



To study the use of allografts with or without vancomycin impregnation in bone reconstructive surgery

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ABSTRACT

Background: To study the use of allograft with or without vancomycin impregnation in bone reconstruction surgery.

Materials & methods: In the study, 30 patients were enrolled out of which 22 were female and 8 were male. They were divided into two equal groups (control and study groups) comprising 15 in each group. In the study group, the bone allograft was impregnated with vancomycin while in the control group the bone allograft was not impregnated with vancomycin. Data were collected and results were analyzed using SPSS software. The P value of less than 0.05 was taken as statistically significant.

Results: A total of 30 subjects were enrolled and they were divided into 3 broad categories. The first category had 18 patients comprised of fractures with comminution and bone loss, delayed or non-unions and difficult to heal fractures. In the second category there were 8 patients with benign osteolytic lesions (3 patients each of SBC and GCT and 2 patients of ABC). The third category of patients were of miscellaneous indications with only 4 patients. The overall success rate in terms of adequate osteointegration in this study was 83.33 % , with 12 cases (80%) out of 15 in study group and 13 cases (86.7%) out of 15 achieving adequate osteointegration and there was no significant difference (p value=1) between the two groups.

Conclusion: It was concluded that the bone allograft which was impregnated with vancomycin was able to osseointegrate adequately without any systemic or local complications.

Keywords: Allogenic Bone graft, Vancomycin, Osteore constructive surgery, Infections, Bone Defects.

Introduction

Current orthopaedics practice is showing an increasing trend toward surgical management of fractures and reconstructive surgery for chronic and degenerative disorders in younger age patients. A major issue in bone reconstructive surgery is the depletion or insufficiency of bone stock during initial

and follow-up revision procedures. Allograft has become more popular due to the limited availability of autologous bone grafts and the high cost, lack of biodegradability, and lack of osteointegration associated with synthetic bone graft materials. Allogenic bone graft is currently being used in the surgical treatment of comminuted fractures with

severe bone loss, non-union or delayed union of fractures, primary and revision joint replacement surgeries, improving fusion techniques in spine and in tumour resection surgeries for filling the bone defect and bone healing [1,2]. The efficacy of autologous bone grafts, wherever required, is well proven due to their osteoinductive and osteoconductive properties and there is no transmission risk of life threatening communicable disease or infection [3,4]. But still use of autografts results in significant donor site morbidity and loss of function [5,6]

Allogenic bone graft carries an inherent risk of microbial contamination by bacterial adhesion and thus surgeries which require use of allogenic bone graft carry a high risk of surgical site infection [7]. Staphylococci and other pathogens in their sessile forms known as small colony variants (SCV) may form biofilms over bone allografts and survive and replicate intracellularly, in the osteoblasts, endothelial cells, leukocytes, and macrophages. These SCVs are difficult to be diagnosed by traditional culture techniques and unlike free floating planktonic forms of bacteria are less easily eradicated by conventional antimicrobial therapy [8].

Bone replacement grafts impregnated with antibiotics are often used as a therapeutic measure to manage osteoarticular infections, though its prophylactic value cannot be undervalued. Hence, the study is conducted to evaluate the use of allografts with or without vancomycin impregnation in bone reconstructive surgery.

Materials & methods

In the study, 30 patients were enrolled out of which 22 were female and 8 were male. They were divided into two equal groups

(control and study groups) comprising 15 in each group. In the study group, the bone allograft was impregnated with vancomycin while in the control group the bone allograft was not impregnated with vancomycin. Patients of age group 14 to 80 years were included in the study. Out of 30 patients, 18 patients undergone allogenic bone grafting for augmenting fracture healing, 8 subjects were of benign osteolytic lesion (3 cases each of Simple Bone Cyst and Giant cell tumour and 2 cases of Aneurysmal Bone cyst), 3 patients required use of allogenic bone graft for augmenting posterior lumbar fusion, while 1 patient had acetabular reconstruction aided by the use of allogenic bone graft. Follow up was done. Data was collected and results were analysed using SPSS software. P value of less than 0.05 was considered statistically significant.

Results

A total of 30 subjects were enrolled and they were divided into 3 broad categories. The first category had 18 patients comprised of fractures with comminution and bone loss, delayed or non-unions and difficult to heal fractures. In the second category there were 8 patients with benign osteolytic lesions (3 patients each of SBC and GCT and 2 patients of ABC). The third category of patients were of miscellaneous indications with only 4 patients. The study group had 9 patients with fractures, 5 patients with benign osteolytic lesions, and 1 patient of miscellaneous indication while the control group had 9 patients with fractures, 3 patients with benign lytic lesions, and 3 patients with miscellaneous indication. This distribution of various categories among the study and the control group also

came out to be comparable with p-value of 0.472.

Table 1: distribution of patients in study and control group based on indication of allograft use

Diagnosis	Study group		Control group		P value
	Frequency	Vancomycin impregnation	Frequency	Non Vancomycin impregnation	
Lytic	5	33.3%	3	20.0%	0.472
Fracture	9	60.0%	9	60.0%	
Miscellaneous	1	6.7%	3	20.0%	
Total	15	100%	15	100%	

A single patient with Aneurysmal bone cyst who was part of the control group and who did not have allogenic bone grafts impregnated with vancomycin developed surgical site infection with serous discharge (observed at the first dressing on the fifth day), which on culture revealed growth of *Pseudomonas aeruginosa*. This patient was one of a total of 30 patients who received allogenic bone grafts. Thus, a 3.3% overall infection rate (one patient out of thirty) was discovered. In contrast to

the control group, which had an infection rate of 6.7% (1 out of 15 cases), no patients in the study group experienced infection (0%). The culture report revealed growth of *Pseudomonas aeruginosa* and based on the sensitivity report the patient was immediately put on intravenous antibiotics with which the infection resolved. The difference in the infection rate between the study and the control group was not statistically significant with a p-value of 1.000.

Table 2: Comparison of infection rate among study and the control group

Infection	Vancomycin impregnation (study group)		Non vancomycin impregnation (control group)		p- value
	Frequency	Vancomycin impregnation	Frequency	Non vancomycin impregnation	
Positive	0	0%	1	6.7%	1.000
Negative	15	100%	14	93.3%	
Total	15	100%	15	100%	

The study witnessed overall success rate of 83.33% of adequately osseointegrated fracture and defect sites with 12 cases (80%) out of 15 in study group and 13

cases (86.7%) out of 15 and there was no significant difference (p value=1) between the two groups.

Table3 : success rate of osteointegration in study and control group

Osteointegration	Study group		Control group		p value
	Frequency	Vancomycin impregnation	Frequency	Non Vancomycin impregnation	
Adequate	12	80.0%	13	86.7%	1.000
Failure	3	20.0%	2	13.3%	
Total	15	100%	15	100%	

Discussion

Allografts are inherently susceptible to infection as the graft material can serve as foreign body not protected by the cellular defense mechanisms [9]. Infection rates ranging from 4-12 % have been reported by different workers (Lord et al [10] 1988, Haddad et al. [11] 2000). Surgical site infection associated with use of allogenic bone graft merits concern as shown by Ketonis C et al [7] who carried out a study assessing bacteriological colonization of allogenic bone grafts and found a high risk of graft being colonized by microorganisms. Hierholzer et al [12] in 2006 compared the use of autogenous bone graft with demineralized bone matrix in treatment of nonunion humeral shaft fractures reported a single case of infection by *Staphylococcus aureus* and it occurred in the demineralized bone matrix group. Although not many studies using allogenic bone graft material for treatment of non unions have reported an increased rate of infection as compared to autogenous bone graft but use of such grafts in cystic lesions has been found to be associated with increased infection rates. Goel SC et al [13] reported a higher infection rate (10.9%) in benign cystic osseous lesions treated by curettage alongwith decalcified allogenic bone grafting when compared with infection rate of 9.5% reported by Campanacci et al [14] who undertook treatment of such lesions by curettage

alone. Due to above reported complication of infection associated with use of bone allograft, this study involved the practice of vancomycin impregnation of allogenic bone graft used. In our study, a total of 30 subjects were enrolled and they were divided into 3 broad categories. The largest category comprised of 18 patients having fractures with comminution and bone loss, delayed unions, non unions and other difficult to heal fractures. The second major category had 8 patients of benign osteolytic lesions (3 patients each of SBC and GCT and 2 patients of ABC). The third category comprised of miscellaneous indications with only 4 patients. Study group had 9 patients of fractures, 5 patients of benign osteolytic lesions, 1 patient of miscellaneous indication while the control group had 9 patients of fracture, 3 patients of benign lytic lesions and 3 patients of miscellaneous indication.

Hierholzer et al(2006) [12] in their study reported an overall union rate of 100% with use of allografts to augment plate fixation in cases of fracture non-unions of humerus. Lin WP et al(2010) [15] in their study comparing the use of autogenic and allogenic bone graft in the treatment of humerus fracture non union did not report any significant difference in the union rates with the two types of graft. They reported an overall union rate of 96.9% at the followup but did not report the union rate for two groups separately.

Osteointegration of the allogenic bone graft was assessed using signs delineated by Sloof et al [16] which included attainment of graft homogeneity and absence of graft resorption. The overall success rate in terms of adequate osteointegration in our study was 83.33 % (5 failure cases out of 30) with (80% (12 case out of 15) in the study group and 86.7% (13 cases out of 15) in the control group achieving adequate osteointegration and there was no significant difference (p value=1) between the two groups. This finding is consistent with results shown by Buttaro et al [17] who assessed vancomycin impregnated allogenic bone graft in two stage infected hip arthroplasty and stated that vancomycin impregnation did not seem to have any adverse effect on allogenic bone graft osteointegration with host bone bed.

Conclusion

It was concluded that the bone allograft which was impregnated with vancomycin was able to osseointegrate adequately without any systemic or local complications.

Conflict of Interests- None

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