THE END-RESULTS OF SURGERY FOR RUPTURED LUMBAR INTERVERTEBRAL DISCS
A FOLLOW-UP STUDY OF 327 CASES
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Between January 1, 1939, and March 31, 1947, 378 patients were submitted to operation for ruptured lumbar intervertebral discs in the private practice of the authors of this communication. Of these, 260 were operated on between January 1939 and April 1942 and the remaining 118 between January 1946 and March 1947. The four-year break in the series was occasioned by the absence of both authors in military service.

One of the 378 patients died. He was operated on in January 1939 and died on the 10th postoperative day. The clinical cause of death, bilateral bronchopneumonia, was verified by necropsy.

The purpose of this communication is to report the end-results to the present time of 327 of the 377 patients who survived operation.

MATERIALS AND METHODS

In July 1947 a questionnaire concerning the results of their operations for ruptured lumbar intervertebral disc was sent to 363 of the surviving 377 patients operated on during the approximately eight-year period ending in March 1947. The 327 replies that were received represent an approximately 90 per cent response. The 80 patients who took advantage of the opportunity for a follow-up examination offered in the questionnaire constituted, in effect, a control group in that they served as a check on the reliability of the answers given by the whole group.

The questionnaire sent to these patients (Fig. 1) was worked over until the questions had been made so simple that they could not possibly be misunderstood, while at the same time they were designed to supply practical, precise information as to the success of the operation in the individual case.

The break in the series of operations occasioned by the military service of the writers naturally divided the group into long-term and short-term follow ups. When the replies to the questionnaires were tabulated, however, it was found that the replies to the four questions in the long-term group of cases differed from those in the short-term group by less than 1 per cent. In the analysis of results the two series are therefore combined.

It should be emphasized that this follow-up study concerns only private patients. Clinic patients are notoriously difficult to trace and for this reason, if no other, it seemed wise to exclude the entire category.

PRINCIPLES OF MANAGEMENT

For a better comprehension of the results to date in these cases it is necessary to summarize briefly the broad policies that are employed in the man-
agement of patients with suspected ruptured intervertebral discs in the lower lumbar region and which have been set forth in detail in a recent publication. These principles of management have been employed with scarcely any modification in the period covered by this study. In particular, the criteria by which patients are selected for operation, as well as the technical surgical procedure employed, have scarcely varied during the entire period.

The principles of management may be summarized as follows:

1. Unilateral (occasionally bilateral) sciatica complicating low back disability and refractory to conservative treatment is regarded as the only specific indication for surgery on the diagnosis of ruptured lumbar intervertebral disc. Low back pain not complicated by sciatic radiation is practically never accepted as an indication for surgery.

2. The initial episode of pain is treated by conservative measures over a long period of time, since a large proportion of patients with ruptured lumbar intervertebral discs will recover without operation. Surgery is never performed until conservative treatment has been given a fair trial.

3. Most patients with ruptured lumbar intervertebral discs present unequivocal neurologic signs if they have symptoms severe enough to justify operation. These signs are essential for the making of an accurate diagnosis and can also be relied upon for localization of the lesion.

4. The diagnosis of ruptured lumbar intervertebral disc is made on clinical findings. If symptoms are incapacitating, and if clinical findings are not
sufficiently clearcut to localize the lesion accurately, myelography is employed. This is a valuable localizing measure but it is not a diagnostic procedure and is not so regarded.

5. Operation is never performed during a remission, even if the patient presents an absolutely classic history of ruptured lumbar intervertebral disc. Failure to observe this precaution is one of the most common causes of negative explorations, of which more will be said later.

6. Operation for removal of a ruptured lumbar intervertebral disc is accomplished without destruction of the lamina or of the articular facets. Complete removal of the entire nucleus pulposus, loose pieces of annulus fibrosis and cartilaginous plates is possible through a small unilateral interlaminar exposure.

7. The posterior annulus fibrosis is not opened unless a complete or incomplete tear can be demonstrated in it by inspection or by palpation with a blunt instrument. If a tear cannot be demonstrated, the exploration is listed as negative. Adequate decompression of the involved nerve root is, however, carried out.

8. Primary spinal fusion is never combined with simple removal of the ruptured intervertebral disc. Patients who continue to have incapacitating backache after simple disc surgery may require secondary spinal fusion, but a properly performed operation on the disc does not in any way interfere with subsequent fusion operations.

9. Convalescence is strictly supervised. The patient remains recumbent for 10 days after operation, is permitted to walk on the 13th day, and may leave the hospital on the 14th day. Unless there is persistent disability referable to the lower back, no support for this region is regarded as indicated during convalescence. Patients who do sedentary work may resume their activities 4 weeks after operation but laborers should not return to their regular work for 3 to 6 months.

GENERAL DATA

The age range in the 378 patients in this series was from 16 to 74 years. Four patients were under 20 years of age and 18 were over 60 years. There were 259 patients, more than two-thirds, who were between 30 and 50 years of age. The series included 257 men and 121 women.

It is unfortunate that data are available as to the occupation of the patients in only 286 cases. Eighty-six (30 per cent) in this group were laborers, 41 (14 per cent) were farmers, 67 (20 per cent) were housewives, and the remaining 92 patients (36 per cent) were variously students, teachers, office workers, executives, nurses, physicians and salesmen. If farmers are classified as doing heavy work, 44 per cent of the entire group of 286 patients whose occupations are known fell into this group. The housewives, who comprised 20 per cent of the patients, constituted another group whose work requires a great deal of activity even if it cannot properly be termed heavy.

In 5 of the 378 cases there were two ruptured discs, the ruptures in each instance occurring in the 4th and 5th lumbar discs.
Negative Explorations. In the long-term group of cases, in which operation was carried out before 1942, there were 28 negative explorations. In the short-term group, in which operation was carried out after 1945, there were only 2 negative explorations. The difference is partly explained by the fact that in the short-term group not a single patient was operated on during a remission of sciatic pain.

Another significant observation in this connection is that 16 of the 30 patients whose explorations were negative (53 per cent) were submitted to operation after diagnosis had been made and localization accomplished chiefly by myelographic findings rather than by clearcut clinical findings. Moreover, in the remaining 14 cases clinical and myelographic findings were often not in agreement. Apparently the best way to reduce the number of negative explorations is to avoid compromise with the classical clinical symptoms of ruptured lumbar intervertebral disc.

FOLLOW-UP RESULTS

Relief of Pain. Of the 327 patients who replied to the questionnaire 152 (46.5 per cent) stated that they no longer suffered from pain in the leg. Twenty-seven (4.6 per cent) continued to have pain as severely as before operation. Of the remaining 148 patients (45 per cent), 123 had infrequent attacks of pain which was usually fleeting and was not disabling. The other 25 always had some discomfort and also had attacks of severe pain at varying intervals.

There were 131 patients (40 per cent) who stated that they were completely relieved of the low back pain from which they had suffered before operation. Twenty-five (7.7 per cent) complained that it was just as severe as before operation. The other 171 patients (52.3 per cent) suffered from attacks of low back pain at varying intervals. In some instances recurrences were regular and disabling. In other instances the episodes consisted only of a transient "catch" in the back, usually following heavy lifting or some out-of-the-ordinary twisting motion.

Ability to Work. Of the 327 patients who replied to the questionnaire, 280 (85.6 per cent) stated that they were then doing precisely the same type of work as they had been engaged in prior to the onset of illness. Thirty-nine patients (12 per cent) were still gainfully employed but had had to change to a less strenuous type of occupation, and only 8 patients (2.4 per cent) replied that they were unable to do any type of productive work because of the persistence of symptoms.

Success of the Operation. Two hundred fifty-nine patients (79 per cent) stated that from their standpoint the operation was entirely successful and 36 (11 per cent) regarded it as partly successful. In other words, 90 per cent of the 327 patients were partially or entirely satisfied with the results of surgery.

Composite Results. When the replies to the various inquiries in the questionnaire were tabulated and evaluated as a whole, it was found that 131
patients (40 per cent of those who replied) considered themselves cured. Their answers indicated that they had been relieved of all symptoms, that they had returned to their former occupations, and that they were able to indulge in all the activities, including the recreational activities, to which they had previously been accustomed. Another 128 patients (39.2 per cent) had some residual low back pain or sciatic disability or both but were able to engage in their usual occupations and activities and considered the operation a success. From their personal standpoint, therefore, the results of surgery were apparently satisfactory. In the remaining 68 patients (20.8 per cent) results varied from partial success to complete failure.

Control Group. Each of the 80 patients who returned for follow-up examination in response to the invitation on the questionnaire, and who were regarded as forming a sort of control group, was personally seen and examined by one or the other of the writers. In each instance a detailed follow-up history was obtained, and a careful physical and neurologic examination was made. Twenty-one of the 92 patients who had indicated in their replies that they regarded their operations as unsuccessful were among those who returned to the office. In only three of the 21 was it possible to determine from physical and neurologic signs that the operation had been really unsuccessful, and in none of the patients who returned was the condition found to be worse than the replies to the questionnaire had indicated.

Compensation Group. Of the 378 patients operated on for ruptured lumbar intervertebral disc, 91 (24 per cent) were eligible for compensation for their condition through the Workmen's Compensation Act or through liability insurance companies. Seventy-five of the 91 (82.4 per cent) returned their questionnaires: 48 (64 per cent) stated that they were engaged in the same type of work as before operation; 19 (25.3 per cent) had changed their occupations because of persistent symptoms; and 8 (10.7 per cent) stated that the severity of their symptoms made it impossible for them to work at all. Fifty of the 75 (66.6 per cent) considered the operation successful, 8 (10.7 per cent) considered it partially successful, and 17 (22.7 per cent) considered it as a failure.

Recurrences. Twenty-one (5.5 per cent) of the 378 patients in this series were subjected to secondary operations for suspected recurrence of the ruptured lumbar intervertebral disc. In 10 (2.6 per cent of the total number) true recurrences were demonstrated at operation at the same interspace at which the original lesion had occurred. In 2 other patients ruptured discs were demonstrated at different levels. One of these patients had been operated on in 1942 and had had relief of symptoms until 1946. The second had been operated on in 1939 and had had relief of symptoms until 1946.

In 9 instances re-exploration demonstrated neither a recurrent nor a new lesion, the only finding being dense scarring about the involved nerve root. In no instance was a third recurrence demonstrated or suspected.

Negative Explorations. Of the 30 patients in whom operation had produced only negative findings 18 replied to the questionnaire, and 13 of these (72 per cent) stated that they had been free of symptoms since operation.
DISCUSSION

From the standpoint of the desired objective, information as to the present status of patients operated on for ruptured intervertebral disc, the simple questionnaire used in this study was entirely satisfactory. Some criticism, however, has been raised concerning the question as to whether the operation was considered satisfactory, on the ground that truthful answers cannot be secured to such an inquiry. It is quite true that some patients might be inclined to classify an operation as successful because they survived it. It is also true that others might be so grateful for any degree of relief from disabling pain that they used the term success rather loosely. On the other hand, these were private patients, who had elected operation for relief and who for the most part had financed their own treatment. It seems fair, therefore, to permit them to be the final judges of what treatment achieved, since they alone could evaluate the pain and disability that they had experienced before operation in terms of the postoperative residual or lack of residual.

Probably the most important inquiry in the questionnaire concerned the ability of the patient to do the same work after operation as before his illness. Certainly this is of paramount concern to the individual and it is of equal concern to employers, who might question whether it is sound economic policy to authorize surgery upon employees with disabilities caused by ruptured lumbar intervertebral discs. It is significant, therefore, that more than 85 per cent of the patients who replied to the questionnaire stated that they could do the same work in which they had previously been engaged, and that only 8 patients replied that they could do no work at all because of persistent symptoms. The large proportion of patients engaged in heavy work makes these figures even more significant.

As has been noted, the incidence of dissatisfied patients in the compensation group was twice as large as in the whole group. A detailed discussion of the discrepancy would involve factors beyond the scope of this paper, but the implications of the poorer results in the compensation group are obvious. The same disproportion was evident when these patients were asked to evaluate the success or failure of the operation: 17 of the 32 patients who thought the operation a failure were patients in the compensation group. Campbell and Whitfield had a similar experience. In their 122 followed-up cases of ruptured intervertebral discs, patients receiving compensation accounted for 19 of the 21 failures. Prince was perhaps not unduly cynical when, in the discussion of this communication, he accounted for the disproportion on the basis of the "universally deteriorating effect of insurance on the ethics of the human race." Be this as it may, it is an agreeable surprise to observe the regularity with which patients submitted to surgery for ruptured lumbar intervertebral discs are able to return to their former occupations.

The age of the patient appeared to influence the results of surgery in only two ways: Convalescence was moderately prolonged in patients over 50
years of age, and those in this age group had more residual backache than
younger subjects, probably because arthritic changes had developed at the
site of the diseased discs. There was no notable difference in results from the
standpoint of sex.

It is interesting that 13 of the 18 patients with negative findings at opera-
tion who replied to the questionnaire reported relief of symptoms. The ex-
planation is probably to be found in certain points of technique. The first is
that in the writers' practice the annulus fibrosus is never opened unless a
distinct tear can be demonstrated by inspection or by palpation; even if a
disc appears prominent or unusually soft, the annulus is not incised unless
a tear, which is the essential feature of the disc lesion, can be demonstrated.
The second point is that in all negative explorations the nerve root is thor-
oughly decompressed laterally into the foramen. It is quite possible that
some of the patients who reported relief after operation had a true rupture
of the annulus fibrosus which was, however, located so far posterolaterally
that it could not be visualized. Under these circumstances a thorough de-
compression of the nerve root might well account for the amelioration of
symptoms.

That the operative treatment of ruptured lumbar intervertebral discs
resulted in only 40 per cent of completely cured patients in a series of 327
followed-up cases at first glance might seem discouraging. Upon reflection,
however, there seems no reason for pessimism. It may be stated unequivo-
cally that once a lumbar intervertebral disc has ruptured, no surgical effort
can hope to restore its anatomic integrity. If this premise be accepted, then
the relatively low percentage of complete clinical cures is easy to under-
stand.

Each one of the intervertebral discs in the lower lumbar region is an im-
portant weight-bearing structure, so important, in fact, that it is in some
respects remarkable that patients learn to compensate for the permanently
diseased joint as well as they do. If to the potential disability which is pres-
ent as the result of the diseased disc is added the additional deleterious fac-
tor of nerve root compression from either disc fragments or postoperative
infiltration of the nerve roots with fibrous tissue, the clinical results become
still more satisfactory. Moreover, as has been pointed out, the functional
results are even more gratifying than the number of complete cures secured.

Perhaps the chief value of this follow-up study is the demonstration of
the results that can be secured by treating all patients by a single method,
simple removal of the injured disc, without any type of spinal fusion. The
combined operation, with its inevitable distribution of responsibility for the
end-results, does not seem to be in the best interests of the patient at the time
the disc operation is performed. If it proves necessary, it can be done as a
secondary, independent procedure. A skilfully performed disc operation does
not in any way interfere with the operative field if it is decided that per-
sistent symptoms warrant spinal fusion.

The results in this series seem to substantiate this point of view. Assum-
ing that spinal fusion by any method could secure results which were 100 per cent effective—such figures, of course, are beyond the claims of even the most enthusiastic advocates of the procedure—4 out of every 10 patients in this series who recovered completely as the result of a simple disc operation would have been submitted to a needless operation, with its attendant risks to life and with its prolonged period of postoperative disability. Unless a large series of long-term results can be published showing a higher percentage of cures and more satisfactory results with the fusion operation than were secured in this series by simple disc surgery, it seems fair to conclude that the best method of treatment of ruptured lumbar intervertebral discs refractory to conservative measures is by simple removal of the damaged disc.

So far as could be determined from the analysis of these replies, patients regard recurrent low back pain after operation as more troublesome than recurrent sciatica. Patients who regard operation as not satisfactory because they must protect their backs when they are engaged in any type of heavy work or exercise form the group in which secondary fusion operations might perhaps be recommended. It is of interest, therefore, that no patient in this series who suffered from recurrent back pain considered his disability sufficiently severe to warrant fusion for its relief.

SUMMARY AND CONCLUSIONS

1. A follow-up study of 378 patients submitted to operation for ruptured lumbar intervertebral disc achieved a response from 327 patients, 80 of whom were also examined personally. Operation in each case was limited to simple removal of the diseased disc.

2. Forty per cent of the patients who replied to the questionnaire could be regarded, on the basis of their own testimony, as completely cured, while another 39 per cent had more or less satisfactory results. In the remaining 21 per cent the results were only fairly successful or operation had to be regarded as a failure. More than 85 per cent of the patients, however, were able to return to their previous occupations, while only 2.2 per cent were unable to work at all. The disproportionately large number of less than satisfactory results in the patients receiving compensation was noteworthy.

3. This series of cases shows the high proportion of cures and of satisfactory functional results that can be secured with a simple operation on the ruptured disc. Spinal fusion is therefore regarded as contraindicated at the original operation, and it is recommended that it be reserved as a secondary procedure for those cases in which persistence of symptoms warrants additional surgery.

REFERENCES
