A STUDY OF EFFICACY OF HETEROGENEOUS BONE GRAFTS (SURGIBONE) IN ORTHOPAEDIC SURGERY

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ABSTRACT

30 patients were operated upon using Surgibone (Bovine Xenograft) for purpose of providing osteogenic stimulation and mechanical support. Good to excellent results were obtained in 93% of cases highlighting the efficacy of this bone graft. Its use can hence circumvent the associated morbidity of bone graft harvest and yet perform as effectively as autologous bone graft. Its high cost, however, restricts its use to specialised centres and institutional practice.

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KEY WORDS: Osteoinduction; Surgibone; Xenograft.

Introduction

A bone graft is defined as any implanted material that promotes a bone healing response by providing osteogenic, osteoconductive and osteoinductive activity to a local site [1]. It is well known that autologous cancellous bone graft is close to the ideal bone graft owing to its superior osteoinductive capacity, lack of disease transmission or problems of immune rejection [2,3]. However, the procedure of harvesting and applying the graft induces additional morbidity in the form of increased operation time, increased blood loss and possible donor site morbidity [4]. Use of xenograft which is available pre-packaged in various shapes and sizes would possibly avoid these complications. This study has been undertaken to study the efficacy of xenograft (Surgibone) in inducing skeletal repair in various clinical applications.

Material and Methods

This study was carried out on 30 patients requiring bone grafting in the Kirkee-Pune complex during the period 1995-1997. Surgibone, which is a bovine bone manufactured by Unilab, Mississauga, Ontario, Canada was used in the study. This is a xenograft obtained from freshly sacrificed calves which is partially deproteinized and processed by the manufacturers. It is available in various shapes like tapered pins, blocks, cubes, granules, circular discs and pegs. The shape appropriate for the clinical situation was chosen. The site at which the graft was to be applied was exposed according to basic standard surgical principles. The graft was used in situations like delayed union, non union, acute fractures with comminution, acute fractures with bone loss and filling of bone cavities. Standard post operative care as appropriate for the type of surgery performed was given.

The patients were followed up regularly at periodical intervals

of 3,6,9,12,15 and 24 months. The patients were evaluated clinically and radiologically and graded as below:

Excellent -	Good radiologic union with complete graft incorporation, complete functional recovery.
Good -	Radiologic union with partial graft incorporation. Does not require orthotic protection.
Fair -	Poor graft incorporation with need for orthotic protection.
Poor -	Marked fragmentation of the graft, no radiologic incorporation. Functionally no improvement over preoperative conditions.

Results

A total of 30 cases were operated of which 24(80%) were males and 6 (20%) were females. All patients were between the ages of 3 to 55 years with maximum number 12 (40%) in the age group 36-45 years (Table 1).

TABLE 1
Age Distribution

Age group (yrs)	No. of cases
0-5	1
6-10	0
11-15	0
16-20	2
21-25	1
26-30	7
31-35	2
36-40	8
41-45	4
46-50	1
51-55	4
56-60	0

The distribution of anatomical site in which the graft was placed is as shown in Table 2.

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TABLE 2
Distribution of sites

Site	No. of cases
Humerus	6
Ulna	2
Femur	8
Tibia	11
Proximal phalanx of hand	1
Lumbar spine	2
Total	30

Tibia was the most common site grafted (37%). The types of cases in which xenograft was used is as shown in Table 3. Nonunions was the most common indication (36.67%) of grafting. 6% of the grafts were used to achieve spinal fusion and 10% were used as an interference graft in tibial and femoral tunnels during ACL reconstruction.

TABLE 3
Distribution of cases

Pathology	Bone involved	No. of cases
Tibial plateau fracture	Tibia	5
Gap non union	Femur	5
	Humerus	6
	Tibia	3
Comminution of fractured fragment	Tibia	2
	Femur	1
	Ulna	2
ACL reconstruction	Peg graft used in tibia and femur (in 2 cases peg graft applied from femoral site and in 1 case from tibial site)	3
Cystic lesion	Proximal phalanx of middle finger	1
Arthrodesis	Spinal fusion	2

The duration of follow up of 30 cases is as shown in Table 4. 24 cases (79%) were followed up for periods between 48-72 weeks. The results as graded at 42-72 weeks are shown in Table 5.

TABLE 4
Duration of follow up

No. of weeks	No. of cases	Percentage
12 weeks	1	3.33
24 weeks	2	6.66
36 weeks	4	10.00
48 weeks	12	40.00
60 weeks	8	2.67
72 weeks	4	13.33
Total	30	99.99 (100)

Excellent to good results were obtained in 28 of 30 cases (93%).

The type and incidence of complications encountered in this series is as shown in Table 6. The rate of infection post operatively noted was 4.16%. There was no case of immune rejection of the graft.

Discussion

Four principal functions of a bone graft are to pro-

TABLE 5
Results

Results	No. of cases
Excellent	12
Good	10
Fair	1
Poor	1
Total	24

TABLE 6
Complications

Type of complications	No. of cases	Percentage
Immune reaction	-	-
Post operative infection	1	4.16
Implant failure	-	-
Delayed graft	3	12.5
Neurapraxia	1	4.16
Total	5	20.82

mote osteogenesis, to provide union between two fragments of bone, to restore the contour, provide a framework which has structural integrity [5]. Though autogenous bone performs these functions satisfactorily, problems of limited supply, prolonged operation time and donor site morbidity has prompted research into bone from animal origin. Bovine xenografts were being increasingly studied abroad [6] though non availability of such xenografts precluded such studies in our service setup. Such grafts were made available in 1995 and this study has followed up 30 cases over a period of 2 years. The duration of follow up in this study is comparable to previously published reports by Salama and co-workers [7]. Previous workers have used xenograft in combination with autologous bone or as a composite graft with autologous bone marrow [8]. In our study we have used xenograft as the primary graft material with excellent results (Fig 1).

In tibial plateau fractures we found the xenograft particularly effective in maintaining reduction, allowing early mobilisation and partial weight bearing at six to eight weeks. Probably, the slow incorporation of xenograft can be considered as an advantage since it allows the relatively soft newly formed bone to mature safely with no danger of collapse (Fig-2).

Another major advantage of this type of graft was seen in situations of fracture with bone loss. Even upto 8 cm bone loss of tibia was satisfactorily managed with onlay xenograft supplemented by external fixation (Fig-3).

Xenograft is also very useful in spinal fusions. Excellent graft incorporation and complete fusion at 20 weeks post op were seen in the 2 cases which were

Fig. 1 : Surgibone cortical slab and granules as primary grafting material in tibial fracture

Fig. 2 : Tibial plateau fracture managed by internal fixation and surgibone grafting

operated. The poor result in this series was a case of compound fracture of the tibia in which ORIF with DCP and grafting with xenograft granules were done. Post op infection could be attributed to the fact that the injury was a compound one.

Fig. 3 : Acute bone loss of tibia with internally fixed surgibone plates and external fixation

In our study, we found no case of immune rejection. This was probably because of the fact that the graft is partially deproteinized and that humans are already exposed to bovine proteins since childhood. However, more sensitive criteria for subclinical immune reaction like lymphocytotoxic antibodies and bovine protein antibody assay would be required to ascertain complete non-immunogenic nature of surgibone.

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