

RADIONUCLID AND HISTOPATHOLOGICAL EVALUATION OF COMBINED ALLOGRAFT AND AUTOGENEOUS GRAFT APPLICATIONS IN ANTERIOR AND POSTERIOR SPINAL FUSION*

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ABSTRACT :

Autogeneous grafting is most effective choice in obtaining fusion in spinal surgery. Allograft usage is also popular especially when the autogeneous graft mass is insufficient. In this study, 42 patients were evaluated in whom Tutoplast allografts and autogeneous grafts were combined for fusion at Departments of Orthopaedics and Traumatology of Ankara Social Security Hospital. Besides radiological evaluation at 6th and 12th months, Tc 99 MDP bone scintigraphic studies of the patients were done. Twenty patients had vertebral fractures and 22 patients had idiopathic scoliosis. A solid fusion mass was observed radiographically and scintigraphically. Histopathologic studies of 11 patients with implant removal and 5 patients of control group who had only autogeneous grafting were done. Any significant histopathological differences were not observed in fusion masses of the patients. In light of these findings it is concluded that autograft combination can be used in selected cases.

Key words: Allograft, spine fusion, Autograft, Anterior, Posterior, radionuclid, histopathology.

INTRODUCTION

The first reports of posterior spinal fusion were by Albee and Hibbs in 1911 and 1924. Albee reported using portions of tibia as bone graft for patients treated by spinal fusion for Pott's disease (2, 7). In recent years, iliac crest graft has been the customary adjunct to facet obliteration and decortication of the posterior elements of the spine. Bone graft is harvested during the operation, either through the same or a second incision. This basic fusion technique with various forms of internal fixation has led to a pseudoarthrosis rate of 1%-2% (9).

Although autograft bone has traditionally been considered as the ideal in spinal fusion, it is not without its complications. These include problems at the donor site such as infection and increased blood loss and operative time. There may also be limitations because of inadequate quality, or insufficient quantity as in the patient with neuromuscular scoliosis who has deficient iliac crests. These problems have encouraged surgeons to look for other sources (6).

The history and development of bone transplantation can be traced back to the seventeenth century. It is

known that in 1668, Job van Meekeren, from Holland covered a skull defect of a soldier with a piece of bone from a dog callote (15).

The use of allograft bone provides a reasonable alternative to meet the growing need for primary or supplementary graft material. The use of allografts from femoral heads has recently been receiving more attention (6). Previous reports have shown successful use of allograft for anterior cervical fusion, myelodysplasia and paralytic scoliosis (5, 9).

In this study, sterilized tutoplast allograft obtained from cadaver was applied to 42 patients with scoliosis and vertebral fractures, being combined with autogenic grafts, in the form of spongy chips posteriorly and in the form of fibula graft anteriorly. Fusion results were evaluated histologically, radiologically and by scintigraphically.

MATERIAL AND METHOD

Forty two patients were observed prospectively in the 1st Orthopaedic and Traumatology Department of Social Security Hospital. Twenty of the patients had vertebral fractures and 22 of them had idiopathic scoliosis. The mean age of the former was 37.4 and the mean age of the latter was 14.7. Seventeen of the 42

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patients were male and 25 of them were female. The mean follow up period was 27.4 months (12-34 months).

All of the patients with idiopathic scoliosis operated posteriorly and TSRH (Texas Scottish Rite Hospital) instrumentation system was applied to them. Cadaveric tuptoplast spongiuous chips were combined with autogenic grafts obtained from iliac crest and posterior fusion was performed. Following posterior TSRH instrumentation, posterior fusion was performed in 12 of 20 patients with vertebral fractures. In these patients autograft and tuptoplast allograft were combined in the same manner.

Following anterior decompression, anterior strut grafting was performed with autogenic costal graft and during the same session posterior fusion was performed. In the 3 of the remaining 8 patients, combination of autograft with tuptoplast spongiuous allograft was used after posterior TSRH instrumentation was performed.

In 5 patients following anterior decompression, tuptoplast fibula graft and Z plate anterior instrumentation were applied for anterior fusion. Multiple holes were opened on fibular allograft and spongiuous chips were filled in them, obtained from decompression materials. Moreover these autogenic chips were installed abundantly around the strut graft. Antibiotic prophylaxis was performed in all patients for 4 days and 1st generation cephalosporins were injected intravenously.

Postoperative brace and cast were used in none of the patients. Patients were called for their follow-up examinations in the 3rd, 6th and 12th months and their last controls were performed in December 1995. Their Tc 99 MDP bone scanning as well as conventional radiographs were taken.

Due to implant failure in 3 patients and to late deep infection in 1 patient and after fusion had developed completely in 7 patients, on their demands, implants were removed. Meanwhile, biopsy was taken from the fusion mass. In order to form a control group biopsy was taken from the fusion mass of the 5 patients whose implants were removed and to whom autograft was applied. Biopsy materials were fixed in formaline and stained by hematoxilene eosine and its histopathological evaluations was performed.

RESULTS

Fourteen of the 22 patients with idiopathic scoliosis had King type III, 8 of them King type II curves.

Preoperative average Cobb angles in thoracal region were 55.9 ± 17.7 . Postoperatively 57.9 ± 18.3 of correction was provided. The Cobb angle of the patients with type II curve which was averagely 68.6 ± 11.4 was brought to 35.0 ± 9.4 and 48.1 ± 6.8 of correction was obtained. The mean Cobb angle of the patients with type III curve was corrected from 52.2 ± 6.7 to 11.7 ± 6.6 . The mean correction rate was $73.2\% \pm 12.4$.

Physiological thoracal kyphosis was provided in 77.3% of the patients. In the 2 patients of this group, implants were removed at the postoperative 9th and 12th months due to implant failure. In 1 of them pseudoarthrosis was established and revision operation was performed with autogenic graft and short segment instrumentation. Despite hook dislodgement in 1 of the patients there was a solid fusion mass and minimal loss of correction was noted. In remaining 19 patients solid fusion mass established radiologically. In the Tc 99 MDP bone scan in 6th and 12th months an increased uptake was observed. The duration of fusion was ranging from 9 to 17 months.

All 20 patients with vertebral fractures were of burst type in thoracolumbar junction. Eleven of them were T12 and 9 of them were at L1 level. Preoperative compression percentages were 48.1 ± 14.3 and they were corrected to 23.5 ± 13.2 postoperatively and correction rate was 48.1 ± 25.6 . Preoperative mean sagittal index which was 30.7 ± 9.2 was corrected to 3.0 ± 5.3 postoperatively and $87.4\% \pm 18.2$ of correction was obtained.

One patient instrumented posteriorly had implant failure and pseudoarthrosis and had revision surgery, fusion and instrumentation were performed again. Also 1 patient developed deep infection in the 4th postoperative month. Tuptoplast fibula allograft had been applied to this patient anteriorly. Anterior Z plate was removed. There was no fusion in fibula. This was removed and following debridement autogenic fibula graft was applied. Following specific antibiotic therapy for three weeks, posterior TSRH instrumentation and posterior autogenic grafting were performed. As this fibular allograft material had infection it was not examined histologically. Since another anterior revision or anterior implant removal was not performed. It was not possible to evaluate fibular allograft histopathologically. A solid fusion mass was observed in the remaining patients radiologically. In the bone scan with Tc 99 MDP in the 6th and 12th months, increased uptake was observed.

In 21 (96.5%) of the patients with idiopathic scoliosis to whom allograft was applied solid fusion mass was observed except one patient (4.5%) with pseudoarthrosis. Of 20 patients with vertebral fractures 1 (5%) had pseudoarthrosis, 1 (5%) had infection and 18 (90%) had solid fusion mass.

When all patients were considered it was determined that 4.8% (2 patients) pseudoarthrosis, 2.4% (1 patient) infection were noted. In the remaining 39 patients (92.9%) solid fusion mass was observed.

Except 3 patients who had revision due to implant failure, 6 patients with idiopathic scoliosis and 2 patients with vertebral fractures, had implant removal on their demand, biopsy materials were taken during these procedures. There was no difference in fusion areas in terms of quality, from patients whom had only autografting or from normal bone tissue histopathological appearance.

DISCUSSION

The accepted surgical treatment for spinal deformities has been to combine correction, instrumentation, and autogenous bone grafting (9). Harvesting and utilization of iliac crest graft adds both time and morbidity to the operative procedure. Obtaining autogenic graft has been associated with complication rates as high as 29% (10, 17). Postoperative graft site pain is frequently the major source of pain requiring narcotic analgesia. Major complications associated with harvesting iliac crest graft include hematoma (occasionally with significant postoperative blood loss), infection, neuroma, persistent local pain and sensory loss (9-10, 17). The supply of autografts is however limited especially in children.

The first large series of allograft transplantations was reported in 1908 by Lexer (12). The use of allograft bone provides the only real alternative to autogenous graft in the quest for suitable material to secure predictable fusion in scoliosis surgery. It is usually used in the form of deep frozen or freeze-dried cadaveric graft or frozen graft taken from the femoral heads of patients undergoing hip replacement. The use of allograft femoral heads has recently been receiving more attention and with the regular performance of total hip arthroplasties and hemiarthroplasties, femoral heads are readily available in most orthopaedic hospitals. As the bone is collected, stored and subsequently used in the same hospital, many of the financial and logistic implications of establishing a central bone bank are

bypassed (6). In our department of our hospital we have bone bank. Bank allografts are mostly used for spinal operations and hip revision operations and for filling tumoral defects. First results of bank grafts were reported by Akalm et al in 1994 and high fusion rates were reported (1).

In this study, tutoplast (Prfrimmer Viggo, Germany) allografts obtained from cadaver, certificated by FDA sterilized by PCR (Polymerase-chain-reaction) method, completely eliminated from Hepatitis B and HTLV viruses were used. Graft were implanted after combining spongy chips or fibula three cortical graft with autogenic grafts.

The pseudoarthrosis rate of autogenous bone graft in spinal surgery is 2% (2). Mc Carty et al had no pseudoarthrosis in patients with paralytic scoliosis using frozen allograft (13). Aurori et al reported a 5.3% pseudoarthrosis rate using frozen graft in patients with idiopathic scoliosis and Osebold et al reported a 20% rate in patients with myelomeningocele using frozen allograft (3, 14). Urist and Dawson reported a 12% pseudoarthrosis rate with posterior lateral fusion with allograft in the lumbar spine of adults (13). In this study 4.5% pseudoarthrosis was determined in 22 patients with idiopathic scoliosis and 5% pseudoarthrosis was determined in 20 patients with vertebral fractures. When all patients are considered pseudoarthrosis rate was noted as 4.8%. The rates of pseudoarthrosis lower than those reported in literature. This has led us to consider that the combination of allografts with local or iliac autografts plays a role. Infection rates reported in the literature range from 2% to 23% (3, 14). Knapp and Jones reported that they encountered no infection in their 50 patients series to whom they had performed spinal fusion (9). In our study 1 of 42 patients (2.4%) had infection and his implants had to be removed.

Berrey et al. reported 16% fracture rate occurred when they especially implanted in long bones (4). In this study no fracture was encountered in the fibular allogenic grafts implanted anteriorly. The reason of this was considered as the effect in the fibular allografts filling with autogenic grafts and opening multiple holes.

Itih et al. emphasized that bone scanning was a noninvasive and sensitive method in the evaluation of bone grafts (8). In this study the implants of 11 patients to whom allografts were used and those of 5 control patients to whom autogenic grafts were used, were removed. During these operations, bone biopsies

were taken and they were examined histopathologically. Two groups did not have any difference from each other in terms of bone formation and of histopathological appearance. And these were not different from normal bone histology.

In light of these findings it is suggested that cadaveric allografts prepared by chemical methods can be combined with autogenic grafts and they can be used securely due to low rate of pseudoarthrosis and infection in spinal surgery for anterior and posterior fusion.

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