



## Case report

## A unique case of a unicameral bone cyst in the femoral neck: Successful management in a 14-year-old male

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## ABSTRACT

**Introduction:** Unicameral bone cysts (UBCs) are benign bone lesions that may resemble tumors. The mechanism of their formation is not precisely known. They tend to manifest with pain in the area of the lesion, thinning of the adjacent bone cortex, and may lead to bone fractures.

**Case presentation:** A 14-year-old boy presented with severe pain in the left hip joint area, which resulted in limping and a tendency to avoid weight-bearing on the affected limb due to the associated pain. He was diagnosed with a unicameral bone cyst and treated percutaneously with aspiration, bone compaction, and fixation.

**Clinical discussion:** Unicameral bone cysts, when located in the hip area, can cause severe pain, potentially leading to compensatory scoliosis and limping. Treatment is essential in this case due to the sensitivity of the area, the high probability of fracture, and the presence of severe pain.

**Conclusion:** This article focuses on a rare case of a unicameral bone cyst in the femoral neck area, successfully managed percutaneously without open surgical intervention. Prophylactic fixation of the femoral neck resulted in an excellent observed outcome.

## 1. Introduction

Unicameral bone cysts are benign lesions that are a single-chambered cavity located in the bone and this cavity is filled with fluid and lined with a fibrous membrane. These cysts constitute about 3 % of primary tumors that occur in the first two decades of life [1–2]. These cysts can commonly occur in the long bones, especially in the area near the femur or the area near the humerus. The heel bone is also a common site for these single-chambered cysts, but they are very rare to see in the hip joint area [3]. Most cases appear in childhood or adolescence and are located in the epiphyseal areas that are located axial to the growth plate in tubular bones. The pathological mechanism causing the formation of these cysts is unclear and may sometimes be explained by trauma and inflammation and sometimes by increased intraosseous pressure due to venous obstruction, which leads to the formation of the cyst [4]. Most cases present with pain, and although the source of this pain is unclear, it disappears with the healing of the cyst [5]. The treatment aims mainly to prevent fractures associated with these cysts, relieve pain, and restore bone strength and increase cortical thickness. In

our case, the cyst was located at a very sensitive level in the hip joint and was treated for the first time in the medical literature through the skin and a review of the medical literature on this case.

This case is described in accordance with the criteria of SCARE [6].

## 2. Presentation of case

We present the case of a 14-year-old boy who had been experiencing left hip pain for approximately 2 years, exacerbated by walking and hip movements at rest, with progressively increasing pain and a limping gait. He exhibited a compensatory trunk lean towards the left side due to the associated pain. He had been treated with analgesics for an extended period without significant response. He had no history of hip-related trauma.

## 3. Clinical findings

Upon arrival at the hospital, clinical examination revealed severe pain upon movement of the hip joint, with a clear limitation of motion

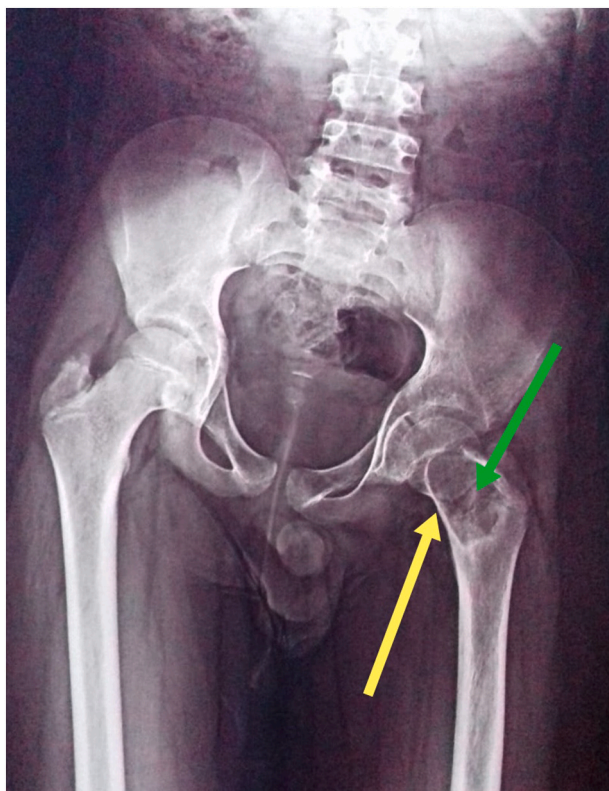
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**Fig. 1.** Plain X-ray image preoperatively, demonstrating a cyst in the femoral neck region (green arrow) with significant cortical thinning (yellow arrow).

due to the pain. No neurological or vascular deficits were observed in the affected limb. The remainder of the systemic examination was unremarkable.

#### 4. Diagnostic assessment

Laboratory examinations revealed a hemoglobin level of 12.5 g/dL, a total white blood cell count of  $14,000/\text{mm}^3$ , and a platelet count of  $543,000/\text{mm}^3$ .

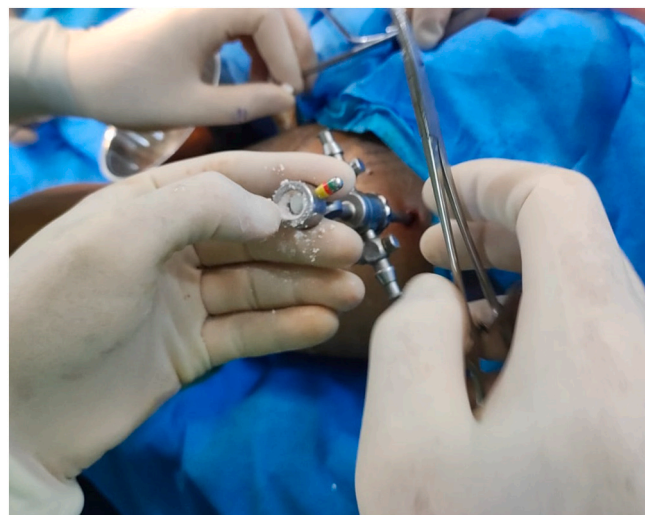
Plain X-ray imaging showed a well-defined lytic lesion in the left

femoral neck area with a thin cortical rim and no associated fracture (Fig. 1).

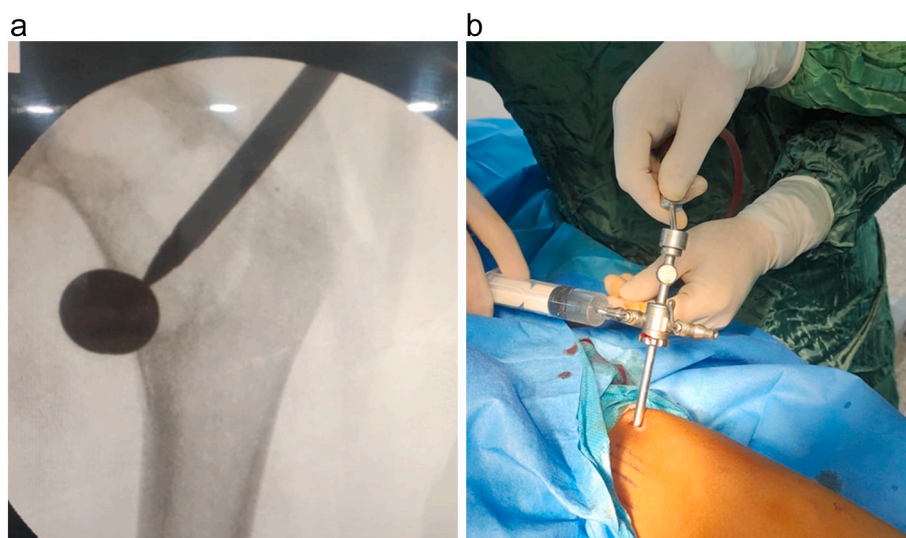
#### 5. Therapeutic intervention

Based on the aforementioned clinical and radiological findings, percutaneous management of the cyst was performed. Under general anesthesia, the location of the cyst in the femoral neck was identified using fluoroscopy (Fig. 2.A). A small anterolateral incision, approximately 0.5 cm, was made, and a trocar was inserted to access the cyst. Upon entry, serosanguineous fluid was aspirated. A 20 % saline solution was injected into the cyst cavity and subsequently aspirated through the same trocar (Fig. 2.B). After thorough debridement of the cyst cavity, a calcium sulfate/calcium phosphate bone graft material was inserted through the trocar and compacted using tamponade (Fig. 3). Percutaneous prophylactic fixation was then performed using cannulated screws through lateral 1 cm incision. Postoperatively, imaging confirmed the correct placement of the fixation screws (Fig. 4.A–B).

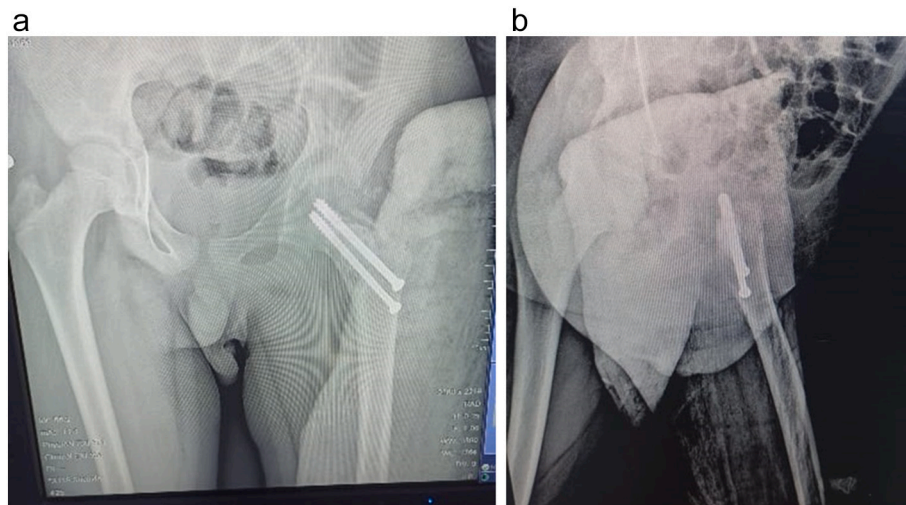
The patient was discharged from the hospital after 24 h.



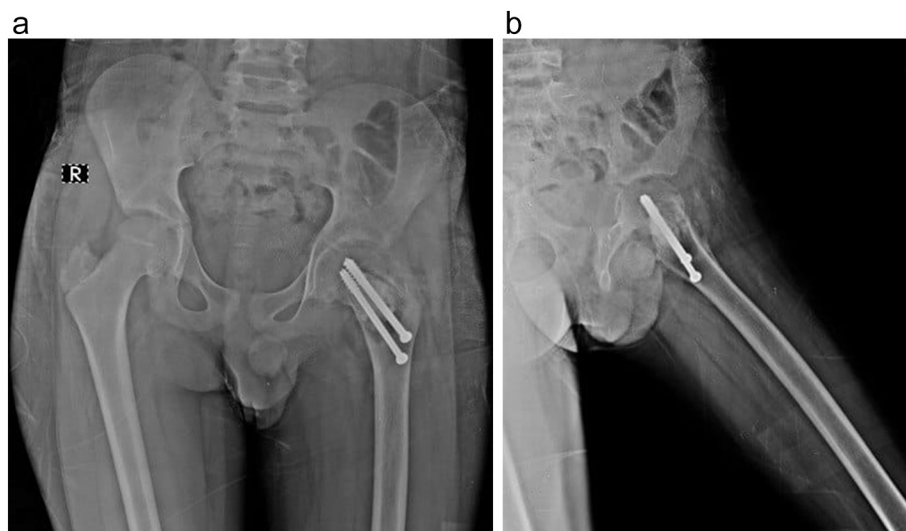
**Fig. 3.** Intraoperative image demonstrating bone grafting of the cyst cavity through the trocar.



**Fig. 2.** -A: Intraoperative image demonstrating the use of the C-arm fluoroscopy to precisely locate the cyst.  
-B: Intraoperative image demonstrating saline injection and aspiration through the trocar.



**Fig. 4.** -A: Postoperative image demonstrating the placement of two cannulated screws through the femoral neck (anterior view).  
-B: Postoperative image demonstrating the placement of two cannulated screws through the femoral neck (lateral view).



**Fig. 5.** -A: Image obtained one month postoperatively, demonstrating satisfactory healing of the region (anterior view).  
-B: Image obtained one month postoperatively, demonstrating satisfactory healing of the region (lateral view).

A splint was applied for three weeks, after which gradual movement and weight bearing were allowed. After about a month and a half, the patient returned to normal movement.

Follow-up radiographs after one month showed a good response to treatment (Fig. 5.A–B) and follow-up after eight months showed remodeling of the graft material and no sign of cyst recurrence with significant increase in cortical thickness in the femoral neck area (Fig. 6. A–B).

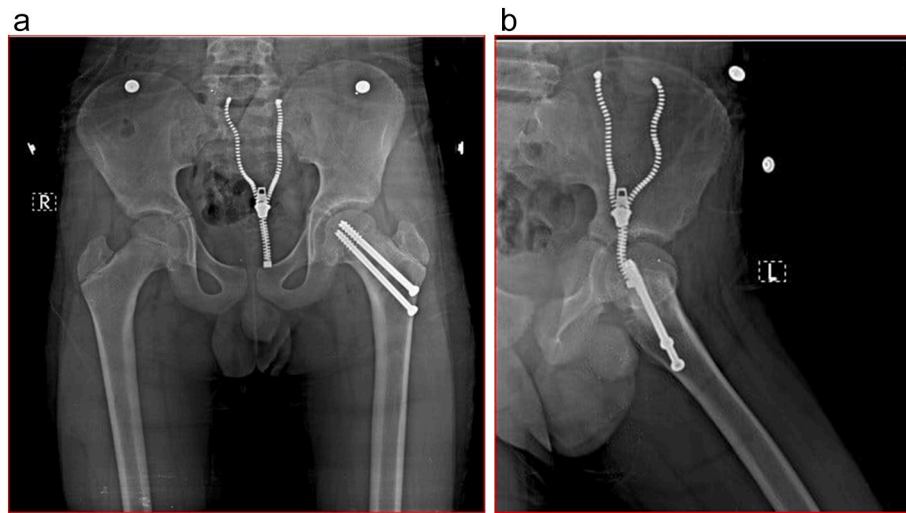
By the tenth month after surgery the screws were completely removed and the result was absolutely amazing (Fig. 7.A–B).

## 6. Discussion

Unicameral bone cysts (UBCs) are common benign bone lesions that may resemble tumors. They are also known as solitary or simple bone cysts. These cysts contain serous or serosanguineous fluid and are lined by a fibrous membrane. Histologically, UBCs exhibit connective tissue within the cyst lining and may contain giant cells, hemosiderin, and reactive new bone. The pathogenesis of these cysts remains unknown. Several theories attempt to explain their occurrence, including the

hypothesis that they develop due to a defect in bone growth, leading to fluid deposition within this defect, which ultimately results in bone collapse and expansion above it [7]. This is consistent with our case, where severe collapse was observed above the cyst area. Some authors have also proposed that increased intraosseous pressure due to venous occlusion may contribute to their formation [8]. These cysts occur more frequently in adolescents and are more prevalent in males than females. The true incidence of UBCs is unknown, as many may remain undetected. They are estimated to constitute approximately 3 % of primary bone lesions [9].

Most unicameral bone cysts (UBCs) manifest with pain in the cyst area and may be accompanied by gait disturbance or limitation of movement in the affected limb. As in our case, the patient presented with significant pain, limiting daily activities and resulting in a complete trunk lean towards the affected side. More aggressive cysts may exert pressure on blood vessels and nerves. These cysts are typically located near or within the metaphysis and are centrally positioned within the medullary cavity. However, they may migrate away from the metaphysis, as observed in the tibia. These cysts do not cross the growth plate and are most commonly found in the proximal humerus, accounting for



**Fig. 6.** -A: Image obtained eight months postoperatively, demonstrating a significant increase in cortical thickness within the area of the previous cyst (anterior view).

-B: Image obtained eight months postoperatively, demonstrating a significant increase in cortical thickness within the area of the previous cyst (lateral view).



**Fig. 7.** -A: Image obtained eight months postoperatively, the thickness of the femoral neck cortex has returned to normal and the cyst has completely disappeared (anterior view).

-B: Image obtained eight months postoperatively, the thickness of the femoral neck cortex has returned to normal and the cyst has completely disappeared (lateral view).

approximately 90 % of cases. They can also occur in other locations such as the calcaneus, ribs, and phalanges, but are very rare in the pelvis, particularly in the hip joint area [10]. Radiographs are the initial diagnostic modality, revealing these lesions as lucent areas with a sclerotic border and a well-defined interface with normal bone. The adjacent cortex may appear thinned, and periosteal reaction is typically absent. Ossification or calcification is rare within these cysts. On computed tomography (CT), they may exhibit an intact surrounding cortex and a central location. Intravenous contrast enhancement is not observed, and a gas bubble may be present within the lateral aspect of the cyst, indicating a pathological fracture. Magnetic resonance imaging (MRI) confirms the presence of a cystic structure with high signal

intensity, and rim enhancement may be seen in approximately 80 % of cases on post-contrast imaging. Notably, MRI does not generally provide significant additional information but may occasionally assist in differentiating UBCs from other mimicking lesions [11]. The differential diagnosis for UBCs includes aneurysmal bone cysts, fibrous dysplasia, chondromas, myxofibrosarcomas, and giant cell tumors. Fibrous dysplasia appears more sclerotic on radiographs compared to the lucency observed in UBCs and may occur within leukocytes. Aneurysmal bone cysts are located subperiosteally and are typically more peripherally positioned. They also cause significant cortical expansion.

Regarding treatment, there is no consensus on the optimal method, and treatment selection remains controversial. However, several factors must be considered when determining the appropriate approach, including patient age, bone strength, activity level, and cyst size. Various treatment modalities have been described, such as cortical decompression, autologous bone marrow injections, or grafting with calcium sulfate [12].

Treatment strategies for unicameral bone cysts have evolved over time. Curettage and bone grafting were historically employed, but this method has demonstrated high recurrence rates of 40-50 % [13]. Subsequently, intracystic steroid injections were utilized, with reported cure rates ranging from 41 to 90 %. Some reports have also indicated cure rates ranging from 42 to 100 % with bone marrow injections [14,15]. Certain studies suggest that steroid injections are superior to bone marrow injections or curettage and bone grafting. Conversely, one study indicated that perforated screws are more effective than steroid injections [16], and another previous study suggested that curettage and bone grafting are superior to non-surgical fixation [17]. Despite numerous studies and research, a universally preferred treatment method has not been established, as each approach presents unique advantages and disadvantages. Treatment options range from simple injections to open surgical interventions and internal fixation.

## 7. Conclusion

Unicameral bone cysts (UBCs) in the femoral neck are exceptionally rare and pose a significant challenge due to the risk of fracture and avascular necrosis. This rare and high-risk location has been successfully treated using a novel percutaneous approach employing an arthroscopic trocar, yielding excellent outcomes.

## Abbreviations

UBC Unicameral bone cysts

## Patient consent

Written informed consent was obtained from the patient's parent/legal guardian for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Ethical approval

Not applicable.

## Guarantor

Mhmoud Adnan Al Salamah

## Research registration number

N/A

## Provenance and peer review

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## Author contribution

Mhmoud Adnan Al Salamah: who performed the surgery and follow-up care, Conceptualization, resources, validated, literature reviewed the manuscript and the corresponding author who submitted the paper for publication.

Khaled Alomar and Hasan Halabi: who wrote, original drafted, edited, visualized, validated, literature reviewed the manuscript.

Mohammad Alomar: Supervision, resources, investigation, data curation, writing, editing.

All authors read and approved the final manuscript.

## Conflict of interest statement

The authors declare that they have no competing interests.

## Data availability

The datasets generated during and/or analyzed during the current study are not publicly available because the data were obtained from the hospital computer-based in-house system. Data are available from the corresponding author upon reasonable request.

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