The use of bovine calcium-hydroxy-apatite in filling defects following curettage of benign bone tumours

M Natarajan, R Dhanapal, S Kumaravel, J Hussain, R Selvaraj, NR Uvaraj

Department of Orthopaedic Surgery, Govt. General Hospital,

The management of the defect following curettage of benign bone tumour is a problem to the orthopaedic surgeon. The usual practice of using autologous bone graft has problems like insufficiency, donor site morbidity, longer operation time etc. The search for ideal bone graft substitute is on. The present series is of 23 cases of benign bone lesions who underwent curettage and filling with calcium hydroxyapatite. GCT and its variants predominated the type of lesions. The age group was three to 62 year. There were three pathological fractures. The involved sites varied from proximal humerus, phalanges of hand, femoral head and neck, femoral condyles, proximal tibia, distal tibia, calcaneum. Three cases were lost to follow-up. One case died due to other causes. These patients were followed up for a period ranging from 24 to 50 months. The main difficulty was in assessing the incorporation of the hydroxyapatite crystals. We had three excellent, two fair and 13 good results.

Key-words : Benign bone lesions- curettage- filling- Calcium hydroxyapatite-osteoconduction.

Introduction

Curettage of bone lesions is a very common orthopaedic procedure and frequently large cavities result which need to be filled. The time honoured method of filling these cavities with autologous bone graft has the disadvantages of increased operating time, donor site morbidity, infection and limitation of the amount of graft harvested. Usage of allograft has problems with storage, preservation and disease transmission.

To overcome these disadvantages we have used bovine calcium hydroxyapatite as a bone substitute in filling large bone cavities after curettage of the lesions.

Materials and Methods

Between 1995 to 2001, twenty three patients with benign bone lesions were selected and included in this study. The age group ranged from three to 64 years. All patients had pain at the site of lesion and majority had swelling. The sites involved are given in table I. They underwent clinical, radiological examination and biopsy. The diagnosis is given in table II.

Table I.

Site	*No*
Proximal humerus	5
Shaft of humerus	3
Proximal phalanx	1
Proximal femur	4
Shaft of femur	1
Femoral condyle	5
Proximal tibia	1
Distal tibia	1
Calcaneum	1
Ischium	1

The sites of these lesions were approached according to the region. The volume of the cavity was assessed by insinuating sterile roller gauze into the cavity.

The calcium hydroxy apatite used was of bovine origin (commercially available G-bone®). The type of materials used were

1. Granules — piece size 0.1 to 0.4 cm
2. Blocks (small) — piece size 1 x 0.5 x 0.5 cm
3. Blocks (large) — piece size 2 x 2.5 x 0.5 cm

Mayilvahanan Natarajan, MS (Orth), M Ch Orth (L'Pool), Ph D (Orth Onco), Additional Professor
R Dhanapal, MS (Orth), D Orth, Additional Professor
S Kumaravel, D Orth, Postgraduate
Jaheer Hussain, Postgraduate
R Selvaraj, MS (Orth) D Orth, DNB, Assistant Professor
Nalli R Uvaraj, MS (Orth), D Orth, DNB, Assistant Professor
Department of Orthopaedic Surgery, Govt. General Hospital, Chennai – 600 003.
Mayilvahanan Natarajan, 4, Lakshmi Street, Kilpauk, Chennai – 600 010.

Table II. Distribution of cases

Diagnosis	*No*
Giant cell tumour	7
Solitary bone cyst	3
Fibrous dysplasia	3
Cystic lesion	1
Histiocytoma	1
Benign Angioma	1
Osteoid Osteoma	1
Plasmacytoma	1
Bone infarct	1
Reparative Granuloma	1
Aneurysmal bone cyst	1
Chondroblastoma	1

These three were mixed to make up the measured volume. Defects were packed completely with this mixture. Check x-rays were taken to confirm packing. A block is used to seal the cavity to prevent extravasation. In three cases preserved bone graft was added to this mixture.

Three cases with pathological fracture were fixed internally. Post operatively the limbs were immobilized depending on the size of the defect and usage of internal fixation in pathological fracture.

Results

Of the 23 cases, three were lost to follow up. One died due to other causes. The remaining 19 cases were followed up for a period of two years to five years (average 25 months). The results were analysed by clinical and radiological examination.

1.Clinical evaluation:

The wounds were checked at third, sixth and twelfth days for any ooze or reaction. All wounds healed by 12 days. There were no sinus or discharge from the wounds. There were no tissue reactions observed during the post-operative period.

In the further follow up ability to weight bear was tested. The ability to move the nearby joint is taken as a good result.

2.Radiological Evaluation:

Radiographs were taken at monthly intervals to look for

i. absence of radiolucency around the packed site and

ii. homogenous conglomeration of the hydroxy apatite granules.

The radiological stages were as follows:

Stage I: Obvious margins

Stage II: Hazy margins

Stage III: Obvious incorporation.[2]

There were three excellent, eleven good, three fair and two poor results. The complications were extravasation, recurrence of tumour and recurrence of symptoms.

Discussion

To fill defects in bone, bone grafts are usually obtained from another part of patients body or another human subject. The triad of osteoconduction include stability, viability and proximity.[1] Corolline porous ceramics are biocompatible and osteoconductive implants. They are effective as bone substitutes in large animal models and in humans. Bone and supporting soft tissue grow into it if the implant is placed in direct apposition to viable bone and interfaces are stabilised.[2]

Schaller et al studied clinical results using bovine hydroxy apatite implant fill small bony defects after excision of enchondromas in 12 patients.[3] Radiographic incorporation occurred with out any problem after six to eight weeks. Irwin et al retrospectively analysed 71 consecutive patients who underwent curettage for benign bone lesions. These defects were filled with calcium hydroxy apatite.[2]

We have used bovine calcium hydroxy apatite in 23 patients. In three cases formaline preserved graft was mixed with hydroxy apatite and used. One of these, developed unexplained pyrexia which subsided from third postoperative day. Whenever there was a pathological fracture it was fixed internally. The poor result was due to bone infarct in a patient who already has systemic lupus erythematosus and treatment with steroids.

The results depended on whether the tumour is static or aggressive, whether the bone substitute is stabilized, antigenic or whether the patient is very active so that he weight bears early, giving rise to poor result.

Irwin reported three major and nine minor complications[2]. We had two complications, one recurrence

of tumour and in another extravasation of implanted hydroxy apatite. We assessed these cases based on appearance of margins of the implant. Of the 23 cases, 13 showed haziness, three were Grade III, rest were of Grade I.

The radiological appearance did not correlate well with the clinical results of the patient e.g. a patient with subtrochanteric fracture with fibrous dysplasia had only grade II margin but a good result clinically. The ideal way of confirming incorporation is by histopathological evidence. But none of our patients consented for a biopsy and hence it could not be not done.

Bovine calcium hydroxy apatite alone or mixed with bone graft is a very good substitute for autologous bone graft especially when situation demands more graft. This can be used more often to reduce morbidity to patient and reduce post- operative pain.

References

1. **Shors EC.** Corolline bone graft substitutes. *Orthop Clin North Am* 1999; 3: 599- 614.
2. **Irwin RB et al.** Corolline - hydroxy appatite as bone substitute in orthopaedic oncology. *Am J Orthop* 2001; 30: 544-550.
3. **Schaller et al** "Hand chir - Micro Chir - plast -chir July 25;1993 (4)