POSTERIOR FUSION OF VERTEBRAE IN TREATMENT FOR PROTRUDED INTERVERTEBRAL DISK*

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MORE than a quarter of a century ago Mixter and Barr described the protruded intervertebral disk as one of the causes of low-back and sciatic pain. Now after 27 years of investigation, the controversy over the proper treatment of these patients is still with us. The main question is whether to fuse the vertebrae following removal of a protruded intervertebral disk.

Unfortunately, some of the arguments rest solely on professional jealousy.

Before Mixter and Barr described the protruded intervertebral disk, the diagnosis and treatment of low-back pain and sciatic pain were relegated to the field of orthopedic surgery. There was not much broad interest in how the problem was handled. In the light of today's knowledge, the methods used appear rather crude. Manipulations under anesthesia, physical-therapy measures, use of braces and supports, and lumbosacral and sacroiliac fusions yielded equivocal results; and yet some of the patients seemed to get well. Naturally the orthopedist was interested in the spinal column as the source of the patient's complaint and believed that if he could correct the vertebral abnormality the patient would be relieved of his symptoms. Some patients with no sciatic pain were incapacitated by backache, and among that group several abnormalities were encountered that were relieved by fusion of the vertebrae involved. Moreover, some of these same patients had sciatic pain, and the fusion relieved a few of them of this latter symptom as well. Although the orthopedic surgeon was encouraged, he was not satisfied with the result of his efforts, for other patients still suffered from their symptoms.

In 1934 it appeared that the solution had been found. In that year Mixter and Barr described the protruded disk as one of the causes of backache and sciatic pain, which fact suggested that perhaps removal of this lesion was what was required for relief of the patients who did not improve with other orthopedic treatment.

Although opinion swung back and forth, a trend toward acceptance persisted until finally it was stated that all backache and sciatic pain were caused by protruded intervertebral disks and if one only removed them the patient would get well. The efforts of the orthopedic surgeon were discarded. Backache ceased to be considered, and relief of sciatic pain became paramount.

Soon after the recognition of the protruded intervertebral disk as an entity there were glowing reports of success following removal of the protruded fragments. Reports of 90 to 95 per cent relief of symptoms were not uncommon, and the operation gained favor not only among the medical profession but among lay persons. When these early reports were scrutinized carefully it became evident that the successes reported pertained only to the relief of the sciatic pain, the backache symptom having been ignored. The fallacy in judging by this single criterion soon became apparent. There are two main symptoms of a protruded disk: backache and sciatic pain. Also, every operation on the skeletal system must stand the test of time before it can be judged either a success or a failure; and removal of protruded intervertebral disks could not for long be allowed as an exception to this rule.

Subsequent reports on the success of disk operations began to consider the relief of both backache and sciatic pain, and the

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percentage of successful operations began to decline. It became apparent that any operation that relieved the sciatic pain but left the patient with a disabling backache—or relieved backache without relieving the sciatic pain—could not be counted a success. If this concept can be accepted the orthopedic surgeon and the neurosurgeon can meet on common ground for the ultimate benefit of their patient.

It must be agreed that there are certain conditions of the vertebral column that produce backache alone and are relieved by fusion. Unless there are nerve-root symptoms the neurosurgeon need not be interested and the orthopedist proceeds with the fusion operation. In this category, for examples, are congenital anomalies of the spine, spondylolysis, spondyloisthesis, fractures, degenerative arthritis, and infectious lesions. In these cases fusion usually relieves backache satisfactorily.

If the above abnormalities of the spine are accompanied by nerve-root irritation and sciatic pain, however, the neurosurgeon should be interested for the part he can play in relieving the nerve-root compression. When the two symptoms are associated, is it justifiable merely to attempt relief of the sciatic pain by removing the source of nerve-root irritation and to do nothing about the cause of the patient’s backache, not fusing the spine? Should a proved operation for relief of backache be discarded because of the recognition of an occasionally associated lesion, with hope to relieve both symptoms?

SELECTION OF METHODS AND PATIENTS STUDIED

At the Mayo Clinic we began in 1938 to try to identify before operation the patient who, because of spinal abnormalities, might have persistent backache after removal of a protruded disk, and who would be served better by simultaneous fusion. Our neurosurgical department has been most cooperative in this endeavor and has relied on orthopedic judgment as to whether to fuse the spine immediately following removal of a disk.

The first accepted indication for fusion was the presence of spondylolisthesis. Gradually added were spondylolysis, localized degenerative arthritis, partial sacralization, scoliosis, vertebral fractures, degenerative changes of the facets, presence of six lumbar vertebrae, and other congenital anomalies. But in some cases fusion was performed though the only physical indication for it was narrowing of the lumbosacral joint; and in some the decision for fusion was based on a judgment of operation that the joint was unstable, even though roentgenograms had revealed no skeletal abnormality. In both of these situations the histories described backaches experienced over long periods, aggravated by activity and relieved by rest, but without general change. Some other patients whose vertebrae appeared normal roentgenographically were treated with fusion because of recurrent protrusion of a disk.

In deciding whether to fuse the vertebrae after removal of a protruded intervertebral disk, each patient must be evaluated individually. The finding of a roentgenographic abnormality of the spine does not in itself make the decision. The patient’s history, his age, his stature, and his occupation must all be considered in making the final decision. One hesitates to advise fusion of the vertebrae for patients beyond the age of 55 to 60, and yet such a patient may be suffering from backache and sciatic pain that can be relieved only by surgical intervention. On the other hand, a young individual who intends to lead an active life may better be treated by fusion, even though the vertebral abnormalities at the time he is seen are rather minimal.

Fig. 1 compares the frequency of the removal of protruded intervertebral disks with that of the combined operation, as recorded at the Mayo Clinic. It is to be noted that in 1936 and 1937 fusion was not added to removal in any case; the evolution of the combined operation began in 1938. The incidence of fusion in conjunction with the removal of a protruded intervertebral disk, having followed a generally upward course,
stood in 1959 at 51 per cent of all instances of disk removal.

The greatest relative use of the combined operation came in the years 1952, 1953, and 1954. At that time a roentgenographic finding that the interspace was narrow was considered an indication for fusion. Also, at that time patients began to return to us who had had protruded disk material removed from normal interspaces and now were experiencing recurrence of protrusion with marked narrowing of the interspace and a complaint of backache.

Whether this narrowing of the interspace constitutes an indication for fusion is debatable. However, it seems only reasonable to assume that if sufficient cartilage is extruded from between two vertebrae, the interspace may narrow further. Moreover, if the protrusion is caused by a degenerative process in the disk, this process will continue and lead to further narrowing, sclerosis, osteoarthritic changes, and the complaint of pain in the back even after the protruded fragments of disk are removed.

Hence the high point in the percentage of combined operations was ascribable largely to development of the belief that the patient with a narrowed interspace as his only abnormal roentgenographic finding is more likely to have a long-term good result if fusion is performed at the time the protruded disk is removed.

Continuance of use of the combined operation can be justified only on the basis of long-term follow-up of comparable groups of patients who have undergone removal of protruded intervertebral disk with and without simultaneous bone-grafting procedures.

In all but one or two patients of the Mayo Clinic the posterior fusion has been used. At first single or double tibial bone grafts were used. In recent years we have been using more iliac bone grafts because of a general impression that the results of such fusions are more satisfactory. Occasionally when the gap to be bridged is too long we still utilize tibial bone, sometimes augmenting it with iliac chips.

Series Studied. In order to compare the results of the removal of a protruded disk with the results of removal and fusion, two groups of patients were traced for a minimum of 6 years and a maximum of 10 years.
following operation. We were able to trace 450 patients who had the combined operation and 555 who had only the removal of protruded disk fragments.

Relief of sciatica as well as the relief of backache was studied in both groups. In respect to each type of pain the result was graded good if complete relief was reported; fair if the symptom was partially relieved; and poor if the pain was the same as before operation, or worse. Thus an excellent result was one in which the patient reported complete relief of both sciatic pain and backache. At the other extreme was total failure—that is, the patient’s backache and sciatic pain were the same as before operation or worse. Between these two extremes were several groups partially relieved of one or the other symptom.

For those who advocate only the removal of the protruded disk and no fusion despite skeletal abnormalities, it should be pointed out that the skeletal abnormalities as observed roentgenographically in the two groups were similar except that there were no cases of spondylolisthesis or arthritis of the facets in the group treated by removal of the disk alone. Otherwise the groups were comparable. Also, though it might be suspected that the inclusion of vertebral abnormalities lowered the proportion of good results among the patients treated by disk removal alone, this did not prove to be true in our study; for if the patients with spinal abnormalities were eliminated, the final results for the group remained unchanged.

RESULTS

Over-all end results of the two operations are given in Table 1. The combined operation completely relieved the backache of 68 per cent of 450 traced patients and the sciatic pain of 73 per cent. Removal of the protruded disk alone completely relieved the backache of only 48 per cent and the sciatic pain of only 52 per cent of the 555 traced patients. For both types of pain there was a poor result in 4 per cent of the combined-operation group and in 13 per cent of those treated by removal of the protruded disk alone. Other patients in both groups received partial relief of both symptoms and their results were judged as fair.

The significant findings from this comparison are that the combined operation relieved both symptoms in 20 per cent more patients than the operation for removal of the protruded disk alone and that there were three times as many failures when the fusion was omitted. Simultaneous fusion appeared to have had an acceptable result in 95 per cent of the patients as compared to 84 per cent in those without fusion.

It is worth while also to compare the relief of sciatic pain in the 304 patients whose backache was relieved completely by the combined operation with the corresponding results among the 266 patients whose backache was relieved completely by disk removal only. Here again, in respect to good results achieved, an advantage of approximately 20 percentage points lies with the combined operation.

The fair results in both groups do not require discussion.

In some cases neither operation relieved the backache or the sciatic pain. Of 23 patients (5 per cent) who were treated by the combined operation and who failed to gain relief from their backache, 17 (4 per cent)

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<td>DR CO†</td>
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<td>Good</td>
<td>44</td>
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<td>Fair</td>
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<tr>
<td>Totals</td>
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* All numbers in table are percentages of these groups.
† Disk removal only.
‡ Combined operation (disk removal plus vertebral fusion).
failed also to gain any relief from sciatic pain. This indicates an over-all total failure of 4 per cent in the combined operative group. Of the 87 patients (16 per cent) treated by disk removal alone who failed to gain any relief of backache, 72 patients likewise failed to gain any relief of sciatic pain, making the over-all failure 13 per cent.

These data represent the most recent Mayo Clinic statistical comparison of results in these two groups of cases.

COMMENT

The preceding statistics seem to indicate that the chances of a long-term good result are approximately 20 per cent better after the combined operation than after removal of the protruded portion of the disk alone. The chances of total failure are about three times higher when the fusion is omitted. Why should this discrepancy be present in the long-term follow-up of cases when the immediate postoperative results of disk removal appear so satisfactory? The questions may be answered as follows.

A spinal column that is fused successfully remains solid and even gets stronger as time goes by; the graft hypertrophies with the stress and strain placed upon it. On the other hand, if a disk protrudes only because of a degenerative process present in it, the simple removal of protruded fragments does not stop progression of this degenerative process. As the degeneration progresses a back that has been asymptomatic may become painful. Indeed, it may incapacitate the patient to such an extent that he seeks further medical assistance, and eventually a fusion may be necessary to relieve him of backache.

By now every orthopedic surgeon and neurosurgeon must realize that successive operations on the vertebral column are increasingly difficult. If fusion is to become necessary ultimately, the optimal occasion for it is the time of the first operation.

At present my colleagues and I do not believe that all vertebral columns should be fused after removal of a protruded intervertebral disk, even though our statistical evidence may seem to warrant this conclusion. Each patient must be evaluated individually; and if his age, occupation, history of backache, physical condition, and roentgenograms indicate the combined procedure as being in his favor, then fusion should be performed after removal of the protruded intervertebral disk.