Intervertebral bone implants following excision of protruded lumbar discs

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The authors describe a technique whereby a portion of the lamina removed during exposure of an intervertebral lumbar disc protrusion is implanted in the intervertebral disc space following disc excision. An analysis of 456 consecutive cases operated on by this technique and followed from 1 to 10 years is presented. Of the 418 patients followed, 92% indicated they were able to return to their normal activities and were satisfied with the result. Thirty percent of the patients indicated they had required some conservative treatment for recurrent episodes of back or leg pain. Ten patients had subsequent back surgery; only one implant has dislocated.

Key Words • lumbar disc protrusion • intervertebral bone implant • long-term follow-up

The treatise by Mixter and Barr describing the surgical treatment of rupture of the intervertebral disc opened a new era in the therapy of low back pain with sciatica. In spite of many refinements in surgical therapy, this method has not always yielded the high percentage of successful relief from back pain and sciatica that is desirable. Instability of the joint space from which the disc has been removed and recurrent disc protrusions are probably the principal causes for poor long-term results.

Reports by Dandy, Cloward, and others encouraged stabilization through the intervertebral disc space. Our technique utilizes a single large piece of bone placed centrally in the concavity of the disc space. The procedure involves no increased operative mortality risk, is technically simple, reduces danger of spinal nerve injury by encouraging a more lateral approach and wide exposure of the spinal nerve, allows ambulation as early as in cases of simple disc excisions, and results in little or no increased postoperative discomfort.

This study comprises a 1- to 10-year follow-up of results in 456 patients operated on in this fashion.

Method and Clinical Material

Surgical Procedure

After the patient has been anesthetized and positioned, the area at the level of the disc protrusion is exposed unilaterally (Fig. 1 upper left). The ligamentum flavum is then carefully dissected away from the inferior aspect of the superior lamina. Using a narrow Love-Kerrison rongeur, the surgeon removes a notch of bone from the superior lamina about 1½ cm medial to the articular facet. This same instrument is then used to cut laterally until the facet is detached from the lamina. The excised piece of bone is roughly
pyramidal in shape and measures approximately 1.5 cm by 1.0 cm. The ligamentum flavum is then removed. The remaining facet and bone from the inferior lamina overhanging the spinal nerve is removed to expose the spinal nerve. The spinal nerve is then retracted medially to expose the disc protrusion (Fig. 1 upper right). The posterior longitudinal ligament is cut away from the edge of the vertebral bodies superiorly and inferiorly, outward to the lateral extent of the exposure, and medially to the nerve root retractor protecting the spinal nerve. The interspace is then thoroughly evacuated of disc material including the accessible portions of cartilaginous plates of the vertebrae above and below (Fig. 1 lower left). The piece of bone obtained during the exposure is denuded of soft tissue and cartilage and shaped with the rongeurs to form a truncated cone, with a thickness equal to that of the distance between the margins of the vertebrae above.
TABLE 1

<table>
<thead>
<tr>
<th>Disc Space</th>
<th>No. of Cases</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-S</td>
<td>115</td>
<td>48</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>L4-5</td>
<td>179</td>
<td>60</td>
<td>238</td>
<td></td>
</tr>
<tr>
<td>L3-4</td>
<td>23</td>
<td>4</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>above L-3</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>multiple</td>
<td>17</td>
<td>7</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>337</td>
<td>119</td>
<td>456</td>
<td></td>
</tr>
</tbody>
</table>

and below the interspace from which the disc has been removed. The spinal nerve is protected with the retractor and the bone implant is wedged into the center of the interspace (Fig. 1 lower right).

Clinical Material

The operation was carried out on 456 patients during the years 1962 through 1971. Patients were studied by retrospective analysis of their medical records, and by follow-up questionnaires sent to all operated patients in 1972. Four hundred and eighteen patients, 91%, answered the questionnaire.

The 456 surgical cases included 337 men and 119 women. One hundred and sixty-three had a disc protrusion at the lumbosacral interspace, 238 at L4-5, and 27 at L3-4. Four patients had protrusion above the L3-4 interspace and 24 had two disc protrusions excised (Table 1).

The criteria for surgical treatment were unremitting pain in the back or leg not relieved by conservative therapy, recurrent attacks of pain seriously interfering with normal activities, or a progressing neurological deficit from spinal nerve compression. In all cases surgery was preceded by Pantopaque myelography to exclude spinal cord tumors, to assist in an accurate localization of the protrusion, and to identify multiple disc protrusions. In all cases the preoperative examination was carried out by the operating surgeon. There was no operative mortality and no neurological catastrophe. The average duration of postoperative hospitalization was 9 days.

Almost without exception all cases were seen in follow-up examination 1 and 3 months after surgery; spine films were made at these times (Fig. 2).

Results

Of the 456 total cases, we were able to trace 418 with a questionnaire. Four of the patients had died during the intervening 10 years; the cause of death was not related to the disc surgery. Thirty-four patients did not answer the questionnaire and were lost to follow-up. Charts of the 418 patients were reviewed and the results of the surgery were analyzed on the basis of the final recheck examination.

Each case was categorized according to whether the result was considered excellent, good, fair, or poor. An excellent result was characterized by no complaint of pain and no neurological deficit. With a good result, the patient had no pain and only a minor neurological deficit. The patient with mild residual pain and/or a moderate neurological deficit had a fair result, while the unimproved patient was classified as having a poor result. According to these evaluational criteria, at 3 months 95% of 418 patients were considered to have a good or excellent result; 5% were considered fair or poor.

In the 418 questionnaires returned, 92% of the patients (387) indicated that they had been able to return to their normal activities. Eighty-two percent indicated that this was the same job they had had prior to back surgery. Of the 73 patients (18%) working in a different job, 13 indicated that their job was more strenuous and 60 that it was less strenuous. Sixty-eight percent of the patients (287) returned to work in less than 6 months, 29% (119) in more than 6 months, and 3% (12) did not return to work. Thirty percent of the patients (129) indicated they had required some conservative treatment for recurrent episodes of back or leg pain, and 70% (289) that they had required no treatment for recurrent episodes of back or leg pain. Ten patients (2.4%) had subsequent back surgery. Ninety-two percent of the patients (387) indicated they were satisfied with the results of surgery.

Interestingly, 11 patients who were classified as having fair or poor results in the 3-month follow-up indicated on the questionnaire their satisfaction with the results of surgery, while 24 patients classified as excellent or good results on the 3-month follow-up indicated on the questionnaire dissatisfaction with surgery, almost all on the basis of recurrent back pain.
Analysis of the medical records of 38 patients who had either died or were lost to follow-up revealed that 3 months postoperatively 32 had exhibited a good or excellent result, four were fair, and two had poor results.

To our knowledge, only one implant has dislocated. This dislocation occurred while the patient was lifting a 50-horsepower outboard motor 15 months postoperatively. He experienced a sudden unremitting acute back pain, without sciatica. Lumbosacral films showed posterior dislocation of the implant without extrusion. The patient was advised to have the implant removed, but refused to do so at that time, stating that he was not seriously disabled and that he had important business activities. Because of low back pain, he returned 3 months later and the implant was removed. He recovered without deficit and returned to full-time work.

Nine other cases have been reoperated. One patient had a protruded disc at another space; this was removed, and a second implant made. This patient returned to full-time work as a mechanic. Two patients were reexplored elsewhere; the operative reports indicate that no recurrent disc protrusion was found and that the implant was solid. Six cases have had spinal fusions by orthopedic surgeons for symptoms of low back instability. Three of these patients returned to work.

Of the 418 patients followed by questionnaire, 39 had had disc surgery prior to our operation. Following additional disc surgery and bone implant, 37 of these patients were able to return to work and two were not.

Of the total 456 cases, 54 were Workmen's Compensation cases. Of these, 68% returned to their former work, 28% returned to less strenuous work, and 4% did not return to work. Therapeutic results in these cases roughly paralleled the nonworkmen's compensation group in functional recovery.

**Discussion**

The high incidence of patients returning to work (92%) reflects in part the farming population from which the majority of our patients come. The strenuous nature of the work done by people in agriculture, and the high percentage of patients who have been able to continue their regular work activities (82%) suggest that the surgical treatment has provided satisfactory stability at the diseased interspace. The unusual cooperation of these patients is being utilized for continuing follow-up.
Intervertebral bone implants

Our present experience with x-ray follow-up, including tomograms and flexion-extension views, does not give a satisfactory indication of the structural consequences of this procedure. A review of x-ray studies done 1 or more years postoperatively suggests that about 10% of the patients develop primary fusion of the interspace, and in most cases the implant becomes fused to the surface of one of the vertebrae (Fig. 3). Occasionally, the implant is absorbed. To determine the structural consequences of this procedure, anatomical and x-ray studies of these patients are being continued.

In most cases the implant appears to deter collapse of the interspace following removal of the intervertebral disc. We believe the intervertebral bone implant is a barrier to recurrent disc protrusion at the same space, since this did not occur in any patient of the series during the follow-up period.

References

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