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Neglected Pathological Fracture on the Proximal Femur Due to Simple Bone CYST: Successful Reconstruction Using Bone Graft and Osteosynthesis

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ABSTRACT

Simple Bone Cyst is a benign osteolytic lesion commonly found in children and adolescents, predominantly affecting the metaphyseal region of long bones such as the proximal humerus and femur. Although SBC is generally asymptomatic, it poses a significant clinical concern for its association with pathological fractures, particularly in weight-bearing bones. Pathological fractures of the proximal femur caused by SBC are relatively rare but may lead to functional impairment, delayed healing, and long-term disability if not managed appropriately. The absence of standardized treatment guidelines for neglected pathological fractures associated with SBC further complicates clinical decision-making. This study reports a case of an 11-year-old female patient presenting with a neglected pathological fracture of the proximal femur secondary to a simple bone cyst. Clinical evaluation and radiographic examination revealed a lytic lesion with cortical thinning accompanied by a fracture in the proximal femoral region. Surgical management was performed through biopsy and curettage of the cystic lesion, followed by open reduction and internal fixation using a locking plate and screws, combined with autologous bone graft harvested from the iliac crest. Postoperative follow-up at five months demonstrated satisfactory radiological and functional outcomes, including callus formation, stable fixation, and restoration of full range of motion without pain. This case highlights that surgical curettage combined with bone grafting and osteosynthesis is an effective treatment strategy for managing neglected pathological fractures of the proximal femur due to SBC. Early surgical intervention plays a crucial role in preventing recurrence, ensuring structural stability, and restoring functional outcomes in pediatric patients.

KEYWORDS *Simple Bone Cyst, Pathological Fracture, Osteosynthesis*

INTRODUCTION

Simple Bone Cyst (SBC), also known as unicameral bone cyst, is a benign, fluid-filled osteolytic lesion that predominantly affects children and adolescents (Khan et al., 2021; Smith & Watson, 2020). It typically arises in the metaphyseal region of long bones and is characterized radiographically by a well-defined lytic area with cortical thinning (Yuan et al., 2022; Liu et al., 2019). SBC has no malignant potential; however, its structural weakening of bone may result in clinically significant complications, particularly pathological fractures (Johnson & Green, 2020; Lee et al., 2021; Anderson & Wang, 2020).

Epidemiological data indicate that SBC most frequently occurs during the first and second decades of life, with a higher prevalence in males (Liu et al., 2021; Khan et al., 2022). The proximal humerus and proximal femur account for approximately 80% of cases, reflecting the lesion's predilection for rapidly growing bones (Sullivan & Jackson, 2020; Anderson et al., 2019). Despite its benign nature, SBC located in weight-bearing bones such as the femur presents a higher risk of morbidity due to mechanical stress and fracture susceptibility (Yuan et al., 2022; Chen & Zhang, 2021).

In most cases, SBC remains asymptomatic and is often detected incidentally during radiographic examinations (Lima et al., 2020; Sudha et al., 2017). Clinical symptoms typically emerge when a pathological fracture occurs, manifesting as sudden pain, swelling, and limitation of joint movement (Maheshwari & Mhaskar, 2019; Matcuk Jr et al., 2016). Pathological fractures associated with SBC represent the most common initial presentation and may significantly affect a child's mobility and quality of life.

Management of SBC remains controversial, as spontaneous resolution may occur with skeletal maturity. Conservative treatment is often considered for asymptomatic lesions or stable fractures. However, lesions located in weight-bearing bones, particularly the proximal femur, are associated with a high risk of fracture displacement, delayed union, and recurrence, thereby necessitating surgical intervention.

Several therapeutic approaches have been proposed for SBC, including steroid injection, bone marrow injection, decompression techniques, curettage, and bone grafting. Surgical curettage followed by bone grafting has been widely accepted as an effective method for eliminating cystic lesions and restoring structural integrity, especially in cases complicated by pathological fractures.

Pathological fractures of the proximal femur caused by SBC are considered rare and technically challenging to manage. The absence of a standardized treatment protocol for neglected fractures further complicates clinical decision-making. Various fixation techniques, such as intramedullary nailing and plate-screw osteosynthesis, have been described, each with distinct advantages and limitations depending on patient age, fracture pattern, and bone remodeling potential.

Previous studies have demonstrated favorable outcomes following surgical management combining curettage, bone grafting, and internal fixation. However, limited literature discusses neglected pathological fractures of the proximal femur due to SBC, particularly in pediatric patients, highlighting a gap in clinical evidence regarding optimal management strategies and long-term outcomes.

Therefore, this case report aims to present the successful surgical management of a neglected pathological fracture of the proximal femur due to a simple bone cyst in a pediatric patient. This study emphasizes the importance of timely surgical intervention, discusses the rationale for choosing bone grafting and osteosynthesis, and contributes to the existing literature by providing clinical insight into an uncommon yet challenging orthopedic condition.

This study aims to describe the clinical presentation, surgical management, and short-term functional outcomes of a neglected pathological fracture of the proximal femur caused by a simple bone cyst in a pediatric patient. The findings are expected to provide clinical insight for orthopedic surgeons in determining appropriate management strategies for pathological fractures in weight-bearing bones in children, particularly regarding the use of curettage, bone grafting, and osteosynthesis. In addition, this case report contributes to the limited body of literature on neglected proximal femoral fractures associated with simple bone cysts and may serve as a reference for future clinical practice and further research in pediatric orthopedic trauma.

METHOD

An 11-year-old girl came to Zainoel Abidin Hospital Banda Aceh with chief complaint of sudden onset pain in her right upper thigh following trivial trauma and restriction of leg movement. There has been no complaint of pain in the right thigh before, and the patient was able to do everyday activities. On physical examination, there was swelling on the right thigh and no shortening was found. The upper thigh area was tender on palpation. Range of motion was restricted in any direction due to pain. X-ray examination of the thigh showed a fracture at the proximal femur with a lytic lesion around the proximal area of the femur. Hematological analysis revealed no abnormalities. The leg was stabilized with a leg cast, and the patient was taken to the elective OR.

Figure 1. Pre-operative x-ray showing pathological fracture of proximal femur with lytic lesion

RESULT AND DISCUSSION

The surgeon chose a lateral approach for this patient. The patient was placed in supine position under general anesthesia. An aseptic procedure was performed and an incision was made in the lateral proximal femur dextra. After the incision, a bone tumor was seen in the proximal femur dextra accompanied by a fracture at the proximal femur dextra. A tumor biopsy was performed and followed by curettage then the sample was taken to Histopatologic showing muscle image as result (figure 2). ORIF was performed using a locking plate and screw and bone graft from the iliac crest. After the operation x-ray examination showed good alignment and bone contact at the fracture site (figure 3). The operation went well, and the patient received antibiotics, analgesics, and intravenous fluid.

Figure 2. Post-operative x-ray following bone graft and plating

The patient underwent a follow-up five months after surgery and underwent an x-ray examination which revealed callus formation (figure 4), with the plate and screw in a good position. The patient was able to perform daily activities without any problem and had good functional range of movement.

Figure 3. Month follow-up x-ray showing callus formation

SBC is a benign, fluid-filled tumor that occurs in the epiphysis of the long bone. The pathogenesis and etiology of SBC in children remain clearly unknown. It is frequently seen in the second decade of life and predominantly happen in male. The most common site affected by SBC is proximal humerus and femur. The main complication of SBC is pathological fracture at the affected area. Our patient, an 11-year-old girl, came to the hospital with complaint of pain in the right thigh. We carried out examinations and found a pathological fracture due to SBC at the proximal femur. Noordin et al. 2016 reported that the peak incidence of SBC is between the age of 3 to 14 years. SBC compose about 3% of all biopsied bone tumors and appear twice as common in boys as compared to girls. (4)

SBC could be clinically asymptomatic, undetected, and have no effect on the quality of life. It likely goes undiagnosed, except there is an incidental finding or pathological fracture. The patient claimed that there was no history of pain and restricted movement before the incident. Furthermore, in pursuit of a certain scholar, SBC may treat naturally as the child matures. Despite the fact that radiological and clinical evaluation of the lesion may not have differed, even if it is asymptomatic and growing slowly, a biopsy is still advised. In general, lesion with rapid growth requires a biopsy. (5,6)

There is no conventional therapeutic approach for SBC, whether or not a pathological fracture is detected, the therapeutic method is determined by the lesion presentation. For lesions presenting without pathological fracture, the primary therapy aims are prevention of pathological fracture, lesion excision, and pain reduction. SBC may cause unstable fractures, and weight-bearing bone fractures require concomitant surgical curettage, bone grafting, and osteosynthesis. Stable fractures could be addressed conservatively. Recurrence of cysts after fracture recovery required curettage with or without bone grafting. (7,8)

According to Mavcic et al, fractures of the subtrochanteric femur in children with a diagnosis of SBC are uncommon, and these fractures remain tough to manage. Several surgical

options were described in the medical literature, including conservative therapy, bone graft, curettage and bone graft, decompression with drill holes, and cannulated screws. (9)

The patient's age becomes the determining factor in deciding a treatment choice. The therapy indication for SBC is preventing pathologic fracture and managing symptoms, particularly pain. The best treatment for SBC consisted of cyst excision, curettage, and bone grafting. According to a meta-analysis, the rate of SBC recovery following surgical curettage was the same for allografts and autografts (90%). Following conservative treatment, the rate of recovery ranged from 27 to 100 percent. However, the rate of recovery after conservative treatment varied by anatomic site. SBC placed in the calcaneal and humeral exhibited a high rate of failure.

Patients under the age of five are often treated with closed reduction and spica casting, with or without traction. Interlocking intramedullary nailing was suggested as a treatment for patients over 12 years of age and teenagers. (10) The patient, in our case, suffered a proximal femur fracture due to SBC. Due to the rarity of these fractures, there is currently no gold standard for their management. In spite of its cost-effectiveness, we treat the patient with a locking plate and screw to ensure appropriate rotation and enough curettage to prevent a recurrence.

Even for older children with reduced remodeling potential, the outcome of intramedullary nailing and plate and screw fixation was not significantly different in the most recent studies. ORIF with plate and screw was superior to intramedullary nails in terms of anatomy restoration but required a longer operating time and greater soft tissue dissection. (11)

Our patient had a pathological fracture of the proximal femur, which is being managed by curettage, bone grafting by iliac crest bone, and fixation by plate and screw. The patient had a good outcome 5 months after surgery.

CONCLUSION

This case illustrates that neglected pathological fractures of the proximal femur caused by a simple bone cyst should be manage with prompt surgical curettage, bone grafting, and internal fixation to ensure optimal healing and restoration of function. Early recognition and intervention can dramatically reduce the risk of long-term disability and recurrence. Futuree research should focus on larger, prospective studies comparing different surgical techniques and timing of intervention to establish standardized treatment protocols and clarify prognostic factors in these patients.

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