lesion at the distal femur measuring 2.4 x 2.7 x 3.0 cm (Figure 1A).

Assessment showed no swelling, erythema, or ecchymosis over the medial knee, with minimal tenderness on palpation. Full knee extension and active flexion up to 80 degrees was observed. Biopsy was consistent with enchondroma, and surgery was recommended but delayed due to financial constraints. After 5 months, a repeat MRI showed an increase in the lesion now measuring 2.4 x 2.7 x 4.5cm (Figure 1B).

A single-stage procedure to address both diagnoses was performed by two subspecialty teams. Extended curettage was done with a high speed burr and application of freezing nitrogen-ethanol composite (FNEC) into the cavity for 15 minutes, followed by cement augmentation and distal femur plating (Figure 2A-C). MPFL reconstruction was completed using a hamstring graft (Figure 2D-F). A drill bit was used to create osseous tunnels in the patella, through which the graft was passed. Graft ends were secured through

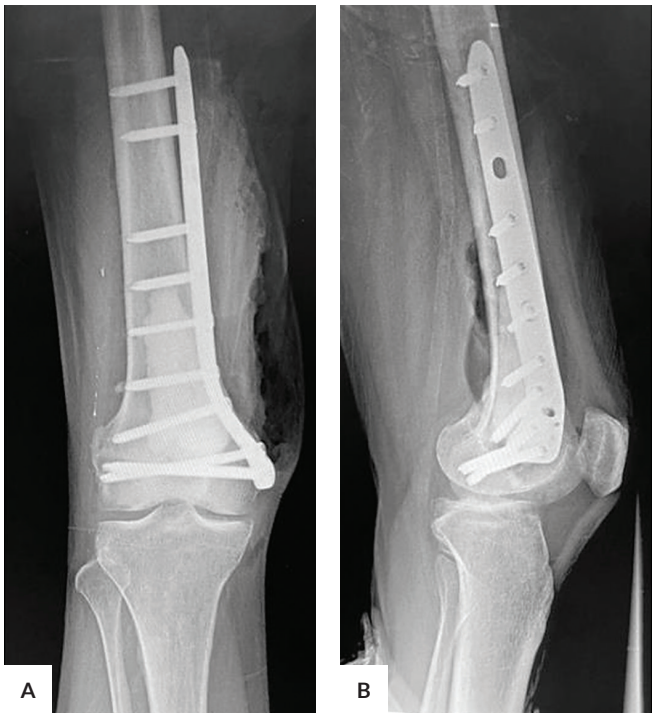

Figure 3. Post-operative radiographs in **(A)** anteroposterior and **(B)** lateral views showing placement of the cement and plate fixation.

a distal plate hole and imbrication was carried out with the knee flexed in 30°.

Final radiographs showed completed filling of the defect (Figure 3). The post-operative course was unremarkable. The patient was placed initially on a hinge-knee brace to allow for protection of the soft tissues following surgery. At two weeks, weight bearing and progression of knee flexion and extension were progressed as tolerated. One year post-operatively, the patient was ambulatory without assistive device and with full range of motion of the knee. Continuous surveillance will be done to monitor for recurrence of disease.

Final histopathology revealed benign-looking hyaline cartilage with endochondral ossification on low power field. On high power field, there was note of low cellularity and no presence of atypia. These findings were correlated with imaging and signed out as an atypical cartilaginous tumor.

DISCUSSION

While good functional outcomes have been achieved with quadriceps strengthening exercises and use of a patellar stabilization brace among patients with recurrent patellar dislocations, surgical intervention is indicated after failure of conservative management.[3]

Chondroid tumors exhibit a wide range of histologic features, from benign to malignant. Enchondromas are among the most common benign cartilaginous tumors, which may be left untreated with regular monitoring. In contrast, dedifferentiated chondrosarcomas are among the most aggressive high-grade malignant counterparts requiring surgical removal, and is associated with poor survival. ACTs lie in the middle of the spectrum and are tumors with intermediate malignant potential.[2] The terminology of "ACT" pertains to a low grade chondrosarcoma in the appendicular skeleton, while "grade 1 chondrosarcoma" is used to refer to the same lesion located in the axial skeleton.[1,2] Treatment and prognosis of chondroid lesions thus depend heavily on histopathologic findings and grading.[1]

Because ACTs are relatively indolent with 5-year survival rates of 90% and low metastatic potential, there has been a recent shift towards intralesional surgery.[1,2] Extended curettage provides comparable local control with lower complication rates and improved functional outcomes versus more extensive surgical resections.[1,2] A recent meta-analysis by Chen at al. found no difference in the rate of local recurrence or metastasis of ACT between intra-lesional excision and wide excision.[4]

Since the 1960s, liquid nitrogen has been used as a cryo-adjuvant for musculoskeletal tumors.[5] It induces rapid freezing and intracellular ice crystallization, causing mechanical cellular damage.[5] A minimum freezing temperature of -50 ˚C to -70 ˚C, with a freezing rate greater than -20 ˚C per minute and thawing slower than 10 ˚C per minute is recommended to induce cellular damage to tumor cells.[5] In as many as 42% of patients however, complications have included fractures, skin necrosis, and nerve palsy secondary to liquid nitrogen's profound freezing effect.[5]

In 2015, Wu et al. developed a novel cryogenic material, the freezing nitrogen ethanol composite (FNEC). FNEC exhibits similar cooling effects but in a semi-solid phase, thereby avoiding accidental spillage to adjacent soft tissues.[5] Histologic analysis has shown effective tumor eradication by achieving the desired freezing temperature and cooling rate in ex vivo and in vivo models, with comparable tumor necrosis to liquid nitrogen.[5] When tested among patients with giant cell tumor of bone, none developed complications such as neurovascular injury, skin necrosis, or infection.[5] This viable alternative to extended curettage was first used in the Philippines in 2019, necessitating the need for long-term studies to determine its overall effect on oncologic outcomes.

A thorough electronic search of NCBI, EMBASE, Herdin, and Google did not reveal previously published reports of extended curettage performed simultaneously with an MPFL reconstruction for recurrent patellar dislocations.

Regarding the benefits of staged versus simultaneous procedure, authors have observed that performing more than one relatively uncomplicated surgical procedures in a single setting for a stable patient incurs less medical costs and reduces the length of hospital stay, eliminating the need for additional recovery before the next operation, while avoiding the risks of anesthesia for subsequent surgery.[6,7] It must be kept in mind however, that increasing the duration

of anesthesia, especially in high-risk patients, is also associated with increased incidence of complications in the immediate postoperative period such as nausea and vomiting, severity of pain, increased blood loss, and likelihood of developing surgical site infections.[6-8]

CONCLUSION

In a patient presenting with an incidental finding of ACT alongside another primary diagnosis, thorough diagnostic imaging and a well-performed biopsy are imperative for adequate surgical planning. The possibility of addressing both concerns in a single surgical setting should be considered in order to mitigate risks associated with a second surgery.

ACTs are low grade chondrosarcomas found in the appendicular skeleton with a relatively indolent clinical course. Current evidence has supported extended curettage for adequate local control.

FNEC is a novel cryogenic material used as an adjuvant to extend margins after mechanical curettage, with local recurrence rates comparable to liquid nitrogen. Long-term outcomes for its use in the management of ACTs among Filipino patients are yet to be determined.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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