Outcome of Simple Bone Cyst Treated With Corticosteroid Injections

Muhammad Azeem Akhund[1], Kishore Kumar[2], Muhammad Faraz Jokhio[3], Allah Nawaz Abbasi[4], Muhammad Ali Jamali[5]

ABSTRACT

Introduction: Simple bone cyst are lined by fibrous membrane and usually contain serous or serosanguinous fluid.

Asymptomatic cysts do not require any intervention. However, if symptomatic then as corticosteroid injection, bone grafting and curettage or injection of bone marrow can be considered as treatment options. Steroid injection therapy is a simple procedure with easy availability and low cost. The aim of this study was to determine the frequency of outcome in patients treated for simple bone cysts and to determine the association of various predicting factors with the positive outcomes.

Materials and methods: This was a retrospective study conducted at Department of Orthopedics of a teaching hospitalfrom1st march 2018 to 28th February 2019. Patients of either gender and aged 12 years or less diagnosed as having simple bone cyst on plain radiographs were, treated with cyst aspiration and steroid injection and had a follow up for at least 12 months were included. Treatment outcome to steroid injection was evaluated radiologically at every three months follow up till 12 months or more and was graded according to Neer's scale. Grades I and II were good treatment response and grades III and IV were regarded as poor response.

Results: Total 141 patients were included in the study. Humerus was the most common site of involvement followed by femur. Fracture was present in majority of the cases before treatment. Neer stage I was found in 57 (40.4%), stage II was found in 41 (29.1%), stage III was found in 28 (19.9%) and stage IV was found in 15 (10.6%) of the patients. Total 69.5% had good treatment response whereas 43 (30.5%) had poor treatment response. There was a significant association of healing with latent cyst (p value = 0.001) and unilocular cyst (p value = 0.000).

Conclusion: Corticosteroid injection for simple bone cyst has high frequency of good response with significant association of cyst activity and cyst cavities with the treatment response.

1. Associate professor, orthopedics, PUMHSW, SBA.
2. Assistant professor, orthopedics, PUMHSW, SBA.
3. Assistant professor, orthopedics, LUMHS, jamshoro.
4. Assistant professor, orthopedics, PUMHSW, SBA.
5. Senior registrar, neurosurgery, PUMHSW, SBA.

Correspondence: Muhammad Azeem Akhund

Associate professor, orthopedics, PUMHSW, SBA

Email: akhundazeem79@gmail.com

INTRODUCTION:

Simple bone cyst, also termed as unicameral bone cyst, was initially described as Virchow as a cystic structure, which was at that time thought to occur as a result of abnormalities in local circulation.[1] Majority of the simple bone cysts (SBCs) occur in children and adolescents with a reported peak in between 3 to 14 years of age.[2,3]The SBCs are lined by fibrous membrane and usually contain serous or serosanguinous fluid. Its exact cause is not known but hypothesis exists that these may occur as a result of defect in bone growth resulting in fluid filling the bony defect ultimately leading to expansion of the overlying bone.[3] Some studies have suggested that these may also develop as a result of venous obstruction inside the bone.[4]

SBCs are usually asymptomatic. When they present, they are usually symptomatic which is commonly due to a pathological fracture causing symptoms of pain, swelling or deformity.[5] These cysts are usually located at or near the metaphysis and are commonly found in long bones with

humerus being the most common long bone involved.[3] However, calcaneus[6], radius or ulna may also be involved.

Asymptomatic cases do not require any intervention. However, if symptomatic then various treatment options can be considered such as corticosteroid injection after cyst aspiration, bone grafting and curettage or injection of bone marrow.[7-9] Steroid injection therapy is a simple procedures and has advantages such as low cost and easy availability. However, studies have reported mixed results, with some suggesting good results[10] and some reporting poor results with incomplete healing.[11,12] According to one international study, steroid injection has a positive response in approximately 62.9% of the cases and recurrence was observed in 37.1% of the cases.[13] Therefore, the aim of this study was to determine the frequency of outcome in patients treated for simple bone cysts and to determine the association of various predicting factors with the positive outcomes.

MATERIALS AND METHODS

This was a retrospective study conducted at Department of Orthopedics of a teaching hospital. Patients of either gender and aged 12 years or less diagnosed as having simple bone cyst on plain radiographs were, treated with cyst aspiration and steroid injection and had a follow up for at least 12 months were included. Patients were excluded if no follow up was available or the follow up duration was less than 12 months. Sample size was calculated using OpenEpi calculator taking frequency of recurrence as 37.1%[13], margin of error as 8% and confidence interval (CI) as 95%. The sample size came out to be 141. Non-probability consecutive sampling technique was employed. The information pertaining to simple bone cyst that was recorded included the cyst site, site within the long bone (metaphysis or diaphysis), cyst status (active or inactive), cyst cavities (unilocular or multilocular) and if there was any fracture present before treatment. Cysts were defined as active if they were located ≤ 0.5 cm from growth plate and latent if they were located > 0.5 cm from the growth plate. The procedure of cyst aspiration and steroid injection was performed in a sterile manner and patient was discharged the same day after the injection. Initially, 11 gauge needles were inserted for cyst content aspiration percutaneously. After cyst aspiration, approximately 40 mg to 120 mg methylprednisolone was injected into the cyst, depending upon the size of the cyst. This procedure was performed three times with four to six weeks interval in between the injections. If any pathological fracture was present, it was allowed to heal for four to six weeks before the treatment. The outcome to steroid injection was evaluated radiologically at every three months follow up till 12 months or more. Neer's scale that was modified by Chang et al.[14] The results of treatment were defined as grade I when complete obliteration of the cyst was shown, grade II when new bone filled the lesion but some opaque areas were still present, grade III when multilocular or lucent residual areas were still visible and grade IV when there was no change in the cyst following treatment. Grades I and II were regarded as having good results (healed cysts) and grades III and IV were regarded as poor results (non-healed cysts).

Statistical analysis was performed on Statistical Package for Social Sciences (SPSS) version 22.0. Mean and Standard Deviation (SD) was calculated for quantitative variables such as age and follow up duration. Frequency and percentage was calculated for gender, cyst site, cyst site within the long bone (metaphysic / diaphysis), cyst status (active/latent), fracture before treatment, cyst cavities and outcome. Effect modifiers such as age, duration of symptoms, gender, cyst site,
cyst site within the long bone, cyst cavities and fracture before treatment were stratified to see their effect on outcome variables. Chi square test was applied and p value of less than or equal to 0.05 was taken as significant.

Table 1: Baseline characteristics of the patients (n=141)		
	n	%
Age, years	9.6 ± 2.2[=]	
≤10 years	74	52.5
>10 years	67	47.5
Gender		
Males	83	58.9
Females	58	41.1
Duration of follow up, months	15.6 ± 3.4[=]	
≤12 months	42	29.8
>12 months	99	70.2
Site of cysts		
Humerus	96	68.1
Femur	32	22.7
Tibia	7	5.0
Fibula	6	4.3
Cyst location within long bone		
Metaphysis	43	30.5
Diaphysis	98	69.5
Fracture before treatment		
Present	95	67.4
Absent	46	32.6
Cyst status		
Active	65	46.1
Latent	76	53.9
Cyst cavities		
Unilocular	105	74.5
Multilocular	36	25.5
[=]mean±SD, n: number		

RESULTS: Total 141 patients were included in the study. Mean age of the patients was 9.6 ± 2.2 years and mean duration of follow up was 15.6 ± 3.4 months. Total 58 (41.1%) were females and 83 (58.9%) were males. Humerus was the most common site of involvement (68.1%) followed by femur (22.7%), tibia (5.0%) and fibula (4.3%). Total 76 (53.9%) cysts were latent and 65 (46.1%) were active. Fracture was present in 95 (67.4%) cysts before treatment. Baseline characteristics are summarized in Table 1.

Out of 141 patients, Neer stage I was found in 57 (40.4%), stage II was found in 41 (29.1%), stage III was found in 28 (19.9%) and stage IV was found in 15 (10.6%) of the patients. Total 98 (69.5%) had good treatment response whereas 43 (30.5%) had poor treatment response. There was a significant association of healing with latent cyst (p value = 0.001) and unilocular cyst (p value = 0.000). No significant association was found with age, gender, follow up duration or cyst site within a long bone. Results are summarized in Table 2.

DISCUSSION

Simple bone cysts are benign fluid containing lesions. Plain radiographs are the modality of choice for their diagnosis. Whenever a child has a diagnosis of simple bone cyst made the decision of its management shall be made by the orthopedic surgeon. No consensus exists regarding SBC management. Asymptomatic

Table 2: Comparison of patient and cyst characteristics with the response (n=141)

	Total	Response		p-value
		Good	Poor	
	n (%)	n (%)	n (%)	
Gender				
Male	83 (100)	54 (65.1)	29 (34.9)	0.170
Female	58 (100)	44 (75.9)	14 (24.1)	
Cyst activity				
Active	65 (100)	36 (55.4)	29 (44.6)	0.001
Latent	76 (100)	62 (81.6)	14 (18.4)	
Cyst cavities				
Unilocular	105 (100)	85 (81)	20 (19)	0.000
Multilocular	36 (100)	13 (36.1)	23 (63.9)	
Fracture before treatment				
Present	95 (100)	66 (69.5)	29 (30.5)	0.991
Absent	46 (100)	32 (69.6)	14 (30.4)	
Cyst site within long bone				
Metaphysis	98 (100)	68 (69.4)	30 (30.6)	0.964
Diaphysis	43 (100)	30 (69.8)	13 (30.2)	

lesions usually do not require intervention. If management of SBC is planned the prevention of fracture should be a consideration. And if fracture is present before management, then its stabilization and prevention of movement restriction should be a consideration. Steroid injection has become a standard treatment method for SBCs. However, the main disadvantage of this procedure is its long duration. This long duration is because of the fact that more than one session is required for complete treatment of SBC.

In this study we determined the outcome of steroid injection for SBC treatment. The results of our study have shown that steroid injection has a good response in treating SBCs. Approximately 69.5% of the patients had a good response to treatment in our study. However, according to a study conducted by Pavone et al.[7] good response was present in 82.6% of the patients. This variation could be attributed to the fact that Pavone et al. studied the long term response in humeral SBCs only whereas in our study cohort SBCs were also present in femur, tibia and fibula. Another study[13] has reported that 62.9% SBCs had good response to steroid injection as compared to 69.1% reported in our study. This slightly lower frequency of good response could be due to small sample size of the previous study[13].

Canavese et al.[15] studied three techniques for SBC treatment. Their study results showed that steroid injection of SBC had satisfactory healing in 41% of the cases. This contrasts to the results reported in this study. Moreover, their results further showed that percutaneous curettage had the highest rate of satisfactory healing of SBC followed by steroid injection and bone marrow injection. Thus the conclusion was drawn that mechanical disruption of cyst wall may help in their healing and this technique may be used for SBC treatment. However, in another clinical trial, no significant difference was observed in the groups treated with bone marrow injection or steroid injection.[16]

According to the results of our study, there was no significant association of treatment response with gender. Similar results have been shown in previous study.[13] Another study comparing different treatment options also demonstrated no significant association of cyst healing with gender.[8,17]

Our study results have shown that there was no significant difference in cyst location within the long bone and treatment response. Similar results were demonstrated by previous studies.[8,13]However, Flont et al.[13] have shown a significant difference of treatment response with the site of bone involved whereas our results have shown no significant difference. This could be due to difference in sample size.

Fracture before the treatment had no significant association with treatment outcome according to the results of our study, which was almost similar in other study cohort.[8,17]According to the results of our study, there was a significant association of cyst cavities with healing response. Similar results were shown by Flont et al in their study cohort.[13]

It was shown in our study that latent cyst had significant association with good response. This finding contradicts with the one reported by Flont et al. [13] in their study cohort. However, another study by Traub et al demonstrated significant association of cyst activity with treatment response.[17] We believe that this finding requires further evaluation with a larger sample size.

The results of our study should be interpreted in light of certain limitations. One limitation was that we did not evaluate the quantitative radiological parameters such as cyst area, cyst index, cyst volume and mean cyst diameter ratio. Turab et al[17] have shown significant association cyst volume and cyst index with the treatment response. We believe that this limitation was due to unavailability of Picture Archiving and Communication System (PACS) at our institute. PACS can help interpret soft copies of plain radiographs allowing various measurements thereby overcoming this limitation. Another limitation of our study was that we included patients with follow up of one year or more and no patient with long term follow up was available. Long term follow up of three years or more can help better evaluate the effectiveness of treatment and should be encouraged.

Despite these limitations, we believe that this study was an attempt to evaluate the effectiveness of simple bone cyst treatment with aspiration and

steroid injection in a population of developing country. It is recommended that further multicentric studies on larger sample size and incorporating the quantitative radiological parameters such as cyst area, cyst volume and cyst index should be undertaken so that further predicting factors related to treatment response could be assessed.

CONCLUSION:

Corticosteroid injection for simple bone cyst has high frequency of good response with significant association of cyst activity and cyst cavities with the treatment response.

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