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BONE CEMENT IN THE MANAGEMENT OF CYSTIC TUMOUR DEFECTS OF BONE AT NATIONAL ORTHOPAEDIC HOSPITAL, IGBOBI, LAGOS

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ABSTRACT

Background: Cystic bony defects are characteristics of bone tumours especially benign ones e.g. Giant cell tumours of bone [GCT] and some metastatic tumours to bone. These patients present late with significant cystic cavities at a time the cost and availability of prosthetic implants to replace these defects sometimes precludes resection.
The objective of this study is to evaluate the outcome of filling these defects with bone cement augmented with plate and screw for stability.

Method: A seven year prospective study was carried out in patients presenting with large cystic bony defects secondary to bone tumours at the oncology unit of the National Orthopaedic Hospital, Igbobi, Lagos. Data such as age, sex, anatomic location of lesions, histological type of tumours, x- ray findings, operation performed with the number of packets of bone cement used to fill the resultant bony defects were retrieved from prepared proforma. The average follow-up was 36 months.

Result: The proximal tibia and distal femur accounted for 42.9% and 28.6% respectively of the 14 patients studied. Giant cell tumour was the most common histological diagnosis 78.6%]. Bone cement was effective in meeting the local requirements of limb salvage, early functional recovery and as a temporising measure until the patients can avail themselves of better options. The complication encountered was that of anaphylactic reaction in 2 scrub nurses.

Conclusion: Bone cement augmented with appropriate implants has proven valuable as a stop gap in filling large cystic bony defects resulting from tumours.

Key Words: Cystic bony defects, bone cement, implant, limb salvage. (Accepted 22 October 2009)

INTRODUCTION

Significant bone defects not amenable to the use of autogenous bone grafts, which are in short supply, would continue to plague tumour surgeries so long as the emphasis is on the limb salvage[1] procedures. About 85% of patients with tumours are now offered limb salvage. The need for tumour free margin creates such defects that one form of augmentation or the other or even composites are required. Bridging diaphyseal defect and filling metaphyseal defects can be achieved by any of the following methods: cementation, distraction osteogenesis, insertion of hydroxyapatite, allografting or endoprosthetic replacement[2]. The use of bone cement either alone or supported with internal fixation to buttress the bone continues to be one popular method in literatures and it is known to give a better early mechanical property than bone grafts[3]. This prospective study looked at our experience with bone cement, which is the only substitute for autogenous grafts available to us for such largedefects at National Orthopaedic Hospital, Igbobi, Lagos.

METHODOLOGY

A seven year prospective study was conducted at the National Orthopaedic Hospital Igbobi, Lagos. Data were retrieved from prepared proforma filled in the All patients were seen and examined on presentation by the leading author, investigations such as plain radiographs of the chest, the involved bone, as well as a fine needle aspiration cytology were performed. Computerised tomographic scans were ordered for all the 14 cases, but only 2 patients could afford it.All lesions were expansile And cystic. All patients had defects on x-rays that were considered too large to be filled with cancellous bone grafts [fig.1]. The bone cement used was the high viscosity methylmetacrylate cement available to us. This was hand-mixed according to the manufacturers instructions. The campanachi grading system was used for all cystic bony lesions. Histological diagnosis was obtained post-operatively in all patients.Patients were given adjuvant chemoradiotherapy depending on the campanachi grading and findings at surgery. Information including age, gender, mode of presentation, anatomic location, histology, treatment and outcome of treatment were obtained and data analysed.

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RESULT

Fourteen patients were studied. The age range of patients was from 10 -85 years, male to female ratio 1.8: 1[Table 1].
Giant cell tumour was the most common histological diagnosis [78.6%][Table I]. The proximal tibia was the most common location [42.9%], distal femur [28.6%], proximal humerus, femoral neck and femoral shaft were 7.1% each [Table 2]. 57.1% of the patients presented in Campanachi grade 11 and 42.9% in grade 111[Table 3].
All patients in Campanachi grade 111 had adjuvant therapy.
A recurrence rate of
35.7% was recorded. Mortality was 14%- seen in 2 patients with recurrence of malignant GCT.
The number of 25gm packets of methyl-metacrylate cement used to fill the bone defects ranged from 4 to 15 packets depending on the size of defect [Average 6.6][Table 1].
The average follow-up period was 36.4 months.

Table 1: **Showing Location, Age/ Sex Distribution, Histological Diagnosis Method of Treatment, Campanachi Grading, No. of Bone Cement Used to Fill Curetted Cavities (Size of Defects and Duration of Follow Up.**

No	Location	Sex / Age	Histological	Method of treatment	Campandic Grading	No. of packet of B. Cement	Fellow up	Recurrence
1.	Proximal Rt. Tibia	M / 28yrs.	GCT	Currettage + Cement+ Condylar plate	II	5	6yrs	-
2.	Proximal Rt. Tibia	F / 21yrs.	Malignant GCT	Currettage + Cement+ Condylar plate	II	6	5	3yrs.
3.	Proximal Rt. Tibia	M / 29yrs.	GCT	Currettage+Ceent+Condylar plate	III	8	1yr.	Died from Recur
4.	Lt. Femoral Neck	F / 85yrs.	Metastasis from Ca Breast	Excision of Head and Neck+Currettage+Cement+prosthesis	II	4	6 /12	Died
5.	Proximal Rt. Tibia	M / 26yrs.	GCT	Currettage + Cement+ Condylar plating	II	5	6yrs.	-
6.	Femoral Diaphyses	M / 29yrs.	Non Ossifying Fibroma	Currettage+Bone Cement only	II	5	3yrs.	-
7.	Rt. Humeral 1/3 diaphyse metaphyseal	M / 10yrs.	Simple Bone Cyst	Currettage + Cement + Contoured Semi tubular plate	II	4	2yrs.	-
8.	Proximal Rt. Tibia	M / 32yrs.	GCT	Currettage + Cement+ Condylar plate	II	5	1yrs.	-
9.	Distal Lt. Femur	F / 26yrs.	GCT	Currettage + Cement+ Condylar plating + Radiotherapy	III	7	4yrs.	3yrs.
10.	Middle / distal third Lt. Femur	M / 29yrs.	Malignant GCT	Currettage + Condylar plate + Bone Cement and Radiotherapy + Chemotherapy	III	15	$2^{1/2}$	2yrs.
11.	Proximal Rt. Tibia	M / 33yrs.	GCT	Currettage + Bone Cement + Bone Cement + Radiotherapy	III	8	3yrs.	-
12.	Distal Rt. Femur	F / 30yrs.	GCT	Currettage + Condylar plate + Bone Cement	III	9	4yrs.	-
13.	Distal Lt. Femur	F / 27yrs.	GCT	Currettage + Condylar plate + Bone Cement	III	7	3yrs.	-
14.	Distal Rt. Femur	M / 29yrs.	GCT	Currettage + Condylar plate + Bone Cement	II	5	$1^{1/2yrs.}$	-

Table 2: **Showing Location of Tumour.**

Location of Tumour	No of patients	Percentage
Femoral neck	1	7.1%
Distal Femur	4	28.6%
Femoral Diaphyses	1	7.1%
Proximal Humerus	1	7.1%
Middle/distal third Femur	1	7.1%
Proximal Tibia	6	42.9%
Grand Total	**14**	**100.0%**

Table 3: **Showing Grading of Tumours.**

Campanachi Grading	No of patients	Percentage
Campanachi 11	8	57.1%
Campanachi 111	6	42.9%
Grand Total	**14**	**100.0%**

Figure 1: **Proximal Giant Cell Tumour of the Tibia.**

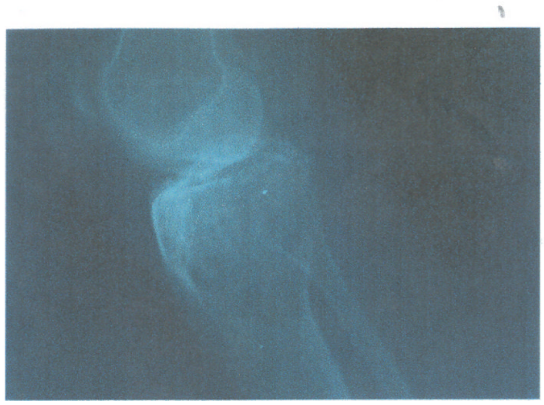
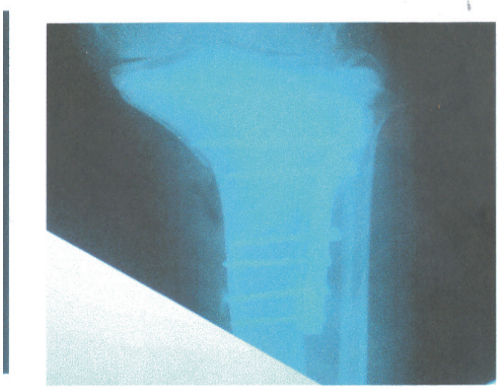


Figure 2: **Cystic Defect Filled with Bone Cement and Buttressed with a Condylar Plate.**



DISCUSSION

Fourteen cases on the whole with significant cystic bony defects were recorded within the 7 year period. The proximal tiba accounted for 42.9% and because limb salvage for proximal tibia using allografts and prosthesis s fraught with complication[4,5], the option of intralesional curettage, bone cement and implant buttressing was adopted not just for better functional outcome but because this was the only option available to us. Hence the review of the effectiveness of bone cement in meeting our local requirement, space filling, load transferring and its ability in withstanding considerable compression. These properties tended to suit our environment, where we need to preserve limbs even as other options for limb salvage are unavailable. Lack of donor site morbidity, unlimited supply, immediate structural stability, low cost and ease of use add to its advantageous properties[6].

In all cases, the high viscosity methylmetacrylate cement was used. This is not by design but is the type in common supply to us and it has been observed by studies that the clinical performance of different bone cements is affected by a number of material and mechanical variables[7]. To date the clinical performance of the one available to us has been good. Biocompatible bioactive cement with high compressive and tensile strengths, which will provide long-lasting fixation of implants to bone under

weight-bearing condition and whose cement bone interface is satisfactory with gradual incorporation of material into lamella bone structure are being developed[8,9].Emphasis on success of use is in the area of handling techniques of the cement. In the absence of centrifuge and vacuum, we used hand-mixing techniques and manual packing of defects. Fatigue has been reported to be likely mode of mechanical failure of cement mantle apart from the progressive, circumferential interface osteolysis[10].

The mantle must be uninterrupted, and adequate, and primary defects due to entrapment of air during mixing; monomer evaporation and others must be avoided. Centrifugation, vacuum mixing, mechanical mixing and pressuring the cement into defects are measures to avoid such voids, which cause stress risers[11, 12]. To obtain adequate mantle we used between 4 to 15 packets of cement as required to fill the defects. Buttressing was a cardinal component of our procedure, which acted as load bearing reinforcements to the cement mantle and provided a smooth axial mechanical transition along the cement bone interface. This prevented the micro motions in this interface and enabled early functional recovery. Implants, which served these purposes, were used and of the 14 cases, 95 condylar plated were used in 5 proximal tibia tumours as against routine buttress plates. [fig.2]

Functional outcome has been very satisfactory from our objective of temporizing with cement until they can avail themselves of better options abroad. The 85 year old with metastatic lesion to the femoral neck was mobilized on a walker 2 weeks after surgery. The other 12[twelve] with lower extremity lesions were mobilised non-weight bearing on axillary crutches in a protective cast 2 weeks post -operatively and graduated to full weight bearing 12 weeks post-operatively. The shoulder lesion was in protective cast for 6[six] weeks. Apart from the 85 year old patient who was lost to follow up after 6 weeks, the others are still being followed up.

Though the anaesthetic monitoring was the non-invasive haemodynamic monitoring which do not pick the reduction in cardiac output and stroke volume during cementation[13], hypotension of such a magnitude that would require resuscitation was not recorded in any of the patients rather, anaphylactic reactions to the cement was observed in 2 scrub nurses.

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