FROM THE ORTHOPEDIC CLINIC OF THE KAROLINSKA INSTITUTET, STOCKHOLM. CHIEF: PROFESSOR STEN FRIBERG

SPINAL FUSION IN LOW BACK PAIN

By

LARS UNANDER-SCHARIN, M.D.

The conservative treatment of low back and sciatic pain with bed rest, corsets and physical therapy is in many cases effective, but a great number of patients do not respond to conservative treatment and surgical intervention must therefore be employed. Surgical treatment during the last few decades has been concentrated on the intervertebral discs, partly by exstirpation of protruding discs and partly in stabilization procedures. The first type of operation is especially directed at sciatic pain. It has been the subject of a great number of publications. The latter type of operation, particularly directed at low back pain, has not been discussed in the literature to the same extent.

Assuming that disc degeneration is the cause of low back pain the requirement of a successful osteosynthesis is that it should stabilize the disintegrated intervertebral discs in a satisfactory manner. This in its turn presupposes an accurate *diagnosis*. The diagnosis of disc degeneration is roentgenological except in those cases where disc herniations are exstirpated (prolapsed disc substance naturally presupposes degeneration of the disc). Sclerosis and osteophytes on the vertebral margins, lowered interspace and vacuum phenomena have all hitherto been regarded as sure signs of degeneration. *Knutsson*'s test for instability has enabled us to make an early diagnosis of disc degeneration. Comparative roentgenological and patho-anatomical investigations by *Knutsson, Friberg* and *Hirsch* have, in point of fact, shown that in cases where there was only instability of the vertebrae without other roentgenological signs, there was extensive disintegration of the disc. A further advance in the diagnosis of disc degeneration has recently been made by *Hirsch* and *Lindblom* by means of disc puncture and contrast filling of the disc.

The *operative technique* for lumbar osteosynthesis has varied. The

original Albee technique of only fixing the spinous process has been extended to include the fixation of the arches and intervertebral joints. Fixation of the vertebral bodies has also been undertaken. If disc degeneration exists, osteosynthesis presents difficulties, thanks to the often pronounced instability in the altered discs and the great mechanical stress on the region. The results of different operative methods have been all too scantily reported to give any sure guidance.

The author dealt with the present problem in a previous work (dissertation 1950). On the basis of this earlier experience several considerations involving the problems and results of spinal fusion for low back pain seem to be worth discussion at this point.

MATERIAL

A total of 80 patients, 36 men and 44 women, suffering from lumbago alone or both lumbago and sciatic pain have been treated by spinal fusion. All of them showed definite signs of degenerative changes in the lumbar or lumbosacral discs. Our principle has been that osteosynthesis should be performed in the presence of severe lumbago without sciatica and, as a secondary procedure, following operation for disc herniation when severe back trouble has occurred or remained. Primary fusion with additional exstirpation of the disc herniation has been done in only three cases and not according to the usual method. The material includes all patients who were operated on in this hospital from 1937 until 1947.

Fifty-one patients had simple disc degeneration of which 21 were lumbar and 30 were lumbosacral. Twenty-nine patients showed multiple disc degeneration.

Symptoms: In addition to back trouble which was the indication for operation, 41 (51.25 %) had or had had sciatic pain. There were two types of back complaint, one in the form of acute attacks of lumbago and the other consisting of nagging pain with fatigue and instability in the back. The latter type has been predominant in these cases of severe low back pain. As is to be expected, this type of pain gives the patient more distress than acute attacks of lumbago with periods of total freedom from pain. Of the 41 patients with sciatica 25 had neurological symptoms. No one had had trouble for less than 2 years. Only 3 patients have had trouble for as little as 2 years. Thirty patients had had symptoms for 5 to 10 years and 37 patients suffered for more than 10 years. Of these 37 patients 11 had had symptoms for 19 years or more.

Working capacity: Twenty-three patients were totally unable to

work for short periods (1-2 weeks) and were partially incapacitated. Fifty-seven patients were totally incapacitated for longer periods (3 months or more). The total loss of working time amounts to 114 years or an average of 1.4 years for each of the eighty patients.

Objective findings: The pre-operative findings for 69 patients consisted chiefly of symptoms from the back in the form of muscular contractures, restricted mobility and pain elicited by a blow in the lumbar region. Twenty-one had neurological symptoms. In 7 cases there were no objective findings. The dominating back finding was the characteristic pain elicited by a blow (67 cases).

Previous treatment: Conservative treatment in the form of corsets, physical therapy and roentgen therapy had been tried without improvement. In 17 cases laminectomy with or without exstirpation of prolapsed disc had been performed. Eleven patients had been operated on once, 4, twice, and 3 patients had been operated on three times.

The operative methods may be analysed as follows:

Albee	7
Albee + fusion between arches (5 of these with arthrodesis in the intervertebral joints)	18
Bilateral grafts after roughening the archsurfaces	11
Unilateral graft, with bone chips on the other side (3 of these with arthrodesis in the intervertebral joints)	24
Bilateral graft on arches that had not been roughened	2
"Locking graft"	18
Total	80

In twenty patients laminectomy was performed in connection with fusion. Disc herniation could be exstirpated in three of these.

Age at time of operation: Sixty-nine patients were between 30 and 49 years old. Eight patients were under 30 years of age, and 3 were more than 50 years old.

Post-operative: After operation the patients remained in bed for 6 to 12 weeks, the shorter periods being for patients operated on with locking grafts. Post-operative complications of any importance have not been observed except for 2 fatal cases of fat embolism which are not included in the 80 cases.

Follow-up examination: No patient was examined, for the purposes of this study, until one year after discharge from the hospital. Fifty patients were examined within 3 years, and 30, 3 years after discharge

from the hospital. One patient has been under observation for 12 years. According to their statements at the time of the last follow-up examination the patients may be classified as follows:

Fully recovered	53 (66.25 %)
Improved	12 (15.00 %)
No improvement	15 (18.75 %)

All 27 of the patients not "fully recovered" complained of low back pain, and of these 12 had residual sciatic pain. *In no case has there been any increase of or any new sciatic pain following the osteosynthesis.* Twenty-five patients were able to resume their work within 6 months after operation, 30 within one year, and 11 were unable to start work again until after one year. Thirteen patients remained unable to work after operation.

In an examination of the objective factors the following circumstances were placed in the foreground:

1) localisation of disc degeneration
2) the number and type of laminectomies
3) the consolidating and stabilizing effect of osteosynthesis
4) the occurrence of post-operative changes
5) the increase in the degenerative changes.

Considered on the basis of the *localisation of the disc degeneration* the simple lumbosacral disc degeneration showed the best results with 76.7 % recoveries; the single lumbar were next at 62 %, and the multiples last with 58.3 % recoveries. Consideration was given to complications such as bone graft complications, number and type of laminectomies, and the occurrence of post-operative changes.

Laminectomies: 14 laminectomies (26.6 %) were performed on the subjectively recovered cases, 4 (33.33 %) on the improved, and 10 (66.67 %) on the unimproved cases. The extent of these laminectomies is recorded as well as the number performed on each patient. The smallest laminectomies were performed on the cases that later recovered and as a rule, only one laminectomy was performed on each case. The laminectomies performed on the improved and the unimproved were of greater magnitude and more in number. The conclusion can be drawn that *major laminectomies carried out on many vertebrae make the prognosis worse.*

Bone *graft complications* were observed in 11 of the recovered cases (20.75 %), in 5 of the improved cases (46.67 %), and in 6 of the unimproved cases (40 %). They were as follows:

Unsatisfactory fixation of the upper end of the osteosynthesis	9
Fracture of the graft with resultant pseudarthrosis	6
Fracture of the graft with resultant pseudarthrosis + unsatisfactory fixation of the upper end of osteosynthesis	3
Unsatisfactory fixation of the lower end of the osteosynthesis	1
Necrosis of the graft necessitating exstirpation	2
Fracture of the graft during operation with subsequent healing	1
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Testing the stability of these cases by x-ray has shown that 12 were stable, 5 unstable; 5 could not be tested because of contractures in the lumbar musculature. Of the unstable cases, 2 had recovered and 3 were unimproved. Of the *7 cases operated on in accordance with Albee's method,* only one healed satisfactorily. This would seem to indicate that Albee's method is not preferable in disc degeneration in which considerable instability is often present. The *18 cases operated on by locking graft* have all, with one exception, united in a satisfactory manner. These cases operated on by locking graft were confined to bed for 3-6 weeks only. The advantage of a shorter convalescence is thus gained by this procedure as well as good rapid union of the osteosynthesis. In subsequent cases not included in this survey we have observed poor consolidation. At the present time we make use of a bone bank and it seems that material from this bone bank together with bone from the patient gives a slower but firmer bone healing than if only the patient's own bone were used.

Degenerative changes have occurred in the disc just above the osteosynthesis in 7 cases. In one of these cases there was also spondylolysis of the arch of the upper vertebra in the osteosynthesis. This would indicate that the disc situated immediately above the osteosynthesis is exposed to increased wear and tear. That this is really so has been proved experimentally by the author.

Increase in the degenerative changes: Nine of the 21 lumbar disc degenerations have shown an increase: 16 of the 30 lumbosacral have progressed, as have also 14 of the 29 cases with multiple disc degeneration. It may be asked whether it really is a question of increase and not one of inactivity and atrophy as a consequence of the osteosynthesis.

Cases *completely free from complications,* without bone graft complications, laminectomies or post-operative changes numbered 31 (38.76 %). Of these 27 had recovered, 3 had improved and 1 was unchanged.

COMMENT

Osteosynthesis performed for severe lumbago with degenerative changes in the lumbar intervertebral discs is of great value if healing is satisfactory. Because of the long hospitalization and frequently lengthy post-operative inaction (especially with manual workers) as well as the risk attending a major operative procedure, osteosynthesis should be reserved for severe cases of lumbago in which the working loss is total or partial for a long period and the conservative treatment has proved ineffective. Cases in which the working capacity is not essentially affected but where the lumbago causes great suffering should be considered for operation. The osteosynthesis seems to prevent the occurrence of sciatic pain, that is to say, the risk of disc herniations can be decreased.

SUMMARY

A survey is given of the results of lumbosacral osteosynthesis performed on 80 patients for severe low back pain associated with degeneration of one or more lumbar intervertebral discs.

1. At the follow-up examination, 53 (66.25 %) had recovered, 12 (15 %) had improved, and 15 (18.75 %) had not improved.

2. No symptoms of disc protrusion in the region of the osteosynthesis could be established at the follow-up examination.

3. Previous extensive laminectomies seem to worsen the prognosis for osteosynthesis.

4. Degeneration of still more discs above the fusion has been seen post-operatively in some cases, and in one case spondylolysis of a previously normal vertebral arch was observed.

RESUME

Il est donné le compte rendu des résultats de l'ostéosynthèse lombosacrée pratiquée chez 80 malades souffrant de fortes douleurs dans le bas du dos associées à une dégénération d'un ou plusieurs disques lombaires.

1. A l'examen complémentaire, 53 (66,25 %) étaient guéris, 12 (15 %) améliorés et 15 (18.75 %) étaient restés inchangés.

2. L'examen complémentaire n'a pas rélévé de symptôme de prolapsus discal à l'endroit de l'ostéosynthèse.

3. Des laminectomies extensives pratiquées antérieurement semblent être défavorables au pronostic de l'ostéosynthèse.

4. On a observé post-opératoirement une nouvelle dégénération des

disques supérieurs à la fusion dans quelques cas et une spondylolyse d'un arc vertébral antérieurement normal dans un cas.

ZUSAMMENFASSUNG

Eine Übersicht der Resultate der lumbo-sakralen Osteosynthese wird gegeben. Die Operation wurde an 80 Patienten, wegen schwerer Schmerzen in der unteren Lendenwirbelregion mit Degeneration von einem oder mehreren lumbalen Zwischenwirbelscheiben ausgeführt.

1. Die Nachuntersuchung zeigte, dass 53 (66.25 %) geheilt, 12 (15 %) gebessert und 15 (18,75 %) der Fälle nicht gebessert waren.

2. Keinerlei Zeichen von Diskusprolaps konnten bei der Nachuntersuchung in dem Gebiete der Osteosynthese gefunden werden.

3. Eine vorausgegangene ausgedehnte Laminektomie scheint die Prognose der Osteosynthese zu verschlechtern.

4. Fortschreitende Degeneration von Bandscheiben oberhalb der Versteifung wurde in einigen Fällen beobachtet. In einem Falle wurde Spondylolysis in einem vorher normalen Wirbelbogen gesehen.

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