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Original Article

Active Hydroxyapatite Based Bone Substitute (OSTIM) with Autogenous Bone Grafting in Benign Cystic Lesion of Bone: An Experience of 30 Cases

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ABSTRACT

Background: Benign cystic lesionsof bone is very common and usually located in the proximal femur and proximal Tibia. The main indications for surgical treatment are lesions with impending or actual pathological fractures, or with aggressive or recurrent lesions. However, patients complaining of persistent pain, limping, or abnormal gait patterns are also considered for surgical treatment. In this study, we describe the outcomes of the surgical treatment of benign lytic lesions of bone by curettage followed by implantation of Ostim.

Methods: This retrospective study included 30 patients (14 females and16 males) with benign lytic lesions of bone. The average age was 17years (8-28years), and the mean follow-up period was 41months (33-52 months). The histopathological diagnoses were (Non-ossifying fibroma n=9, aneurysmal bone cyst n=15, fibrous cortical defect n=6). These patients underwent intralesional curettage and filling of cavity with active hydroxyapatite-based bone substitute (ostim) and autologous cancellous bone graft.

Results: The mean operative time was 143 min (80–245 min). Patients had regained normal unrestricted activity without pain at the operation site. Patients treated with Ostim achieved radiographic consolidation of the bone defects within 1 year after the surgery. No post-operative infection was observed.

Conclusion: We concluded that the treatment of benign cystic lesions of bone, using synthetic bone graft with autologous cancellous bone graft is a safe and satisfactory method and the addition of internal fixation should be carefully planned.

KEYWORDS: Benign Lytic Lesions, Ostim, Synthetic Bone Graft.

INTRODUCTION

Benign cystic lesions of bone include two broad groups - one which does not behave aggressively and the other which does. The first category includes simple bone cyst (SBC), aneurysmal bone cyst (ABC), fibrous dysplasia (FD), non-ossifying fibroma, brown's tumor of hyperparathyroidism, etc. The second category of locally aggressive lesions includes - giant cell tumor (GCT), chondromyxoid fibroma (CMF), chondroblastoma, osteoblastoma. Treatment of benign cystic lesions of bone by curettage and filling of void by autologous bone graft is considered as the gold standard Owing to its osteoconductive, osteoinductive and osteogenic potential.[1-6]

Autogenous bone graft is associated with donor site morbidity, prolongation of surgery, immunogenicity, disease transmission. Synthetic bone graft is devoid of such problems. However, these materials have osteoconductive properties primarily and none is ideal. Calcium based materials have been most commonly used as bone graft substitutes.[7,8]

Calcium hydroxyapatite (HA) has been shown in a number of series to be a useful biocompatible osteoconductive material, which provide scaffold for bone in growth. Calcium HA can be obtained from natural sources as well as from a synthetic process. Natural HA may be coral based, or of bovine origin.

Synthetic HA is formed by the precipitation of calcium nitrate and ammonium-dihydrogen phosphate with a chemical formula $Ca_{10}(PO_4)_6(OH)_2$.[9-14]

We conducted a study to evaluate the healing of cystic lesions with use of active hydroxyapatite-based bone substitute (ostim) mixed with autogenous cancellous bone graft as demonstrated by serial radiographs.

MATERIALS AND METHODS

30 consecutive patients with benign Cystic lesions of bone, managed by Intralesional Curettage and filling of cavity with active hydroxyapatite-based bone substitute (ostim) and autologous cancellous bone graft, between 2008 and 2014 were included in this prospective study. Inclusion criteria were benign cystic lesions of bone with or without pathological fractures.

The exclusion criteria were: (1) Active infection (2) Suspected or diagnosed malignant lesion (3) Traumatic bone loss (4) Very large tumor volume.

14 female and 16 male patients aged 8 to 28yrs (mean 17yrs) with benign cystic lesions in long bones (Non ossifying fibroma n=9, aneurysmal bone cyst n=15, fibrous cortical defect n=6) underwent intralesional curettage and filling of cavity with active hydroxyapatite-based bone substitute (ostim) and autologous cancellous bone graft. The patients were followed upto mean of 41 months (33-52 months).

Histopathological examination of curetted material was done routinely. It was done preoperatively in the form of fine needle aspiration cytology (FNAC)or needle core biopsy. To reach a definitive diagnosis, we subjected the curetted material for histopathology postoperatively.

Table 1: Patient Demographic and Clinical Details.

No **of patients**	**Sex/Age (Years)**	**Tumor**	**Location**	**Follow Up Period (Months)**	**Time to Consolidation (Weeks)**
n=2	M/8	ABC	Proximal Tibia	38	24
n=3	F/10	ABC	Proximal Humerus	33	16
n=4	M/11	FCD	Distal Tibia	36	12
n=3	M/19	NOF	Distal Tibia	42	12
n=5	M/28	ABC	Proximal Femur	48	20
n=3	M/14	ABC	Proximal Tibia	36	28
n=2	M/24	FCD	Distal Tibia	52	16
n=2	F/18	ABC	Proximal Tibia	32	18
n=3	M/13	NOF	Distal Tibia	40	24
n=3	F/16	NOF	Proximal Tibia	43	18
MEAN	17			41	18

ABC = Aneurysmal Bone Cyst, FCD = Fibrous Cortical Defect, NOF = Non-Ossifying Fibroma.

Table 2: Comparison of Grafts

GRAFT	**FAVOURABLE**	**UNFAVOURABLE**
1. Autogenous bone graft	Gold standard Bio compatible	Limited Donor site morbidity
2. Allograft	-	Fear of infection Failure
3. Artificial bone substitutes		
(a) Bone cement (methylmetacrylate)	Instant stability Thermonecrosis prevent recurrence.	Osteolysis Recurrence Arthroplasty?
(b) Hydroxyapatite (ostim)	No limitation Preserve physiological surroundings Rapid integration Rapid ingrowth Osteoconducive	Immature skeleton affects growth.

CASE 1: Pathological fracture of femoral neck with a large lytic lesion in neck and head of femur

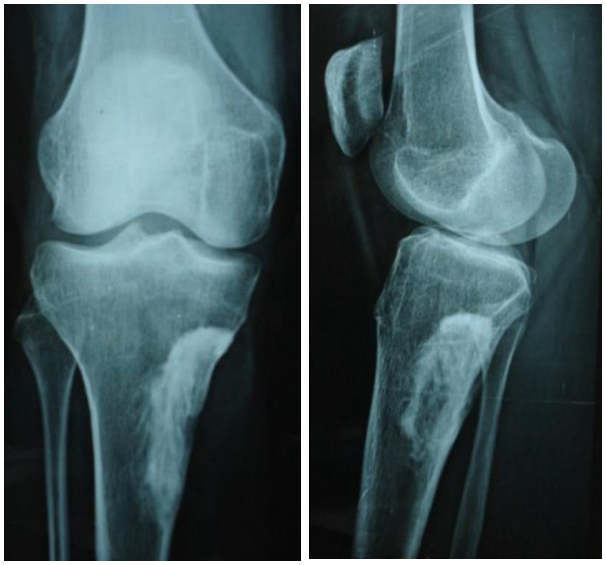
Pre-Operative X-Ray

3 months follow up

9 months Follow Up

CASE 2: A Male Child 12-Year-Old with Non-Ossifying Fibroma of Proximal Tibia.

Pre-Operative X-Ray



9 Weeks Post-Operative

RESULTS AND DISCUSSION

All the 30 patients displayed clinical and radiological consolidation at a mean of 4.6 months (range 3-7 months).

The use of available synthetic bone graft substitutes is rapidly increasing. HA has low density ultraporous structure with osteoconductive properties. The three-dimensional structure provides scaffolding for bone in-growth. The ultrastructure allows migration of osteoblasts, fibroblasts and osteoclasts along with unobstructed flow of nutrients and fluid.

Patients treated with HA grafting have bone formation period of 4–6 months. Smaller lesions like UBC of proximal humerus show signs of complete healing clinically and radiologically at 3 months while larger lesions like GCT of the proximal tibia show healing at 12 months. In the study of Yamamoto et al., mean period

for bone formation was 4.2 months.[15] In the study of Reddy and Swamy, bone formation was seen in all cases by 4–6 weeks.[16]

Reason for postoperative discharge may be inadequate filling of gap after curetting the cavity. The dead space thus formed may provide shelter to infection.

In our series, we did not find any adverse reaction to OSTIM such as excessive postoperative drainage, erythema, immunogenic reaction or other wound problems. Studies of Reddy and Swamy,[16] Natarajan et al.,[19] Yamamoto et al.[15] and Uchida et al.[8] supported the fact that there is no reaction to HA material.

No patient had restriction of movements. Saikia et al.[18] in their study found that all the patients attained a range of movement comparable to or better than the preoperative range. All the patients were able to bear weight without pain at 3 months follow-up. After 3–5 months, OSTIM graft showed an increase in density with indistinct margins. Our radiological results are comparable to other series.[15,16] All the pathological fractures in the vicinity of lytic lesions united in a maximum of 3-4 months postoperatively.

Though it is difficult to claim excellent results with less number of cases and short follow-up, the results of this study are comparable to previous studies. From our study, we have concluded that OSTIM along with Autogenous bone graft has excellent biocompatibility and provides right scaffolding for in-growth of bone forming tissue and thus ultimately gets well incorporated with the host bone.

CONCLUSION

Composite filling of benign cavities with this nanoparticulate hydroxyapatite (OSTIM) stimulates bone growth and provide a framework for osteogenesis.

These results with long term follow-up show that active hydroxyapatite mixed with autogenous cancellous bone graft offer a reasonable alternative for the treatment of bone cysts, and fibrous lesions of bone.

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