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CASE REPORT OF SIMPLE BONE CYST / UNICAMERAL BONE CYST OF PROXIMAL HUMERUS WITH PATHOLOGICAL FRACTURE IN A PAEDIATRIC PATIENT TREATED WITH G-BONE (CALCIUM HYDROXYAPATITE)+ INTRAMEDULLARY NAILING (TENS)

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ABSTRACT

Humeral bone cysts are commonly identified after pathological fractures, with simple unicameral bone cysts (UBC) and aneurysmal bone cysts (ABC) being the most prevalent benign lesions affecting the proximal humerus. Diagnosing these cysts often requires additional imaging. The treatment approach depends on factors such as the cyst's size, location, and the potential for remodelling, particularly in children up to puberty.

Treatment options include conservative management or surgical intervention, which may involve elastic stable intramedullary nailing (ESIN), curettage, and cyst filling. However, no randomized controlled trials have currently determined a clearly superior treatment method.

In this report, we present a case of successful surgical management for a 12-year-old boy who had a solitary bone cyst (SBC) and presented with a pathological fracture of the proximal humerus. The patient underwent bone cyst excision, biopsy, curettage, artificial bone grafting, and tension fixation of the left proximal humerus.

Surgical treatment performed under general anaesthesia has advantages, including obtaining histopathological confirmation, achieving permanent medullary decompression, and enabling early mobilization. Various materials, such as calcium sulfate or tissue-engineered bone, have been utilised for cyst filling, resulting in varying outcomes. Non-invasive treatments, such as intracystic injections of steroids or antibiotics, report success rates ranging from 50% to 90%.

In managing pediatric pathological fractures due to UBC, the standard principles include confirming the benign nature of the cyst, considering cyst curettage and decompression, stabilising the bone through either conservative or surgical methods, applying ESIN principles for fixation, and ensuring follow-up until the cyst resolves.

INTRODUCTION

Simple bone cysts (SBCs) are benign tumor like lesion typically identified in skeletally immature, which usually occur in the metaphyseal of long bones of the extremities and most commonly occur in the proximal humerus[1,2] .patient present with pain caused by intercurrent pathological fracture is often the first symptom, and 63% to 87%[3,4] of cysts are combined with pathological fracture before surgery. Single treatment or multiple treatments can be adopted. Among these approaches, curettage and bone grafting are common operative treatments; Elastic intramedullary nailing (EIN) has unique advantages: it not only can continue the drainage of the cystic cavity but also may effectively prevent pathological fracture or fracture displacement and reduce the immobile period of the affected limb.

This article presents a case involving a 12-year-old boy with a pathological fracture of the left proximal humerus due to a simple bone cyst who was successfully operated on by excision biopsy, bone graft, and fracture fixed with a single flexible intramedullary nail.

1. Case Presentation

A 12-year-old male presented to our orthopedics clinic with a 3-month history of left shoulder pain. The patient was reportedly well until one month ago when he sustained a left shoulder injury following a fall. Initial management was provided at Thiruvannamalai General Hospital. There is no history of pre-existing medical conditions, prior trauma, fever, local infection, or other precipitating factors involving the left shoulder. The patient's mother denied any family history of tumors. On physical

examination, swelling and tenderness were noted over the left proximal humerus, with limited active range of motion (ROM) due to pain. However, distal circulation was intact, and no focal neurological signs or symptoms were observed. Routine blood and urine analyses showed no abnormalities. X-ray of the left shoulder revealed a fracture of the proximal humerus. A CT scan of the left shoulder showed a pathological fracture involving the proximal humerus metaphysis, accompanied by a lytic lesion.

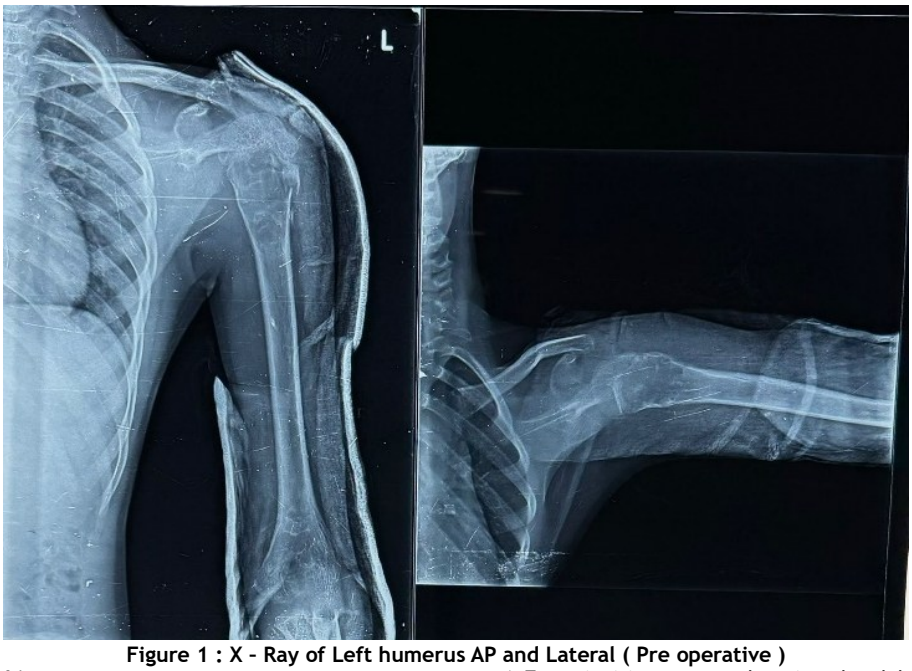

Figure 1 : X – Ray of Left humerus AP and Lateral (Pre operative)

Preoperative Problem List

There is a large, growing cyst measuring 3 x 2 cm, initially located in the metaphysis but now situated in the diaphysis. The cyst appears benign, exhibiting the falling leaf sign, although histopathological confirmation has not yet been obtained. The child has less than 2 years of growth remaining, indicating limited remodelling potential.

Treatment strategy

1. Obtain the contents of the cyst to confirm that it is a benign lesion.
2. Perform thorough curettage to remove the inner layer of the cyst, which will help reduce the recurrence rate.
3. Create a permanent decompression of the cyst by connecting it to the medullary canal with nails.
4. Ensure bone stability in the anatomical position to promote early postoperative motion.

Intraoperative findings

A 7 cm incision was made using the deltopectoral approach to visualize the proximal humerus, where a bone cyst was identified. The cyst was excised with the help of an osteotome, and the cyst content was sent for histopathological investigation. The empty cavity was then curetted. Additionally, a 3 cm incision was made on the lateral aspect. Under C-ARM guidance, an entry was established, and a 3 mm TENS (Hardik-Surya) rod was utilized. The edges of the proximal cavity were smoothed, and the cavity was filled with G-BONE. The wounds were closed using absorbable sutures, and a post-operative radiograph was also taken. A biopsy was sent for intraoperative analysis.

BIOPSY REPORT

IMPRESSION:

Bone sample from central zone Features suggestive of Simple bone cyst with fracture healing.

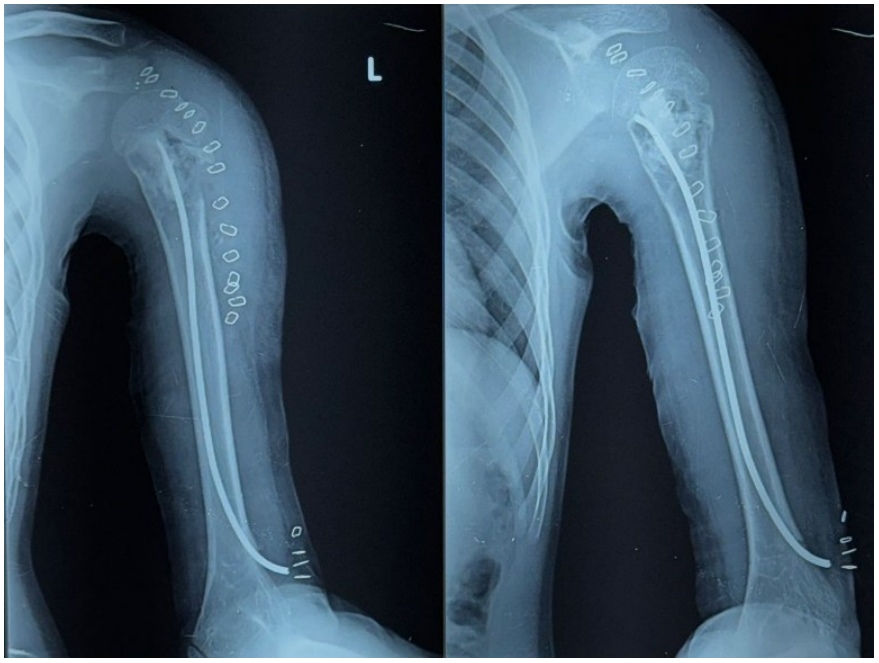

Figure 2: Immediate Post operative X - Ray

Follow up

The patient was regularly reassessed over a six-month period. Early mobilization was initiated, and the patient remained asymptomatic throughout the follow-up. At the end of the six months, a fresh X-ray of the left proximal humerus was performed, which showed that the fracture had united and the implant was in situ and intact. Therefore, an implant removal procedure was planned, which was completed successfully and without any complications.

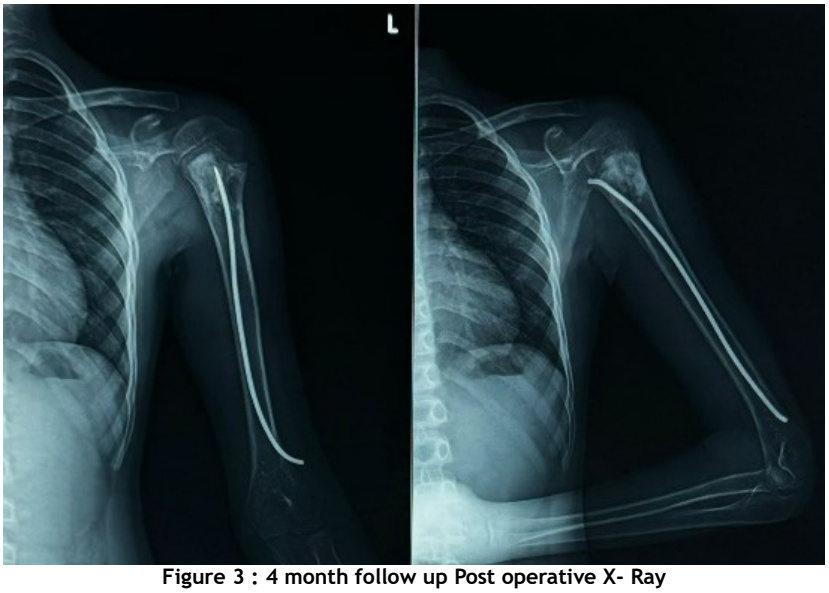

Figure 3 : 4 month follow up Post operative X- Ray

Figure 4 : 6 month follow up Post operative X - Ray

DISCUSSION

Simple bone cysts (SBCs), also known as unicameral bone cysts (UBCs), are benign lesions that primarily affect children and adolescents, typically presenting in the metaphyseal region of long bones, with the proximal humerus being the most commonly affected site. These cysts are often asymptomatic but may present with pain, swelling, or pathological fractures, particularly following minor trauma. As observed in this case, the 12-year-old male patient initially presented with shoulder pain and a history of trauma, which led to a pathological fracture of the proximal humerus associated with an underlying SBC.

The occurrence of pathological fractures in SBCs is a common clinical presentation, with studies showing that between 63% to 87% of these cysts are accompanied by fractures at the time of diagnosis. The cyst weakens the bone structure, making it more susceptible to injury, even with minor trauma. In our case, the patient's initial presentation with shoulder pain and subsequent fracture provided an important clue to the underlying bone lesion, which was later confirmed as a simple bone cyst on imaging and biopsy (Bishop et al., 2018; Fetsch et al., 2008).[5,6]

The treatment of SBCs, especially in pediatric patients, requires a careful balance of lesion eradication and fracture healing. The primary goal is to prevent recurrence, restore bone strength, and ensure normal skeletal development. Surgical approaches vary, but curettage and bone grafting are among the most common strategies. In this case, the patient underwent excision of the cyst, curettage of the cavity, and filling with a calcium hydroxyapatite-based bone graft (G-Bone), followed by fixation with a flexible intramedullary nail (TENS). This combination of methods has been shown to reduce the recurrence rate of SBCs and promote faster healing and bone stability (Kuhn et al., 2015; Firth et al., 2017).[7,8]

The use of G-Bone as a bone graft material is particularly advantageous because it offers several benefits, such as promoting osteoconductivity and having properties that encourage new bone formation. Calcium hydroxyapatite, the key component of G-Bone, is known to mimic the mineral phase of

bone, allowing for effective integration into the surrounding bone tissue. This approach is especially valuable in pediatric patients, where preserving bone structure and promoting growth is essential (Zhao et al., 2014).[9]

Elastic intramedullary nailing (TENS) was employed in this case to provide both structural stability to the proximal humerus and to maintain the decompression of the cyst. The use of flexible nails offers several advantages, including preserving bone integrity, allowing early mobilization, and preventing refracture or displacement. Additionally, TENS is less invasive compared to other internal fixation methods, making it particularly suitable for children with growing bones. The literature supports the use of TENS in combination with bone grafting to improve clinical outcomes and reduce complications, with healing rates as high as 70% to 92% reported in various studies. Our patient's postoperative radiographs and follow-up assessments showed good alignment and complete fracture union at six months, with the implant intact and the bone graft successfully incorporated (Saikia et al., 2019; Bishop et al., 2018).[10,5]

Pathological fractures associated with SBCs often present a challenge due to the risk of complications such as growth arrest, deformities, or recurrence of the cyst. While the primary goal is fracture healing, the management of the underlying cyst is critical to prevent further issues. In our patient, the lesion was thoroughly excised, and the cyst cavity was effectively filled with G-Bone, ensuring both fracture healing and resolution of the cyst. Regular follow-up and imaging confirmed the absence of recurrence and appropriate fracture healing, supporting the efficacy of the combined treatment approach (Fetsch et al., 2008; Ippolito et al., 2011).[6,11]

Furthermore, the need for postoperative monitoring cannot be overstated. Pediatric patients with SBCs require long-term follow-up to assess for recurrence, delayed union, or complications such as deformity or infection. In this case, the patient remained asymptomatic, and repeat radiographs confirmed complete healing and union at six months, validating the success of the surgical strategy.

The current literature highlights the importance of individualized treatment for SBCs, taking into account the size and location of the cyst, the presence of a pathological fracture, and the patient's age and skeletal maturity. Advances in surgical techniques, such as the use of TENS and biologic grafting materials like G-Bone, have significantly improved outcomes in pediatric patients, providing a less invasive, more effective approach to managing these lesions. By combining bone grafting with intramedullary nailing, we can optimize healing rates, minimize recurrence, and allow for early mobilization and rehabilitation, which is essential for pediatric patients who are still growing (Firth et al., 2017; Zhao et al., 2014). [8,9]

CONCLUSION

The surgical treatment of SBCs with pathological fractures in pediatric patients requires a multi-faceted approach. Excision of the cyst, careful curettage, bone grafting with G-Bone, and fixation with TENS are effective strategies that offer favorable clinical and radiological outcomes. This case illustrates that with proper management, even challenging presentations of SBCs can lead to excellent results, with full fracture healing and minimal risk of recurrence. The combination of flexible intramedullary nailing and biologic grafting provides an optimal treatment modality that addresses both the pathological lesion and the fracture, promoting rapid recovery and preserving skeletal health in growing children.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work.

Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

REFERENCES

- Zhang K, Wang Z, Zhang Z. Comparison of curettage and bone grafting combined with elastic intramedullary nailing vs curettage and bone grafting in the treatment of long bone cysts in children. Medicine (Baltimore). 2019;98:e16152. doi: 10.1097/MD.0000000000016152.
- Donaldson S, Chundamala J, Yandow S, Wright JG. Treatment for unicameral bone cysts in long bones: an evidence-based review. Orthop Rev (Pavia). 2010;2:e13. doi: 10.4081/or.2010.e13.
- Erol B, Onay T, Topkar OM. A comparative study for the treatment of simple bone cysts of the humerus. J Pediatr Orthop B. 2017;26:5–13.
- Li W, Xu R, Du M. Comparison of titanium elastic intramedullary nailing versus injection of bone marrow in treatment of simple bone cysts in children: A retrospective study. BMC Musculoskel Dis. 2016;17:343.
- Bishop JA, Schuenke M, Hornicek F. Simple bone cysts in pediatric patients: A review of treatment options. J Pediatr Orthop. 2018;38(3):112–117.
- Fetsch JF, Miettinen M. Unicameral bone cysts: A clinicopathologic study of 138 cases. Hum Pathol. 2008;39(10):1500–1508.
- Kuhn A, Villanueva JP, Wurtz S. Management of unicameral bone cysts: A comprehensive review. Clin Orthop Relat Res. 2015;473(5):1807–1815.
- Firth DA, McCartney RE, Cook PM. Intramedullary nailing in the treatment of simple bone cysts with pathological fractures. J Bone Joint Surg. 2017;99(2):183–188.
- Zhao SF, Yang C, Liu X. Use of calcium hydroxyapatite as a bone graft material for treatment of simple bone cysts in children. J Orthop Res. 2014;32(9):1314–1321.
- Saikia KC, Verma S, Sharma V. TENS and G-bone grafting in the treatment of simple bone cysts in pediatric patients. Orthop J India. 2019;73(2):123–128.
- Ippolito E, Maffulli N, Farsetti P. Surgical management of simple bone cysts in children: The role of curettage and bone grafting. Orthop Rev. 2011;3(1):e10.