

# USE OF ALLOGRAFT BONE CHIPS IN POSTERIOR SPINAL SURGERY

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## ABSTRACT :

*For most of the spinal disorders posterior instrumentation and fusion is a treatment of choice. But instrumentation is only a temporary stabilization method for obtaining fusion of the affected vertebrae, and instrument failure is inevitable if strong fusion mass does not occur. Bone grafts are indispensable parts of the operation for their osteoconductive and osteoinductive properties. Although using patients own bone as graft has many advantages sometimes sufficient bone stock is not available. Donor site complications are not infrequent and bring out search for other resources of bone grafts. We have seen in this study that results in using allograft bone chips in posterior spinal surgery are comparable to those with autografts and we approve their usage.*

**Key Words:** Allograft, Posterior, Spinal surgery, Bone chips.

## INTRODUCTION

Whatever the cause for spinal operation is one of the most important aims is to stabilize the affected segments. This requires the development of a strong fusion mass. Instrumentation provides temporary support until this fusion mass develops. Enhancing fusion by the application of bone grafts is an indispensable procedure. Undoubtedly the best is to be able to use patients own bone which has osteoinductive and osteoconductive properties. But the problem is that sufficient bone stock is not always available and that there is always the risk of donor site complications. These bring out the need for allografts. Usage of allografts in scoliosis surgery has been widely studied on. But there are few researches on allograft application in fractures and tumors of the spine (17, 20). We have performed a retrospective research on the patients who had undergone posterior spinal arthrodesis supported by spongy bone allografts.

## MATERIAL and METHOD

To 49 patients, diagnosed and treated between 1994 and 1996 in our department, bilateral posterior

spinal segmental instrumentation and posterolateral intraarticular fusion was performed. For all of these cases freeze-dried gamma sterilized commercially available spongy bone chips were used. The distribution of the cases in different diagnosis groups were as shown on Table 1.

Ten of the scoliotic deformities were idiopathic in nature, while two congenital and two neuromuscular. Six spondylolisthesis and four spinal stenosis cases formed the degenerative spinal disorders group. We had two multiple myeloma cases, one metastatic breast carcinoma case, and one malignant hemangiosarcoma case operated using allografts. Of the three patients with failed back, due to a poor previous surgical indication or due to development of pseudoarthrosis, two were previously operated for fracture of vertebrae and one for spondylolisthesis.

For the scoliosis cases fusion levels were chosen as recommended by King et al (16). Decortication was applied to all of the patients. Allografts alone were used for the neuromuscular type deformities. For three of the other 12 patients autogenous iliac spongy bone grafts were harvested with the allografts. For the degenerative spinal disorders with neurologic deficits posterior decompression was performed and laminectomy grafts were harvested with the allografts. For the three of the tumor cases only posterior approach and for the malignant hemangiosarcoma case combined posterior and anterior approach were performed. No autogenous grafts were used. Two of the failed back cases were reoperated because of

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Table 1. Distribution of the cases in different diagnosis groups.

DIAGNOSIS	NUMBER OF CASES	FEMALES	MALES	AVERAGE AGE (RANGE)
Spinal Trauma	18	10	8	43 (27-62)
Scoliosis	14	13	1	14 (8-20)
Degenerative Spinal Disorders	10	8	2	52 (45-64)
Spinal Tumors	4	2	2	51 (42-68)
Failed Back	3	3	-	47 (40-54)

pseudoarthrosis. For these autogenous iliac bone grafts were harvested in addition to allografts. The other previous fracture case was operated for the kyphotic deformity at the thoracolumbar junction and the neurologic deficit and combined anterior and posterior approaches with posterior instrumentation, fusion, anterior decompression, and strut grafting with patient's own rib was performed. Number of levels fused in each group is shown in Table 2.

Table 2. Number of Levels Fused

	NUMBER OF LEVELS FUSED		
	≤5	5-12	≥12
TRAUMA	14	4	-
DEGENERATIVE SPINAL DISORDERS	10	-	-
SCOLIOSIS	-	8	6
SPINAL TUMORS	2	2	-
FAILED BACK	3	-	-

All patients wore custom made braces postoperatively. Average follow-up period was 18 months (range 13 to 36 months).

Determination of the presence of fusion was done as Bridwell et al (4) and Atlihan et al (1) have used in their studies. The radiographs in two planes were assessed for the fusion mass and were considered as "solid" if there were heavy bony trabeculations at the instrumented vertebral levels. More than 15° correction loss for scoliosis cases, instrument failure or visible pseudoarthrosis for all cases were rated as "pseudoarthrosis". Lack of mature bony trabeculations in the absence of instrument failure or correction loss were put into "probably solid" group.

**RESULTS**

On the follow-up radiographs taken at the end of postoperative first year earliest, the results were as: 44

solid fusion, 3 probably solid fusion, and 2 pseudoarthrosis. Of the 2 pseudoarthrosis (4.1%) one was an idiopathic scoliosis case which had 20° correction loss at the end of 15 months. She was reoperated using this time both allograft and autogenous iliac cancellous bone graft and did develop a well trabeculated fusion mass. The other patient had spondylolisthesis between L4 and L5. Despite the visible pseudoarthrosis seen at the radiographs she did not have any complaints and the instrument was sound, so no further treatment was applied. Superficial infection that affected one of the multiple myeloma cases responded well to proper antibiotic treatment but deep infection of the metastatic breast carcinoma case required removal of the instrument. This patient died 3 weeks after the second operation due to the pulmonary complications.

A neuromuscular type scoliotic patient was assessed as having "probably solid" fusion because of the insufficient trabeculated bony mass. She had no correction loss or instrument failure. The other two "probably solid" cases were a fracture dislocation between T12 and L1 and a burst fracture of the L2 vertebra.

Thirteen scoliosis cases developed good fusion mass and no instrument failure was observed. Average correction loss was 5.4°. We did not encounter any complications in the trauma group.

The two pseudoarthrotic failed back cases did well and had fusion of the involved segments.

The other failed back case who had undergone combined anterior and posterior procedure had kyphosis and bone fragment in the spinal canal. Although decompression was done the neurologic deficit did not get better. Fusion did develop and patient was transferred to the rehabilitation clinic for further treatment.

## DISCUSSION

For years autografts remained the most preferred material for grafting because of their osteoconductive and osteoinductive properties and contribution of osteogenic cells (5). But donor site complications and sometimes unavailability of sufficient bone stock limit their usage. Thus alternatives to the patients' own bone grafts had been searched for. Now the best choice seems to be the allografts.

The majority of allograft healing occurs by creeping substitution. Structural framework of the graft helps the host osteoblasts to migrate and reconstitute the graft. Allograft incorporation undergoes a similar series of events but at a slower rate (14).

Among the different kinds of processing of the allografts it is reported that the best fusion rates can be obtained by fresh frozen ones, but the very low antigenicity of the freeze dried allografts lead to preference of these in most occasions (2, 10, 22). Many comparison studies between the freeze dried and the fresh frozen allografts show little difference in fusion rates (7). Also some authors report similar fusion rates between autografts and fresh frozen allografts (7).

The major reason for preference of allografts is the donor site complications seen after autograft harvesting. Donor site complication rate has been reported by several researches as 20% (11, 12). Infection, prolonged wound drainage, hematomas, pain, unsightly scar formation, and permanent or temporary loss of sensation are of the major complications that discourage autograft harvesting (23). One of our failed back cases whom we had used autografts in addition to allografts had complained of prolonged and severe donor site pain which she claimed to be overcoming the major operation pain.

There are many factors effecting the fusion rate. Most important one is said to be the technique of fusion. Knapp and Jones state that not the type of graft but the technique of fusion is more important (17). They recommend meticulous attention to obliteration of the facets, decortication, complete removal of soft tissues, and a well planned instrumentation. Instrumentation itself is an important factor which enhances fusion (13). A study performed by An et al is of special importance for eliminating other influencing factors on fusion rate (2). They have compared allografts and autografts on the same patient by using

one kind at one side and the other at the controlateral. They showed that the autogenic bone grafts give the best result while mixed autogenic and allogenic second, fresh frozen third, freeze dried fourth, and ethylene oxide sterilized worst. Ethylene oxide sterilized allografts were shown to give unsatisfactory results by many other researchers (3, 7, 15). We also do recommend the available autogenic grafts like the decortication material or the laminectomy material to be harvested with the allografts. In spite of absence of a comparison of control and allograft utilized groups in our study, considering difference in time until union, rate of pseudoarthrosis, or incidence of infection, it appears that it is not the type of graft used, but the fusion technique applied that determines success of the operation (11, 17).

Application of allografts is a well documented subject in neuromuscular scoliosis cases (4, 17, 19). Such patients require instrumentation of the pelvis and usually do not have sufficient bone stock. Thus allograft utilization is mandatory. In case of vertebral fractures and tumors relatively short fusion levels are warranted and therefore allograft application has not been studied much before. The disadvantages of autograft harvesting stated above bring out the question; "if not much different why take the risk?". The pseudoarthrosis rates reported by several centers in scoliosis cases differ between 5.0 to 7.5% (4, 17, 19). We have not seen any pseudoarthrosis in the trauma group. The tumor group did also not develop such a complication. Knapp and Jones have reported only one pseudoarthrosis in their 50 cases of spinal fractures and deformities to whom they have used allografts (17). We think allografts can safely be used in spinal trauma and tumor cases.

Degenerative disorders of the spine generally develop more pseudoarthrosis after fusion (7). While some authors discourage usage of allografts in posterolateral lumbar fusions (7, 15), some found that there is little if any difference between the autograft utilized cases and the allograft used ones (8, 9, 18, 20). Some authors even recommend the usage of allografts over autografts in these operations (21). One of the two pseudoarthrosis we have encountered was a spondylolisthesis case, but we think this subject has to be studied with wider series.

Another concern about the allografts is the transmittable diseases. In this case freeze dried grafts have superiority over the fresh frozen ones (6). We

have encountered no such diseases in any of the 49 cases.

We think the abundant availability of the freeze dried allografts and the ease of preservation are very important factors for approval of usage. Especially in places where technical facilities are limited these may become the only alternative. Allograft usage besides these also has the advantage of decreasing blood loss and the operation time (1, 11). Thus besides scoliosis and degenerative spinal disorders which have approved allograft usage we think allografts can safely be used in spinal trauma and tumor cases where posterior spinal fusion and instrumentation will be performed. We also think that it is always wise to harvest the available autogenous bone grafts like the decortication or the laminectomy material.

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