The Use of Allografts for Posterior Spinal Fusion

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ABSTRACT

This is a retrospective study of 37 patients operated for posterior spinal fusion using allografts in Department of Orthopaedic Surgery, National University Hospital between January 1991 and December 1998. Indications for surgery include degenerative conditions (stenosis and spondylolithesis), developmental conditions (spondylysis and spondylytic spondylolithesis), scoliosis (idiopathic, congenital and paralytic) and trauma due to burst fracture. All allografts used for posterior fusion were deep frozen, except for 1 patient where a lyophilized allograft was used. Of the 37 cases undergoing posterior spinal fusion, instrumentation was performed in 34 cases. Good results were obtained in this series. The authors emphasised the importance of meticulous preparation of the fusion bed, performing facet joint fusions using spinous process autografts and advocating the use of a 50% allograft-autograft mixture for the remainder of the fusion bed. There was one case of superficial wound infection. There was no case of implant failure due to clinical pseudoarthrosis.

INTRODUCTION

With the development of several new tissue banks in the region, allograft transplantation is increasingly being used in the field of Orthopaedic Surgery[1,2]. In Singapore, the first transplantation was performed in June 1989. Up to 31 August 1999, 543 transplantations have been performed using tissue grafts procured and processed by National University Hospital Tissue Bank including 118 transplantations for spinal surgery. In spinal surgery, allografts have been used for both posterior spinal fusion and anterior spinal reconstruction.

MATERIALS AND METHODS

Study Population

This is a retrospective study of 37 patients operated for posterior spinal fusion in the Department of Orthopaedic Surgery, National University Hospital between January 1991 and December 1998.

There were 19 males and 18 females. Their ages ranged from 5 to 80 years with an average of 39 years. Majority of the patients were Chinese (21), followed by Malays (9), Indians (5) and others (2). The duration of follow-up ranged from 5 months to 95 months, the average being 33 months.

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Indications

The indications for posterior spinal fusion were shown in Table 1. The commonest indication in the elderly age group was degenerative stenosis and degenerative spondylolisthesis (12 cases). In the paediatric age group, the commonest indication was idiopathic scoliosis (7 cases). There were also 7 cases due to burst fracture.

Table 1. Indications for posterior spinal fusion

Indications	No. of patients
Degenerative stenosis	8
Degenerative spondylolisthesis	4
Spondylolysis	5
Spondylolytic spondylolisthesis	3
Idiopathic scoliosis	7
Congenital scoliosis	2
Paralytic scoliosis	1
Burst fracture	7
Total	37

Instrumentation

Out of the total of 37 cases undergoing posterior spinal fusion, instrumentation was performed in 34 cases. No instrumentation was carried out in 3 cases. The types of instrumentation performed were depicted in Table 2. Hartshill instrumentation was the commonest used. However, sub-laminar wiring is no longer used. Only pedicle screw instrumentation is now performed for all cases undergoing posterior spinal fusion in National University Hospital.

Allografts Used

In this study, all the allografts used for posterior spinal fusion were supplied by the National University Hospital Tissue Bank. A total of 43 deep frozen bone allografts and 1 lyophilized allograft were used for the 37 cases for posterior fusion. The femoral head was the commonest allograft used (33 allografts). This was followed by 9 total knee replacement (TKR) bone slices, 1 iliac crest and 1 humeral head.

Allograft Preparation

Allografts must be properly prepared before they are used. The preparation of allografts should be done on a separate trolley prepared and draped for this purpose. The allografts were thawed at least one hour before the start of operation. The allografts were then soaked in normal saline containing 500mg of Ampicillin and Cloxacillin. The articular cartilage was meticulously removed from the bone using a bone nibbler. All soft tissues were also removed and the allografts were flushed with normal saline using a jet

Table 2. Types of instrumentation performed

Type of instrumentation	No. of patients
Hartshill	17
Isola	9
Cottrel Dubousset	4
Moss-Miami	3
Synergy	1
Total	34

lavage to remove blood and fat globules. Subsequently, the allografts were osteotomised into 3 to 4 pieces and then ground into smaller pieces using a sterile bone mill. The allografts were then mixed with the autografts procured from spinous processes or laminectomy bone from the decompression performed to form a 50% allograft-autograft bone graft mixture.

Operative Technique

A midline incision was made to expose the spinous processes at the level of the vertebrae involved. Spinal decompression was first preformed where indicated. The spinous processes were removed and were collected together with bone pieces obtained from laminectomy as autografts to augment the allografts used for the spinal fusion. Next, the transverse processes, facet joints and adjacent laminae were exposed and the fusion bed was meticulously prepared. After thorough preparation of the fusion bed, autografts from the spinous processes were used for the facet joint fusions. Instrumentation was then performed. The 50% allograft-autograft bone graft mixture was then used for the remainder of the fusion bed. Instrumentation was then completed, a drain inserted and the incision closed.

When decompression was performed for the operation, sufficient autografts could be obtained from the spinous processes and from the laminectomy performed. When decompression was not performed, additional spinous processes could be removed (if necessary) to ensure that enough bone autografts could be provided to form the 50% allograft-autograft mixture to be used for the posterior spinal fusion. In this way, procurement of bone grafts from the patient's own iliac crest could be avoided to reduce donor site morbidity.

RESULTS

In this study, no bone infection was encountered in all cases. There were 3 cases with complications. One patient had a superficial wound infection which healed with treatment. Two patients had unrelated stroke and hemiplegia. It is interesting to note that there was no case of implant failure due to clinical pseudoarthrosis in our series.

DISCUSSION

Both autografts and allografts are widely used for posterior spinal fusion. Good results have been obtained using autografts for spinal fusion.[3,4] Fusion with autografts have been considered as the gold standard with which other grafting materials such as allografts could be compared. However, there are disadvantages with the use of autografts. These include limitation of bone graft availability and donor site morbidity. On the other hand with allografts, there is no limit to the amount of bone graft available and no donor site morbidity. Disadvantages of allografts however include lack of osteogenic potential and presence of immunological reaction. Several studies have shown promising results with the use of allografts for posterior spinal fusion.[5,6,7,8]

Three types of allografts have been used namely ethylene-oxide sterilized freeze-dried allografts, gamma irradiated freeze-dried allograft and sterile procured deep frozen allografts. Ethylene-oxide sterilized freeze-dried allografts were shown to give inferior results to autografts and their use for spinal fusion should be discouraged.[4,9,10,11] For enhancing posterior spinal fusion, deep frozen allografts have been shown to give good results. [5,6,7,12,13] Deep frozen allografts have also been shown to achieve better results than freeze-dried allografts. [3,10,14] The authors advocate that deep frozen allografts should not be used alone and should be used in combination with autografts.[2] Allografts are only osteoconductors and lack osteogenic potential and have no osteoinductive properties. Autografts added serve to provide osteogenic potential to the bone graft mixture used. Other advantages in using allografts include decreased blood loss, reduced operative time and no donor site morbidity.[6,8,12,13]

To achieve good results for posterior spinal fusion, the authors advocate meticulous preparation of the fusion bed. This is an extremely important step. Without adequate preparation of the fusion bed, even pure autografts used will not fuse.

It is also recommended that only pure autografts taken from the spinous processes and laminectomy bone must be used to perform the facet joint fusions especially for scoliosis surgery. This was the most important factor to achieve good spinal fusion and was more important than the ratio of allografts to autografts in the mixture used. The authors used a 50% allograft-autograft mixture as bone graft material for optimal results. However, in small children, where the bones were mainly cartilaginous, allografts could be used alone with good results.

CONCLUSIONS

Deep frozen allografts gave good results for posterior spinal fusion in this series. The authors emphasised the importance of meticulous preparation of the fusion bed, performing the facet joint fusions using spinous process autografts and advocating the use of a 50% allograft-autograft mixture for the remainder of the fusion bed. One patient had superficial wound infection and there was no case of any implant failure due to clinical pseudoarthrosis. Deep frozen allografts have been shown in this series to be a good alternative to autografts.

ACKNOWLEDGEMENTS

The authors would like to thank Dr Wang Li Hui and Mrs DP Vathani for typing the manuscript.

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