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Functional outcome of curettage and reconstruction with bone grafting or combined bone graft and cement (Sandwich Technique) in primary benign osseous tumors around Elbow: A prospective study

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Abstract

Background: Common benign bone lesions around elbow joint include giant cell tumors, chondroblastoma, simple bone cysts, fibrous dysplasia and osteoid osteoma. These lesions can be managed either by observation and follow up, curettage with bone-grafting or combined bone grafting and cementing (sandwich technique). In some cases wide excision is indicated. We conducted this prospective study to find out the functional outcomes after curettage and reconstruction using bone graft sandwich technique with or without internal fixation.

Materials and Methods: After obtaining approval from institutional ethical committee we conducted a prospective study of 25 patients diagnosed with benign osseous lesions around the elbow joint and who were managed with extended curettage and reconstruction using either bone grafting or sandwich technique. Patients having any exclusion criteria were excluded from the study. Patients were followed up at least for 1 year. Functional Outcomes were assessed according to Mayo Elbow Performance Score (MEPS) and Quick DASH scores. The data was tabulated and analyzed using SPSS 16.0 version software.

Results: Out of 25 studied cases there were 16 males and 9 females with a M: F ratio of 1:0.56. The benign lesions in the studied cases included Giant cell tumors (80%), chondroblastoma (12%) and simple bone cysts (8%). All patients were treated by curettage and reconstruction with bone grafting or combined bone graft and cement. Postoperatively patients were followed up at 1month, 6moths and 1 year. Majority of the patients (92%) were found to have either excellent or good outcome. the Mayo Elbow Performance Score (MEPS) was found to have improved statistically significantly. Quick Disabilities of Arm, Shoulder and Hand (Quick DASH) score was also found to have improved in all the patients and majority of the patients had either no or mild difficulty with a mean Quick Dash Score of 14.

Conclusion: Treatment of benign epiphyseal bone tumors by curettage with bone grafting or combined bone grafting and cementing (sandwich technique) was found to have good to excellent functional outcome. There were no patients with significant functional disability at the end of 1 year postoperatively.

Keywords: Benign epiphyseal bone tumors, curettage, sandwich technique, functional outcome

Introduction

The common benign lesions seen around elbow include giant cell tumors, simple bone cysts, aneurismal bone cysts, fibrous dysplasia, chondroblastoma and osteoid osteomas^[1]. Giant cell tumors, though benign, show a great tendency for bone destruction. They are also known for local recurrences and malignant transformations^[2]. These tumors almost invariably arise from epiphysis and may extend into metaphysic and rarely to diaphysis. The common locations for GCT are distal femur and proximal tibia (round knee), distal radius and vertebral bodies^[3]. They may also occur in distal humerus or proximal radius or ulna (around elbow). They usually present as a solitary lesion but in some patients multicentric GCTs can also occur. These multicentric GCTs have a propensity towards involvement of small bones of hands and feet and are more aggressive than solitary lesions^[4]. Most common presenting complaints include pain, swelling, deformities, functional disability and Pathological fractures.

On X-ray these tumors can be seen as lucent and eccentric lesions located within the bone and involving epiphysis and usually extending to the diaphysis. The other characteristic features of these tumors include local bony destruction, cortical breaks, narrow zone of transition and soft-tissue expansion. Computerized tomography may show similar features but with greater details. On magnetic resonance imaging these tumors appears as hypointense on T1 and of variable intensity on T2 weighted images. Soft tissue involvement is better appreciated on Magnetic resonance imaging [5].

Chondroblastomas are other benign lesions which may be seen in humerus (most frequent), femur and tibia. They may involve bones of hands and feet in approximately 10% of the patients. These tumors are almost invariably seen before the fusion of epiphysis and are very rare after 30 years of age [6]. The patients usually present with Soft-tissue swelling, mass and in some cases joint effusion. These tumors are usually seen as well defined lucent lesions arising from the epiphysis of long tubular bone such as the femur, humerus, or tibia. Computerized tomography shows similar features as that of plain film but with better delineation and MRI may be helpful in demonstrating surrounding bone marrow and soft tissue edema [7]. Simple bone cysts are other benign lesions which may be seen as intramedullary lesions in long bones. The usual affected age group is between 10 to 20 years. The common locations of simple bone cysts include proximal humerus, proximal femur, spine and pelvic bones. The uncomplicated and asymptomatic simple bone cysts usually don't require any treatment except follow up [8].

Management of Benign bone lesions around elbow consist of removal of tumor tissue, reconstruction of bone defect created due to removal of tumor and restoring functional ability of the patient to maximum possible extent [9]. For this purpose curettage with bone grafting or combined bone grafting and cementing (sandwich technique) has been found to have a satisfactory postoperative functional outcome in many studies [10].

We conducted this prospective study of primary benign osseous lesions found around the elbow and functional outcome of treatment of these patients by curettage and bone grafting or combined bone grafting and cementing (sandwich technique).

Materials and Methods

This was a prospective study conducted in the department of orthopaedics of a medical college located in an urban area. The study consisted of 25 patients who were admitted to our institute with the diagnosis of primary osseous tumors around elbow. The study was approved by institutional ethical committee. The information like demographic profile (age sex and address), relevant history, clinical examination with a special emphasis on presence of swelling, pain and restricted movements of affected elbow were all noted. Investigations like Complete blood count, biochemical tests and Imaging studies (X-Ray in all patients and 3D CT and MRI in selected patients) were done. After appropriate preoperative evaluation patients underwent curettage and bone grafting or combined bone grafting and cementing (sandwich technique).

Appropriate post-operative care was taken in all the patients. The outcome was determined on the basis of quick-Disabilities of Arm, Shoulder and Hand (quick -DASH) and Mayo Elbow Performance Score (MEPS). Patients were

followed up at 3months, 6 months and 1 year. Those patients who didn't come for follow up at least for 1 year were excluded from the study. The results were studied using appropriate statistical methods. Data analysis was carried out using SPSS16.0 version software. Microsoft word and excel were used for generating charts and graphs.

Inclusion Criteria

1. All cases of primary benign osseous lesions around elbow.
2. Patient who were treated by either curettage and bone grafting or combined bone grafting and cementing (sandwich technique).
3. Patients who attended follow up OPDs at least for 1 year.

Exclusion Criteria

1. Patients having dysplastic elbow joints.
2. Patients who refused consent to be part of the study.
3. Patients who didn't come for follow up visits at least for 1 year.
4. Patients having inflammatory or autoimmune conditions like rheumatoid arthritis, seronegative arthropathy or any other significant co- morbid condition.

Results

Total 25 patients with primary osseous tumors were included in this study. Out of these 25 patients there were 16 males (64%) and 9 (36%) females with a M: F ratio of 1: 0.56.

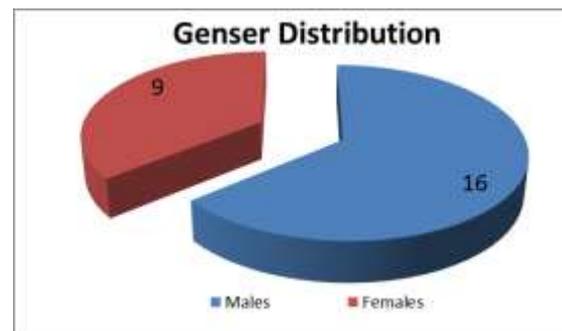


Fig 1: Gender Distribution of the studied cases.

Out of these studied cases majority of the patients had Giant cell tumor (80%) followed by chondroblastoma (12%) and simple bone cysts (8%). Out of 20 patients with GCT 13 were males and 7 were females while out of 3 patients with chondroblastoma 2 were males and 1 was female. Bone cyst was found in 1 male and 1 female each.

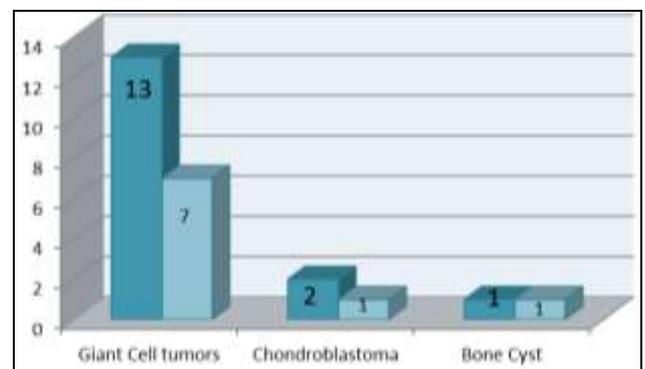


Fig 2: Type of Tumor in the studied cases

The analysis of the age groups of the patients revealed there were 18 (472%) patients in age group between 31 – 40 years, 4 (16%) patients in age group between 18 – 30 years and 3

(12%) patients in age group between 41 – 60 years. Mean age of the study group was 34.62 ± 4.12 years.

Table 1: Age distribution of the studied cases.

Age groups	No. of Patients	Percentage
18 - 30 years	4	16%
31- 40 years	18	72%
41 – 60 years	3	12%
Grand Total	25	100%
Mean Age \pm SD = was 34.62 ± 4.12 years.		

The lesions were seen around right elbow in 14 patients (56%) while the pathology was seen on left side in 11 patients (44%).

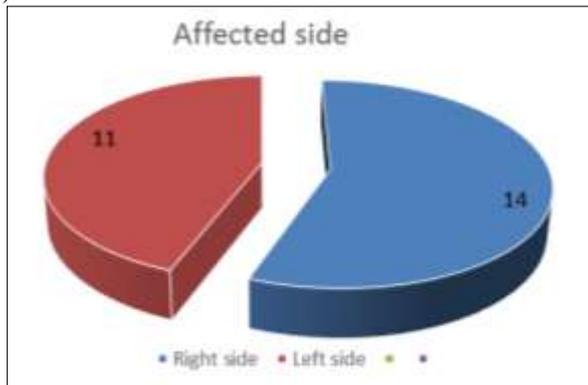


Fig 3: Affected side in the studied cases

Out of the studied patients 11 patients (44%) underwent curettage and bone grafting while in 14 (66%) patients combined bone grafting and cementing (sandwich technique) was done. The decision regarding the type of procedure was based upon subchondral bone thickness. If there was inadequate subchondral bone thickness then sandwich technique was utilized otherwise curettage and bone grafting was done. In sandwich technique after curettage bone graft was used to cover the defect. Gel foam and cement was used to restore anatomical shape of the defect. In 18 cases, fixation was not required, K wires were used in 4 cases, cannulated cancellous screws were used in two cases and plating was needed in 3 cases. Following the procedure the soft tissues, subcutaneous tissue and skin was closed in layers. Postoperatively plaster casts were applied for immobilization.

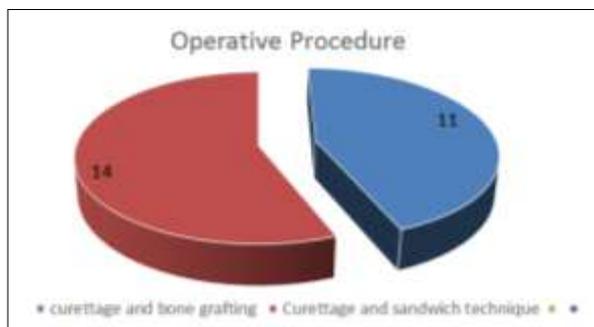


Fig 4: Operative Procedure in the studied cases

The analysis of the results obtained from curettage and bone grafting or combined bone grafting and cementing (sandwich technique) in studied cases showed that there was a significant difference in preoperative and postoperative Mayo Elbow Performance Score (MEPS). While in preoperative patients it was found to be 52 ± 12 after operative intervention MEPS score was found to be 84 ± 17 . The

difference in mean preoperative and postoperative MEPS score was statistically significant.

Table 2: Mean Pre and post-operative Mayo Elbow Performance Scores.

Mean Preoperative MEPS score	52 ± 12	P< 0.001. Statistically Significant
Mean Postoperative MEPS score	84 ± 17	

Based on the outcome of patients on the basis of MEPS scores it was found that 14 patients had excellent results (MEPS score more than 90) while 8 patients had good results (MEPS score between 75-89). Fair (MEPS score between 60-74) and poor (MEPS score less than 60) results were found in 2 and 1 patients respectively.

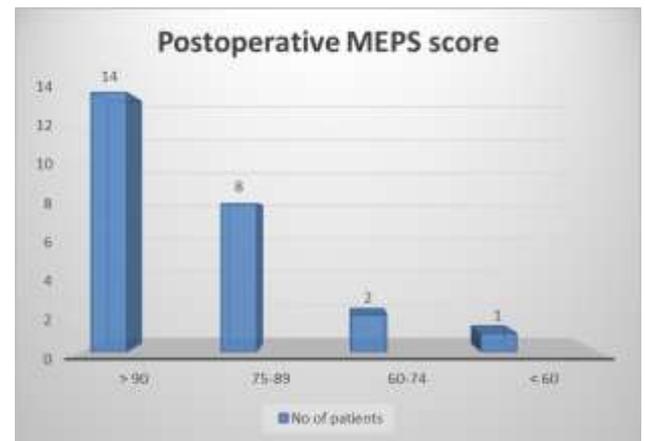


Fig 5: post-operative Mayo Elbow Performance Scores

Quick-DASH takes into account the factors like opening a jar, intensity of pain, tingling intensity, sleep quality, level of socialization, ability to wash back, forceful recreation, heavy chores, carrying a bag, using a knife and extent of limitation in routine work Mean Quick DASH score in operated cases was found to be 14 ± 6 .

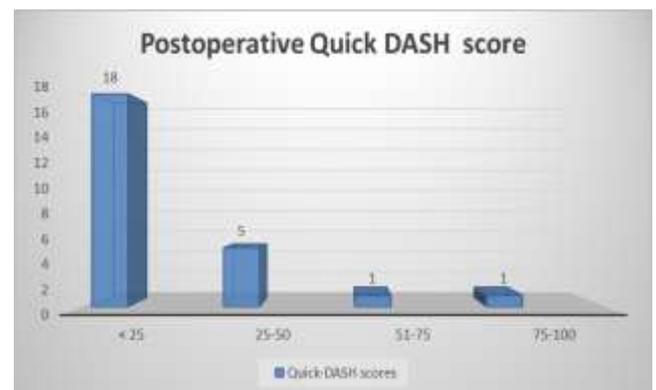


Fig 6: Mean post-operative Quick DASH scores

Analysis of the complications in the studied cases revealed that out of 25 operated cases there were 4 patients with postoperative complications. These complications included wound infection (4%), stiffness (4%), valgus deformity (4%) and nerve injury (4% patients). There were no patients who presented with recurrence or required a revision surgery during period of 1 year of follow up. During follow up of patients at 3 months, 6 months and 1 year there was no patient with evidence of recurrence and no patient required repeat

surgery



Fig 7: Complications in the studied cases

Discussion

This was a prospective cohort study comprising of 25 patients diagnosed to be having primary osseous tumors around elbow and who were treated by curettage and bone grafting or combined bone grafting and cementing (sandwich technique). Out of 25 studied cases 20 patients were diagnosed to be having giant cell tumor, 3 patients had chondroblastoma and 2 patients had simple bone cysts. In various studies conducted by various researchers common bone lesions around elbow were found to be aneurysmal bone cyst, simple bone cyst, giant cell tumor, fibrous dysplasia, chondroblastoma and osteoid osteoma. On the other hand common malignant lesions around elbow may consist of malignancies like osteosarcoma, chondrosarcoma, Non-Hodgkin's lymphoma and Ewing's sarcoma [11].

In our study most common benign tumor around elbow was found to be giant cell tumor followed by chondroblastoma and simple bone cyst. Though these are classified as benign tumors they are known for their aggressive behavior and local recurrences are common. He Y *et al.* in their prospective study of 48 patients with giant cell tumors found that cystic changes on imaging were more likely to be associated with recurrence of GCT [12]. In our study out of 20 patients with Giant cell tumors all patients were of more than 30 years of age. Though it is well known that giant cell tumors are benign osseous epiphyseal tumors usually seen after 30 years of age (After closure of epiphysis) there are case reports of giant cell tumors in pediatric age group [13]. These case reports emphasize the importance of keeping these tumors in the differential diagnosis of any Epiphysio-metaphyseal tumor in an age group including in children. In our study GCT were seen more commonly in males than in females (13:7). Male preponderance in GCT has been reported by many researchers including Fengsong Lin *et al.* and Karpik M *et al.* [14, 15].

Chondroblastoma is a benign epiphyseal tumor seen usually in young patients. Despite being benign chondroblastoma is notorious for bone destruction and recurrences. These tumors usually present with non specific symptoms like pain swelling and muscle atrophy. In our study M: F ratio for chondroblastoma was found to be 2:1. Though there was a male predominance the number of patients was too small to draw any inference. Various studies have shown chondroblastoma to be more common in males. In a study of 189 patients with chondroblastoma Xu H *et al.* found 145 males and 44 females with a M: F ratio of 1:0.3 similar male preponderance was reported by de Silva MV *et al.* [16, 17].

Simple bone cysts are other benign lesions which are usually seen in childhood (1st or 2nd decade) and are often asymptomatic but may present with complications like

pathological fracture. They are typically found in the upper end of humerus but may also be present around elbow. Gokce mik *et al.* in their study of 55 patients with simple bone cyst found the most common location to be proximal humerus (15/55) followed by distal humerus i.e. around shoulder (13/55). The other common sites reported by the authors were calcaneus (9/55) and proximal femur (7/55) [18].

Being benign tumors their treatment usually consist of curettage and bone grafting. The other options include combined bone grafting and cementing (sandwich technique) if there is inadequate subchondral bone thickness after curettage. Puthoor *et al.* in their study of 34 cases treated with curettage and bone grafting found satisfactory outcome in majority of the cases [19]. The outcome of cases treated by combined bone grafting and cementing (sandwich technique) was found to be excellent in majority of the patients. Similar findings were reported by Saiz P *et al.* in their study in which they found that use of cement after curettage was associated with decreased recurrence rates and excellent functional outcomes [20].

Conclusion: Primary benign intraosseous tumors like giant cell tumors, chondroblastoma and simple cysts can be effectively managed by curettage and bone grafting or combined bone grafting and cementing (sandwich technique). Both these techniques are associated with an excellent functional outcome and low risk of recurrence.

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