ORIGINAL ARTICLE

A comparison of treating Unicameral bone cyst using steroids and percutaneous autologous bone marrow aspiration injection

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Abstract

Objective: To compare the results of percutaneous autologous bone aspiration injection and steroids injections in the treatment of unicameral bone cyst.

Methods: The prospective study was conducted at Mayo Hospital, Lahore, from January 2008 to March 2014, and comprised patients diagnosed radiologically as a case of unicameral bone cyst. The patients were divided into two groups, with group 1 being treated with bone marrow aspiration injection, while group 2 was given steroids injection. Aspiration of bone marrow was done from tibial tuberosity.

Results: The 30 patients in the study were divided into two groups of 15(50%) each. In group 1, 8(53.34%) patients and in group 2, 3 (20%) patients achieved healing after the first injection ($p<0.05$), while overall success rates were 13(86.67%) in group 1, and 11(73.33%) in group 2 ($p>0.05$). The mean number of procedures required in group 1 was 1.57± 0.495 (range: 01-3) and for 2.19 ± 1.076 (range: 1-5) in group 2 ($p<0.05$), and mean interval-to-healing was 14.3 months ± 8.705 (range: 7-36) for group 1 and 12.5 months ± 7.88 (range: 4-32) for group 2 ($p>0.05$).

Conclusion: Bone marrow aspiration injection was better than steroids in treating unicameral bone cyst.

Keywords: Bone marrow, Unicameral bone cyst, Methylprednisolone acetate. (JPMA 65: S-156 (Suppl. 3); 2015)

Introduction

Unicameral bone cyst is a benign lesion usually seen in the ends of long bones in skeletally immature persons leading to pathological fractures and skeletal deformities. The aetiology of the disease is still not clear. Different hypothesis have included synovial cysts, abnormalities in local circulation and dysplastic processes. The diagnosis of unicameral cyst is mostly incidental, while some present with pathological fractures. Radiographic finding includes a symmetric lesion with cortical tinning and expansion of cortical boundaries.

Virchow in 1876 for the first time recognised unicameral bone cyst and the treatment of the disease was open surgery.[1] Surgical procedures ranged from simple curettage with autologous bone graft or allograft to sub-periosteal resection with fixation and grafting.[2-4] Percutaneous injection of methylprednisolone acetate for treatment of unicameral bone cyst was described for the first time in 1974 by Scaglietti,[5] and 50% to 90% success rates were reported by different authors but long time (one to three years) and multiple injections were required for the patient to return to his daily routine lifetsyle. Its relative low success rate led to interest in other methods of treatment. Based on the results of a study by Wientroub et al in which he described the use of autologous marrow aspirate to improve the osteogenic potential of bone grafts in children, Lokiec et al in 1996 described for the first time the use of autologous bone marrow aspirate in treatment of unicameral bone cyst.[6,7] The main focus should be to assess the effectiveness of close methods rather than going for open surgical treatment.

The current study was planned to compare the outcome of injecting percutaneous bone marrow aspiration injection and steroids in treating unicameral bone cyst.

Patients and Methods

The prospective study was conducted at the Department of Orthopaedic Surgery, Mayo Hospital, Lahore, from January 2008 to March 2014 and comprised patients diagnosed radiologically as a case of unicameral bone cyst. Patients with open biopsies were excluded. The patients were divided into two groups, with group 1 being treated with bone marrow aspiration injection, while group 2 was given steroids injection. Both the procedures were carried out in the operation theatre as a day case. The patient was placed in supine position, proximal tibia and recipient area were draped separately to avoid cross-contamination. The procedure was done by a senior surgeon under image intensifier. A wide-bore needle was inserted in the cyst through the thinnest accessible wall and cyst was aspirated. In group 1, bone marrow aspirate was injected, while in group 2 steroids were injected in the

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cyst through the same needle. The dose of steroids was calculated by patient's body weight, and the amount of the marrow was determined by the size of the cyst on X-ray, using the formula [π/6 x length x width x height].[8] The autologous bone marrow was taken from tibial tuberosity using a K-wire and a blood transfusion set needle. A total of 20-40 ml of bone marrow aspirate was mostly used. Patients were advised to have complete rest for four weeks in case if the lesion was in the humerus, and for eight weeks in patients with lesion in tibia. X-rays were taken 3 months after the procedure and were repeated after every three months till the evidence of healing was observed. Once the evidence of healing taking place, the radiographs were repeated annually. Modified Neer's classification was used to evaluate the radiological changes (Table-1).[3,9,10]

The procedure was considered successful if the cyst was completely healed or had healing in progress with a radiological defect as shown in Figure. When there was no evidence of healing six months after the initial procedure, the procedure was repeated. The results of both the groups were compared in terms of clinical symptoms, success rate, recurrence, number of procedures and time to healing. Additional factors, including age, gender, and location of cyst, were also assessed. Chi-square test was used to evaluate categorical variables and Student t-test for continuous variables. Three pathological fractures in the bone marrow group were excluded from statistical analysis. P<0.05 was considered significant.

Results

The 30 patients in the study were divided into two groups of 15(50%) each. Overall success rates were 13(86.67%) in group 1 and 11 (73.33%) in group 2 (p>0.05). In group 1, 8(53.34%) patients healed after the first injection (p<0.05), 5(33%) showed good response and only 2(13.3%) recurred; 1(6.6%) at 06 months and 1(6.6$) after 14 months. In group 2, 3(20.0%) patients healed after the first injection, while 9(60%) showed good response, but 3(20.0%) required a second injection. The mean interval between the first injection and recurrence was 10.5±3.579 months (range: 2-15). A comparison was made between the groups in terms of age, gender or location of cyst as a healing factor, but none of these affected the success rates (Table-2).

Group 1 had 25 injections, while group 2 received 37 injections. The mean number of procedures required for bone marrow aspiration injection was 1.57±0.495 (range: 01-3) and for steroids was 2.19±1.076 (range: 1-5) (p<0.05). The mean interval-to-healing time was 14.3±8.70 months (range: 7-36) and 12.5±7.88 months (range: 4-32) for groups 1 and 2 respectively (p>0.05).

The male-to-female ratio in group 1 was 10:5, while it was 08:07 in group 2. The mean age was 10.5±2.46 (range: 2-12), while the mean follow-up was 3.7±1.207 years (range: 2-6). The proximal humerus was the most commonly affected in 20 (66.67%) cases, followed by proximal radius in 08(26.67%). The remaining 2(6.67%) cases had issues in proximal tibia. No difference was found between the

Table-1: Modified Neer Classification of radiological results.

Classification	Description
Healed	Cyst filled by new bone, with or without small radiolucent area(s) < 01cm
Healing with defects	Radiolucent area(s) < 50% of the diameter of bone, with enough cortical thickness to prevent fracture
Persistent cyst	Radiolucent area > 50% of diameter of the bone and with a thin cortical rim. No increase in the size of the cyst. Continued restriction of activity or repeated treatment is required
Recurrent cyst	Cyst reappeared in a previously obliterated area, or a residual radiolucent area has increased in size

Table-2: Comparison of successful results after failure of the initial procedure.

	Steroids Group (n = 15)			Bone marrow group (n = 15)		
	Success (n = 03)	Failure (n = 12)	P value	Success (n = 08)	Failure (n=07)	P value
Mean age	8.54	10.93	0.78	11.4	10.4	0.76
Male female Ratio	2:1	6:6	0.50	6:3	4:2	0.92
Active : latent	1:2	4:8	0.5	3:5	4:3	1.00
Location						
Humerus	02	08	0.25	04	05	0.8
Radius	01	03	0.33	02	01	0.2
Tibia	0	01	0	0	01	0

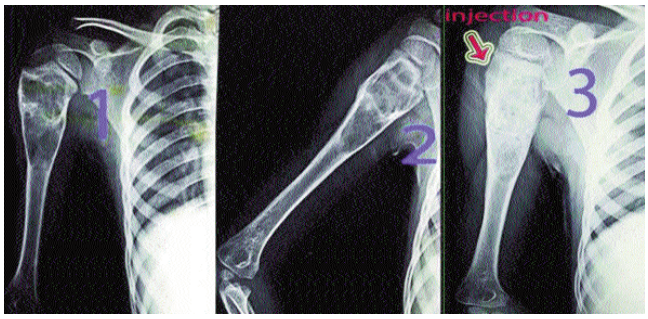

Figure: X-ray of a 11-year boy having unicameral bone cyst proximal humerus.

groups in demographic variables or duration of procedures (p>0.05).

Discussion

The aetiology of unicameral bone cyst is still not much clear. Failure to reabsorb hematomas,[11] low-grade form of osteomyelitis,[12] defect in remodelling,[13] a true intra-osseous synovial cyst,[14] degenerative phase of benign tumour,[15,16] and venous obstruction[17] are the different theories proposed to explain the aetiology of unicameral bone cyst. Cohen in 1970 proposed that the venous obstruction causes cyst formation by elevating intra-osseous pressure.[17] Komiya et al. presumed that prostaglandin E2, interleukin-1β and gelatinase in cyst fluid promote bone resorption, and surmised that trepanation of a cyst reduces the internal pressure; removes bone resorptive factors and promotes venous recirculation.[18] Formation of these bone resorptive factors was effectively inhibited by injecting steroids, but this itself will not provide the bone forming potential. When venous recirculation is insufficient, a cyst cannot escape the osteoclastic pathway completely. However, reducing the internal pressure of the cyst and removing bone resorptive factors and owing the osteogenic potential of autologous bone marrow, its grafting with bone marrow aspirate might be effective in inducing successful bone formation. This osteogenic potential may explain the lower rate of recurrence.

Though no preferred treatment for unicameral bone cysts has been established, most authors[6,19] agree that open surgery cannot be justified as an initial approach. In the current study, the overall success rates in both the steroid and the autologous marrow groups were satisfactory after several procedures, but were less impressive after a single procedure, especially in the steroid group. Other studies have found that the healing response to steroid injection was unpredictable and usually incomplete.[9,10,20] Scaglietti et al. noted that a single injection was sufficient to heal a bone cyst in only 24% cases[19] and Campanacci et al. found recurrence, or no response, after the initial injection in 32% patients.[9] Capanna et al. thought that recurrence after steroid injection was associated with multiloculation, the size of the cyst and the age of the patient.[10] They recommended that close radiological surveillance should be maintained in those with risk factors even after the cyst has consolidated. Several other studies also suggested that repeated steroid injections may be needed to achieve adequate consolidation.[9,10,19,20]

Autologous bone marrow grafting of unicameral bone cysts was introduced by Lokiec et al. in order to circumvent the repetition of steroid injections.[6] Although grafting does not completely prevent recurrence, but it has been reported that the healing rate after a single bone marrow graft is about 60%.[21,22]

Recently, demineralised bone matrix has been used in the treatment of unicameral bone cysts and has provided excellent results, inducing bone formation by osteoconduction.[23-25] A mixture of demineralised bone matrix and autologous bone marrow introduces osteoprogenitor cells as well as osteoconductivity and osteoinductivity.

The study has its limitations as the number of patients enrolled was small, and thus the statistical power of the study was relatively weak. A larger study would provide more information.

Conclusion

The use of both the steroids and bone marrow aspirate was effective in treating unicameral bone cyst, but bone marrow aspirate yielded better outcome in treating the disease.

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