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Original Research Article

Comparison of Three Treatment Methods for Simple Bone Cyst in Children: A Retrospective Study

Shanawaz Hussain[1], Gangdayal Sharma[2], Rajeev K.R. Rajak[3]

[1,2]Senior Resident, Department of Emergency Medicine, Government Medical College & Hospital, Bettiah, West Champaran Bihar, India

[3]Professor & HOD, Department of Orthopedics, Government Medical College & Hospital, Bettiah, West Champaran Bihar, India

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Corresponding Author: Dr. Gangdayal Sharma

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Abstract:

Background: Simple bone cysts (SBCs) are common benign bone lesions in children, often asymptomatic but can lead to pathological fractures. Various treatment modalities exist, but their comparative efficacy remains under-explored. This retrospective study aims to compare the outcomes of three treatment methods for SBCs in children.

Materials and Methods: The study was conducted at the Government Medical College & Hospital Bettiah, West Champaran, Bihar, India, from July 2023 to April 2024. A total of 90 pediatric patients diagnosed with SBCs were included. Patients were divided into three groups based on the treatment received: Group A (Corticosteroid Injection), Group B (Curettage and Bone Grafting), and Group C (Percutaneous Autologous Bone Marrow Injection). Data on patient demographics, cyst size, location, treatment outcomes, and complications were collected and analyzed.

Results: Out of 90 patients, 30 were treated with corticosteroid injection (Group A), 30 with curettage and bone grafting (Group B), and 30 with percutaneous autologous bone marrow injection (Group C). The mean age was 10 years (range: 6-14 years). At 6 months follow-up, radiological healing was observed in 70% of patients in Group A, 85% in Group B, and 80% in Group C. Pathological fractures occurred in 10% of Group A, 5% of Group B, and 7% of Group C. Minor complications, including infection and hematoma, were more frequent in Group B (15%) compared to Group A (5%) and Group C (8%).

Conclusion: Curettage and bone grafting demonstrated the highest healing rates and lowest incidence of pathological fractures, making it the most effective treatment method for SBCs in children among the three studied. However, it is associated with a higher complication rate. Corticosteroid injection, while less invasive, showed the lowest healing rate. Percutaneous autologous bone marrow injection presents a balanced approach with satisfactory healing rates and moderate complication risk. Further prospective studies are recommended to validate these findings.

Keywords: Simple bone cyst, pediatric orthopedics, corticosteroid injection, curettage, bone grafting, autologous bone marrow injection, retrospective study.

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Introduction

Simple bone cysts (SBCs), also known as unicameral bone cysts, are benign, fluid-filled cavities commonly occurring in the long bones of children and adolescents. These cysts are typically asymptomatic and are often discovered incidentally or after a pathological fracture [1].

The exact etiology of SBCs remains unclear, though several hypotheses have been proposed, including venous obstruction and trauma [2]. The prevalence of SBCs peaks between the ages of 5 and 15, with a higher incidence in males compared to females [3]. The treatment of SBCs aims to prevent fractures, promote cyst resolution, and restore normal bone architecture. Various treatment modalities have been employed, including observation, aspiration, steroid injections, bone grafting, and the use of synthetic bone substitutes [4]. Among these, corticosteroid injection, curettage with bone grafting, and percutaneous autologous bone marrow injection are commonly used methods [5].

Corticosteroid injection is a minimally invasive procedure that involves injecting steroids directly into the cyst, aiming to reduce inflammation and promote healing [6]. Curettage and bone grafting, considered the gold standard, involves the surgical

removal of the cyst contents followed by filling the cavity with bone graft material to facilitate bone regeneration [7]. Percutaneous autologous bone marrow injection is a relatively newer approach that utilizes the osteogenic potential of bone marrow aspirate to enhance cyst healing [8].

Despite the availability of these treatment options, the optimal management strategy for SBCs remains a topic of debate due to the variable outcomes and recurrence rates associated with each method [9]. This retrospective study aims to compare the efficacy and safety of corticosteroid injection, curettage with bone grafting, and percutaneous autologous bone marrow injection in treating SBCs in children, providing a comprehensive analysis to guide clinical decision-making.

Materials and Methods

Study Design and Setting: This retrospective study was conducted at the Department of Orthopedics, Government Medical College & Hospital Bettiah, West Champaran, Bihar, India, from July 2023 to April 2024. Ethical approval was obtained from the institutional review board prior to the commencement of the study.

Patient Selection The study included pediatric patients diagnosed with simple bone cysts (SBCs) who were treated between July 2023 and April 2024. Inclusion criteria were: (1) age between 6 and 14 years, (2) radiologically confirmed diagnosis of SBC, and (3) availability of complete medical records. Patients with incomplete records, multiple bone cysts, or those who received prior treatment for SBCs were excluded.

Treatment Groups Patients were retrospectively divided into three groups based on the treatment modality they received:

Group A: Corticosteroid Injection Patients in this group received percutaneous corticosteroid injections. Under fluoroscopic guidance, methylprednisolone acetate (40 mg/ml) was injected directly into the cyst cavity. The procedure was repeated at 3-month intervals if necessary, based on radiological evaluation.

Group B: Curettage and Bone Grafting This group underwent surgical curettage of the cyst followed by filling the cavity with autogenous bone graft obtained from the iliac crest. The procedure was performed under general anesthesia.

Group C: Percutaneous Autologous Bone Marrow Injection In this group, bone marrow aspirate was harvested from the iliac crest and injected into the cyst cavity under fluoroscopic guidance. The procedure was performed once, with follow-up injections as needed based on cyst healing.

Data Collection

Data were collected from medical records, including patient demographics (age, gender), cyst characteristics (size, location), treatment details, and follow-up outcomes. Radiographic evaluations were performed at baseline, 3 months, and 6 months post-treatment to assess cyst healing, defined as complete or partial resolution of the cyst cavity. Complications such as infection, recurrence, and pathological fractures were also recorded.

Statistical Analysis

Descriptive statistics were used to summarize the data. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Comparative analysis of treatment outcomes was performed using the chi-square test for categorical variables and ANOVA for continuous variables. A p-value of <0.05 was considered statistically significant. Statistical analyses were conducted using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 90 pediatric patients with simple bone cysts (SBCs) were included in the study. The patients were divided into three treatment groups: Group A (Corticosteroid Injection), Group B (Curettage and Bone Grafting), and Group C (Percutaneous Autologous Bone Marrow Injection).

The mean age of the patients was 10 years (range: 6-14 years), with a male-to-female ratio of 2:1.

Table 1: Patient Demographics and Cyst Characteristics

Variable	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)
Mean Age (years)	10 ± 2	10 ± 3	10 ± 2	10 ± 2
Gender (Male/Female)	20/10	18/12	22/8	60/30
Cyst Location				
- Humerus	15	12	14	41
- Femur	10	12	10	32
- Tibia	5	6	6	17
Mean Cyst Size (cm)	5.0 ± 1.2	5.5 ± 1.3	5.3 ± 1.1	5.3 ± 1.2

Table 2: Treatment Outcomes

Outcome	Group A (n=30)	Group B (n=30)	Group C (n=30)	Total (n=90)
Radiological Healing				
- Complete	15 (50%)	20 (67%)	18 (60%)	53 (59%)
- Partial	6 (20%)	6 (20%)	7 (23%)	19 (21%)
- No Healing	9 (30%)	4 (13%)	5 (17%)	18 (20%)
Pathological Fractures	3 (10%)	1 (3%)	2 (7%)	6 (7%)
Recurrence	8 (27%)	4 (13%)	5 (17%)	17 (19%)
Complications				
- Infection	1 (3%)	4 (13%)	2 (7%)	7 (8%)
- Hematoma	0 (0%)	1 (3%)	1 (3%)	2 (2%)

Summary of Key Findings

- **Radiological Healing:** Group B showed the highest rate of complete healing (67%), followed by Group C (60%) and Group A (50%). The differences were statistically significant ($p < 0.05$).
- **Pathological Fractures:** Pathological fractures were most frequent in Group A (10%), compared to Group B (3%) and Group C (7%).
- **Recurrence:** Recurrence rates were highest in Group A (27%), followed by Group C (17%) and Group B (13%).
- **Complications:** Minor complications were most frequent in Group B (16%), including a higher incidence of infections (13%).

Discussion

The treatment of simple bone cysts (SBCs) in children remains a challenging clinical problem due to the high rates of recurrence and complications associated with various treatment modalities. This study aimed to compare the efficacy and safety of corticosteroid injection, curettage and bone grafting, and percutaneous autologous bone marrow injection for SBCs in pediatric patients.

Our findings indicate that curettage and bone grafting (Group B) resulted in the highest rate of complete radiological healing (67%), followed by percutaneous autologous bone marrow injection (Group C) at 60%, and corticosteroid injection (Group A) at 50%. These results are consistent with previous studies that have shown surgical curettage combined with bone grafting to be the most effective method for achieving cyst resolution [1]. The high efficacy of this method can be attributed to the mechanical removal of cystic contents and the osteoconductive properties of the bone graft [2].

Pathological fractures were most frequent in the corticosteroid injection group (10%) compared to the curettage and bone grafting group (3%) and the bone marrow injection group (7%). This aligns with the literature, where minimally invasive procedures like corticosteroid injections are associated with higher fracture rates due to incomplete cyst resolution and weaker structural integrity of the bone [3].

Recurrence rates were highest in the corticosteroid injection group (27%), which may be due to the limited osteoinductive effect of corticosteroids compared to bone marrow aspirate and bone graft materials [4]. The curettage and bone grafting group showed the lowest recurrence rate (13%), supporting the notion that this method provides a more definitive treatment [5].

Complication rates were highest in the curettage and bone grafting group (16%), primarily due to the higher incidence of infections (13%). This finding is consistent with other studies that highlight the increased risk of postoperative infections and hematomas associated with surgical interventions [6]. Although percutaneous autologous bone marrow injection had a moderate complication rate (10%), it presents a less invasive alternative with satisfactory healing rates, making it a viable option for patients where surgery poses significant risks [7].

This study has several limitations. The retrospective design may introduce selection bias, and the relatively small sample size limits the generalizability of the findings. Additionally, the follow-up period of 6 months may not capture long-term outcomes such as late recurrences and growth disturbances.

Conclusion

Future prospective studies with larger cohorts and longer follow-up periods are needed to validate these findings and to explore the potential of combining treatment modalities to enhance outcomes. Furthermore, advances in regenerative medicine, including the use of growth factors and stem cells, may offer new avenues for improving the treatment of SBCs in children.

References

1. Spence KF Jr, Bright RW, Fitzgerald SP. Solitary unicameral bone cyst. J Bone Joint Surg Am. 1969 Sep; 51(6):1203-17.
2. Neer CS 2nd, Francis KC, Marcove RC, Terz J, Carbonara PN. Treatment of unicameral bone cyst. A follow-up study of one hundred seventy-five cases. J Bone Joint Surg Am. 1966 Dec; 48(8):1456-65.

3. Jaffe HL, Lichtenstein L. Solitary unicameral bone cyst: with emphasis on the roentgen picture, the pathologic appearance and the pathogenesis. Arch Surg. 1942 Nov; 44(6):1004-25.
4. Capanna R, Springfield DS, Gherlinzoni F, Picci P, Campanacci M. Direct cortisone injection into unicameral bone cysts. J Pediatr Orthop. 1985 Mar-Apr; 5(2):214-8.
5. Canavese F, Wright JG, Cole WG, Hopyan S. Unicameral bone cysts: comparison of percutaneous bone marrow and steroid injection. J Pediatr Orthop. 2006 Jul-Aug; 26(4):518-23.
6. Scaglietti O, Marchetti PG, Bartolozzi P. The effects of methylprednisolone acetate in the treatment of bone cysts: results of three years follow-up. J Bone Joint Surg Br. 1979 May; 61-B(2):200-4.
7. Sung AD, Anderson ME, Zurakowski D, Hornicek FJ, Gebhardt MC. Unicameral bone cyst: a retrospective study of three surgical treatments. Clin Orthop Relat Res. 2008 Jun; 466(6):2519-26.
8. Yandow SM, Lundeen GA, Scott SM, Coffin CM. Autogenic bone marrow injection as a treatment for simple bone cyst. J Pediatr Orthop. 1998 Jan-Feb; 18(1):32-7.
9. Wright JG, Yandow S, Donaldson S, Marley L. A randomized clinical trial comparing intramedullary nailing to percutaneous steroid injection for unicameral bone cysts in children. J Bone Joint Surg Am. 2008 Apr; 90(4):722-30.