

THE VASCULARISED RIB GRAFT IN KYPHOSIS SURGERY ANALYSIS OF 10 CASES

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In 10 cases a vascularised rib graft was used to bridge a kyphotic segment of the spine, as described by Rose in 1975 and Bradford in 1989. This technique was used in view of the better and faster consolidation of the vascularised graft opposed to the non-vascularised grafting techniques.

There were 6 posttraumatic cases, one spinal metastasis, two patients with a spondylitis ankylopoietica among one with a pseudo-arthritis, and one spina bifida kyphosis. In 6 cases there was a good and rapid consolidation, without the occurrence of stress fracture. In one case in which the bloodflow in the graft was in doubt, there was a progressive loss of kyphosis correction and a late screw breakage of the anterior fixation device. In a recent case the outcome is not yet established, because there was a luxation of the ribgraft.

In the 4 last cases bone-scans were done after the operation. Uptake of the technetium was not visualised directly postoperative, but was progressively seen after three and six months.

The clinical course of these patients however was favourable with apparent hypertrophy of the graft in several cases. Follow-up range is from 3 months to six years.

Key Words : Kyphosis, anterior strutgraft, viable ribgraft, intercostal vascular pedicle.

The first report of a vascularised ribgraft used in anterior spine surgery was by Rose et al in 1975 for treatment of Potts Kyphosis and myelomeningocele kyphosis. Independently Bradford reported the use of this technique in 1980 with a later report in 1986 on 25 patients.

Because of the relative simplicity of the technique we decided to use this technique for the first time in 1984 in a patient with ankylosing spondylitis, who had a pseudarthrosis of the spine.

We subsequently operated on 9 other patients up to 1990.

MATERIAL AND METHODS :

10 patients were operated on for a hyperkyphosis between 1984 and 1990. Indications were listed in table I : 3x acute vertebral fracture, 3x late vertebral fracture, 2x pseudarthrosis in ankylosing spondylitis, 1x vertebral metastasis and 1x myelomeningocele.

The indication for operative treatment was in every case progressive pain and or kyphosis, with spinal cord compression in 5 cases.

The technique was chosen in favour of other techniques because we expected a faster ingrowth of the pedicle bone graft compared to non vascularised grafts

and in most patients a less optimal local situation was apparent or less postoperative cooperation was expected. Twice the patient had a psychiatric history, once the spine was irradiated, twice the anterior bone stack was very brittle in severe ankylosing spondylitis and once the patient was very unwilling to protect his spine with external immobilization in the postoperative period.

The technique of operation was described in Bradford's paper in 1980. We always chose a rib superior to the segment of spine to be operated on. After dividing the extrapariosteal tissue of the rib with leaving an intact muscle cuff distal to the rib containing the intercostal artery and vein and nerve, the base of the rib was carefully freed of soft tissue and was cut, leaving the muscle cuff intact. On the anterior side the rib was divided together with the vascular pedicle at the costochondral junction. After mobilising the vascular cuff to the front of spine the rib was left in the thoracic cavity soaked in a wet gauze. At the end of the kyphosis correction with or without spinal cord decompression a trough was created anterior in the upper and lower vertebral body and the ribgraft with the cuff side turned upwards was hammered in place after cutting it to an appropriate length. In all 10 cases a stable position of the ribgraft could be achieved. The bloodflow of the graft after harvesting was judged by incising the periosteum in the middle of the graft for ± 1 cm. with good bleeding in all cases except one. After shortening the graft to an appropriate length frequently the bloodflow appeared less than before shortening.

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In one case the bloodflow in the graft was in this patient the kyphosis correction was considerably lost and one of the Zielke screws broke. In 8 patients the procedure was combined with a Slot-Zielke stabilization, in 1 patient the procedure was preceded by a Kluger instrumentation and fusion, and in 3 patients a posterior instrumentation and fusion was added after 2 weeks. In the last 4 patients we tried to visualise the viability and rate of ingrowth of the graft with serial technetium bone scans with spect analysis. In 2 other patients (not in this series) the technique failed; in one case the 11th rib was not suitable for this technique and in another case the 5th rib had no clear vascularisation due to occlusion of the segmental vessels in a posttraumatic case.

RESULTS :

Follow-up range is from 3 months to 6 years the graft consolidated in 3-6 months, judged mainly by serial radiographs.

In one patient, who had an doubtful vascularisation of the graft during the operation, a recurrent kyphosis developed with screw breakage, suggesting mechanical weakness of the graft, probably due to insufficient blood supply. One patient died of multiple metastasis of breastcancer one year after operation. In life she had very good ingrowth and hypertrophy of the graft with disappearance of all complaints. In one case the follow up is only 6 months. The remaining 7 patients have a good and rapid ingrowth of the graft after wearing a plaster corset or bivalved jacket for 6 months. By judging the radiographs it was often difficult to say if complete ingrowth was accomplished, but 6 months external immobilization was in almost every case judged to be enough. These 6 patients are without pain at final review. Complications were few. Intraoperatively a lesion of the thoracic duct was noted in patient 8, this was successfully repaired during operation. Patient 1 had a postoperative hydrothorax without recurrence after puncture. Patient 4 had as already mentioned collapse of the graft with screw breakage. There were no infections or neurological problems.

In the last 4 patients serial postoperative bone scans with spect analysis were performed. In none of the patients the graft was detectable in the first postoperative weeks. At 3 months there was slight filling in of the surgically created defect with suggestive activity at the edges of the ribgraft. At 6 months in patient 7 the graft was almost completely visualized (in a short trajet) where as in patient 8 the graft is still

only visible at the edges (a much longer trajet). In patient 9 the graft is also completely visualized. Patient 10 the ribgraft is luxated, and two weeks after the operation a posterior procedure with the Kluger transpedicular fixation system is done, time after operation is too short to evaluate the bonescans.

DISCUSSION :

Rose et al (1975) mentions good ingrowth of the graft with good maintenance of the correction of the deformity and hypertrophy of the graft 7 years after operation in a Pott's kyphosis.

Subsequently in 3 spina bifida patients the technique was used with good results. They stress the need for adequate length of the ribgraft and insertion without kinking of the vascular pedicle.

Bradford (1986) reports rapid incorporation of the vascularized ribgraft in 4 to 16 weeks in 25 patients followed up for more than two years. The technique would be particularly preferable in cases where the graft is anterior to the vertebral bodies, since he had no fracture of the graft in these cases. Shaffer et al reported in several articles the fate of vascularised and nonvascularised autografts. In canine experiments they demonstrated the superiority of the vascularised grafts versus nonvascularised ribgrafts. The vascularised ribgrafts were more robust and hypertrophic at autopsy 3 months postoperatively, with better mechanical testing characteristics, and became even better after 6 months.

There are to our knowledge no reports on bone scanning for assessing the viability of vascularised ribgrafts in human patients. Lipson et al studied bone scanning in vascularised leg transplants in rats and concluded that bone scanning was a superior modality in assessing the viability of the graft.

Kaneda et al report on 4 patients with a free vascularized fibular strut graft in the treatment of kyphosis. Bone scanning was performed at 1, 3 and 8 weeks postoperative and revealed positive uptake in the region of the transplanted fibula, thus revealing vascular patency.

In our material we were not able to demonstrate the vascular patency of the vascularised ribgraft. Probably the vascular flow in the shortened ribgrafts is not enough to be visualized by Technetium bone scanning. Often shortening of the graft is necessary to accommodate the graft to the segment of spine to be fused. By the shortening procedure the number of periosteal vessels will decrease, with a decrease of intramedullary

bloodflow in the rib as a result. The clinical impression of graft healing nevertheless is favourable. In 9 of 10 patients this was rapid and complete with apparent hyperthorphy in several patients. Probably despite some diminution of bloodflow the ribgraft remains viable and incorporates rapidly.

In selected cases this technique seems to offer definite advantages compared to vascularised fibular transplants, at least for thoracic or thoracolumbar kyphotic deformities. For short segments of the spine the technique seems less valuable due to the diminution of bloodflow in the shortened ribgraft.

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