An Assessment of Fate of CHA Blocks Used in the Cystic Lesions of Bone.

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ABSTRACT

Background: The calcium phosphate system and in particular hydroxyapatite (CHA), has been the subject of intensive investigation. Although coralline hydroxyapatite is not inherently as strong as trabecular bone and does not exhibit plastic properties owing to the absence of a collagen matrix, with subsequent growth of native bone, it has been shown to become stronger but less stiff than autogenous graft material. **Method:** Thirty six cases of cystic lesions of long bones were curretted and filled with CHA blocks with or without autogenous cancellous bone chips between 2013 to 2014 with follow up duration ranging from 12 to 24 months. Filling by CHA blocks, mixing with autogenous bone grafts was done in osteoclastoma and fibrous dysplasia cases, while only CHA block filling was done in solitary bone cyst, aneurysmal bone cyst and fibroma cases. In all the cases, the diagnosis was made on the basis of clinical, radiological and histopathological examination. Both with and without pathological fractures cystic lesions were taken. **Results:** In the present study, 11 cases had pathological fracture. In our series, maximum cases were of osteoclastoma. Most of the cases were associated with pathological fracture. The pathological fractures united from 20-30 weeks time, Radiologically, the density of CHA blocks increased with the lapse of time. In our series, the longest follow up period was about 24 months and the shortest was of 12 months duration. 20 patients had excellent results with full functional, anatomical restoration without any pain and radiograph shows no recurrence, with healing of pathological fracture. While 2 patients had poor results they were not able to do activities of daily living, had pain and delayed healing. **Conclusion:** The CHA has favourable clinical result because of less adverse effects, biocompatibility to the tissue of the body, ease of manufacture, production and shape adjustment. Therefore, it is strongly suggested as a useful bone substitute.In our limited experience with coralline hydroxyapatite bone graft substitutes, we have encountered no significant complications related to implant themselves.

Keywords: Calcium Hydroxyapatite, Tumours-Cystic lesions of bone (Osteoclastoma, Fibrous Dysplasia, Solitary bone cyst, Aneuysmal bone cyst, Fibroma).

INTRODUCTION

The calcium phosphate system and in particular hydroxyapatite (CHA), has been the subject of intensive investigation. It is from this system that vertebrate tooth and bone mineral are derived. The precipitation and dissolution of hydroxyapatite in aqueous media have been and continue to be studied in detail in order to gain insight into in vivo mineralisation processes.[1-3]

Two major types of Caroline implants have been extensively investigated, each derived from a different genus of reef building coral.[4] The scleractinian coral genus goniopora which possesses a micro structure resembling that of cancellous bone, has been converted to hydroxyapatite, chiefly for use as an alternative to autogenous grafting in the management of residual subchondral osseous defects following elevation of depressed articular fragments of epiphyseal-metaphyseal long bone fractures.[5-8]

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Although coralline hydroxyapatite is not inherently as strong as trabecular bone and does not exhibit plastic properties owing to the absence of a collagen matrix, with subsequent growth of native bone, it has been shown to become stronger but less stiff than autogenous graft material.[9]

Calcium hydroxyapatite ceramics are non-toxic substances that provoke little reaction from tissues and have many properties both chemical and physical that make them suitable alternatives to bone grafts.[3,4] The biological compatibility of calcium hydroxyapatite of bone and bone marrow has been adequately demonstrated. In recent years, therefore hydroxyapatite has become accepted as a suitable material for the repair and filling of bone defects.

MATERIALS AND METHODS

In the present series of 36 patients with cystic lesions of bone there were histologically proved 14 cases of osteoclastoma, 6 of aneurysmal bone cysts, 4 of fibrous dysplasia, 4 of fibroma and 8 of solitary bone cysts.

Out of 18 cases in the present series, 11 had pathological fractures of which 5 were of Osteoclastoma & 1 of Fibrous dysplasia, 2 each of aneurysmal bone cyst & solitary bone cyst and 1 of fibroma [Table 1 & 2].

Table 1: Distribution of cases according to pathological diagnosis.

Lesion	Age (yrs)	Total No of Cases	Pathological fracture
Osteoclastoma	19-38	14	5
Fibrous Dysplasia	11-17	4	1
Aneurysmal Bonecyst	11-26	6	2
Solitary Bone cyst	9-19	8	2
Fibroma	22-30	4	1
Total		36	11

Operative Procedure

Under General/Spinal anaesthesia, patient's position on the table was made depending on the site of tumour. An incision was given at the site of tumour. A window was made in the cortex of bone. The tumour was adequately currettaged. The calcium hydroxyapatite blocks were heaped up to fill the cavity. [Figure 1] The fitting of blocks was done pressly with the surrounding bone. The variable sized blocks were inserted into remaining small recess or defects. In Osteoclastoma & Fibrous Dysplasia, Calcium hydroxyapatite blocks were mixed with autogenous bone graft while in aneurysmal Bone cyst, Solitary bone cyst and Fibroma filling by only CHA blocks was done. The cortical window was again closed like a lid. The wound was sutured in layers after inserting a suction drain. Compression bandage was given and immobilisation was done as required.

Table 2: Site Of Lesion.

Lesion	Autogenous Bone graft	Humerus (UE)	Femur (UE)	Femur (LE)	Tibia (UE)	Ankle	Total
Osteoclastoma	+	2	-	6	6	-	14
Fibrous Dysplasia	+	-	2	-	2	-	4
Aneurysmal Bone Cyst	-	3	-	-	-	3	6
Solitary Bone Cyst	-	4	2	2	-	-	8
Fibroma	-	-	-	-	2	2	4
Total		9	4	8	10	5	36

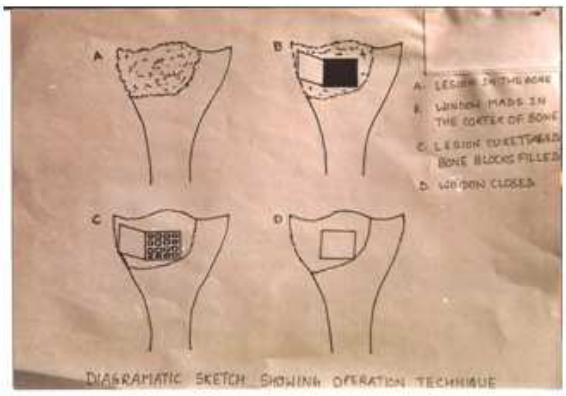

Figure 1: .???

Observations

In our series, maximum cases were of osteoclastoma. Most of the cases were associated with pathological fracture. The pathological fractures united from 20-30 weeks time, radiologically, the density of CHA blocks increased with the lapse of time. In our series, the longest follow up period was about 24 months and the shortest was of 12 months duration.

RESULTS

Grading of result:

It is done according to functional, Anatomical and Radiological Criteria. The results are shown in [Table 3]

Table 3: Result

Lesion	Total No of cases	Excellent	Good	Fair	Poor
Osteoclastoma	14	8	4	1	1
Fibrous Dysplasia	4	-	2	1	1
Aneurysmal Bonecyst	6	4	2	-	-
Solitary bone cyst	8	4	4	-	-
Fibroma	4	4	-	-	-
Total	36	20	12	2	2

Excellent :
Fully functional, anatomical restoration without any pain and radiograph shows no recurrence, with healing of pathological fracture.

Good:
Mild and intermittent discomfort during weather change. Strength & endurance of joints are normal. <10° restriction of Joint motion. Radiograph suggestive of increased density of CHA blocks.

Fair:
Moderate intermittent discomfort which does not limit activity of daily living (ADL). Restriction of joint motion to <25°. Radiograph suggestive of delayed healing.

Poor:
Includes any finding outside the acceptable limits listed for a grade of fair.

No complications such as anaphylactic reaction to CHA ceramics & excessive post operative drainage was observed. In one case superficial infection was noted which subsided uneventfully. Our results were comparable to a series of **Sartoris et al 1986, Bucholz cotton and Holman 1987, Uchida A 1984**.

DISCUSSION

The CHA has favourable clinical result because of less adverse effects, biocompatibility to the tissue of the body, ease of manufacture, production and shape adjustment. Therefore, it is strongly suggested as a useful bone substitute.

Case 1: 36 year Female with Osteoclastoma Left Lower End Femur with Pathological fracture. Xray:- A. Preoperative, B. Postoperative, C. After 18 Months .Clinical & Functional result after 1 year

Radiographic observation after implantation show evidence of abundant bone formation around CHA with incorporation into host bone. These radiographic results are generally consistent with those from other studies in fractures.[10-14]

Because no quantitative measurements are available for the evaluation of bone in growth into porous mineral it is impossible to compare exactly the in growth rates with that of other bone substitutes.[15-18]

To get good mechanical results, technical skill in tightly filling the defects is important for optimal bone in growth. In our series, all the pathological fractures healed and no re-fracture was seen in a follow up of two years. Post-operative radiographs may suggest that CHA-implanted bone has sufficient mechanical strength because of dense radiographic image of CHA early after operation. These findings should not misguide us, to let the patients mobilise early, so post-operative immobilization is important. Particularly after curettaging lesion of the femur and tibia and in cases associated with pathological fractures.[19,20]

Case 2: 20 year female with Fibrous Dysplasia Left Proximal Femur with pathological fracture: Xray:- A. Preoperative, B. Postoperative, C. After 1 Year. Clinical picture at 4 and 9 months follow up

Judging from radiological findings the biodegradation of CHA is likely to be very slight even after our follow up of 24 months.

The currently available types of porous CHA lack substantial mechanical integrity because of their

brittle nature, which make them mechanically unsuitable for unstable segmental diaphyseal defects.[21,22] However, where surrounding bone is intact or rigidly stabilised to shield the ceramic from loading during bone in growth a block of porous CHA can provide better support than standard cancellous bone within months, the composite of CHA and newly formed bone should have sufficient mechanical strength.[23-26]

Case 3: 45 year Female with Osteoclastoma Upper End Humerus (Right) with pathological Fracture. Xray:- A. Preoperative, B. Postoperative, C. After 1 year. Clinical & functional outcome after 1 year.

In our limited experience with coralline hydroxyapatite bone graft substitutes, we have encountered no significant complications related to implant themselves. The observed slight loss of definition involving the intrinsic architecture and margins of the implants on follow up radiographs is presumably related to bone in growth and osteoclastic activity associated with normal incorporation, with the latter confined to the exposed surface of the material. This phenomenon should not be misinterpreted as graft infection, although the latter might be expected to produce similar findings. In our experience to date in no case the infection has occurred. Only in one case superficial infection was observed, which subsided uneventfully.

Functionally, at the end of follow up out of all the 9 cases involving the area around shoulder 6 cases had full abduction range, 2 cases had abduction of 130°. In one case abduction was of 90°. In 8 cases of shoulder and upper arm lesion the internal and external rotation of the shoulder was nearly normal at the end of follow up. But, in one case of osteoclastoma upper end of humerus associated with pathological fracture the rotation movement was only 35° at the end of follow up (after 22 weeks of operation). This patient was well satisfied with this range of motion at the shoulder as she returned to her previous house work without any problem. At the elbow, all movements were normal. Calcium hydroxyl apatite is thus a suitable alternative to bone graft.

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