Diagnostic external fixation of the lumbar spine

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Indications for operative fusion in the lumbar spine is much debated. It is generally accepted that this operation can be beneficial in certain cases of spondylolisthesis and iatrogenic instability, but its role in chronic low back pain is controversial. Chronic low back pain is one of our most common disorders, and obviously has a multifactorial origin, which can not generally be attacked by operative treatment.

However, experimental works (Mooney and Robertson 1976), have shown that painful conditions similar to those seen in some patients with low back pain can be induced by injection of irritating substances into intervertebral joints or disc spaces. Thus it is probable that painful conditions exist in segmental structures of the lumbar spine. In clinical practice, we have no established method to discriminate pain of segmental origin from pain from other sources, and the differentiation between various levels is uncertain. It is also known that pain extends into adjacent segments and their regions for referred pain when it becomes more intense. Radiographs are usually of little help as they often show degenerative changes at several levels. The significance of these changes is doubtful, and even if they may induce pain, we do not know in what stage or under which circumstances they do so. Several more or less invasive procedures have been presented to diagnose and to localize the origin of pain. These procedures can be either pain provoking, i.e. disc injection, or pain inhibiting as injection of anesthetic agents into intervertebral joints or other anatomical structures supposed to be the origin of pain. However when such tests have been evaluated under scientific premises, it has been hard to prove their diagnostic value.

Locking one or several lumbar vertebral segments with an external fixation frame is a comparatively new method for evaluation of low back pain of possible segmental origin. The external frame connecting pedicular screws was first introduced in the treatment of vertebral fractures (Magerl 1982). Olerud in Uppsala, Sweden, was, so far as we know, the first to apply the technique in patients with low back pain, to investigate whether pain relief could be obtained by immobilization of a suspected painful segment of the spine (Olerud 1986).

In this report of 18 patients, 16 became pain free or dramatically improved in the test, why the pain was considered to originate from the immobilized level, which was then fused.

In their series, a double frame was used where adjustments, usually with distraction of the segment, was performed to find optimal position for pain relief. Diagnostic external fixation of the lumbar spine has later been used clinically, and reports have been published from Toronto (Esses et al. 1989) and Helsinki (Soini and Seitsalo 1992). The general experience is that a majority of patients, usually about 80 percent, has dramatic relief of their back pain with the external immobilization. This has been recorded independent of the type of external frame, for example also with the Magerl Frame or with single frames of Hoffman type locking the segment without distraction. Though, while there is a general experience of pain relief with external pedicular fixation, less is known whether this pain relief will last after subsequent fusion of the immobilized segments, i.e. if the method is useful as predictor for the result of lumbar fusion.

In an early report, Esses et al. (1989) presented a short-term follow-up of 35 patients tested with different methods, among them external pedicular fixation. 27 of these were then fused after a positive response to the test. The short-term result after fusion showed that external fixation was the only test having any correlation to the result after operation. However, the series was small and one of the authors have later indicated the the result might not stand the test in the longer run.

Patients and method

After the first 18 tests previously mentioned, Olerud et al. went on and applied the method in more than 100 patients up to 1987. The main indication was low back pain. These patients were treated in a uniform manner with external fixation test (Figure 1). Patients who

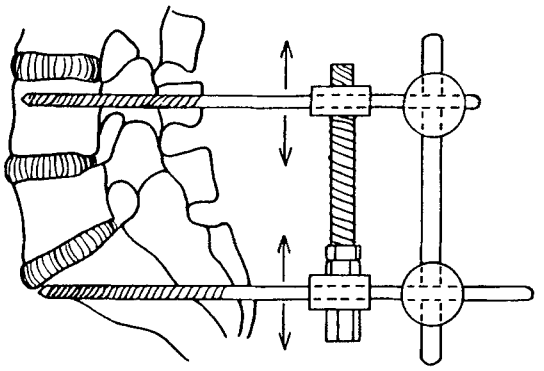

Figure 1. The external fixator locking two vertebral segments

Table 1. 5-year follow-up of patients tested with external fixation of the lumbar spine for low back pain

	Pos. test Fused (n 63)	Neg. test Fused later (n 4)	Neg. test Not fused (n 10)
Improved	(35) 32	3	1
No difference	13	1	4
Worse	15	1	3
At work	15	0	1

became pain-free or significantly improved by the test were operated on by an anterior lumbar interbody fusion (ALIF). The external fixation was kept for immobilization until the fusion was regarded as solid. Two of the authors who did not take part in the original treatment have evaluated these patients as independent observers more than 5 years after test and fusion. The evaluation is not yet complete, but we now have information from more than 80 percent of the patients.

95 patients have been identified from case records, who were all tested with external pedicular fixation because of low back pain, with or without radiation to the legs. 2 of the patients were deceased. Remaining 93 case records have been reviewed. Most of the 93 patients had a long history of back pain and 56 had early retirement pension or sick leave for more than 2 years at time of test. 51 had had previous operations before the test; the total number of previous operations was 103.

While treatment was similar, the radiological diagnosis differed in the group. 22 had spondylolisthesis, 3 had proven spinal stenosis, 3 had previous vertebral fractures and 6 had disc protrusions. Remaining patients had either no changes at all or degenerative changes. A few cases had only increased mobility on flexion-extension radiographs.

Of the 93 patients tested 75 had substantial pain relief by the test and went on to fusion. Another 4 had some effect but did not want to be operated on.

Results

Until now we have results from 77 patients from our own evaluation. In these, the proportion going on to fusion was similar to that of the the whole group, 63 patients out of 77. However, at the reevaluation we found that 4 of the patients with a negative test that were not fused after the test, had later been operated on with fusion on the tested level. They will thus be considered separately.

At the reexamination radiographs with flexion-extension films was performed. All have not yet been reviewed by the radiologist, but from preliminary data pseudarthrosis was only present in a few cases and was no important reason for remaining problems.

Of the 63 patients significantly improved during the test, only 35 regarded themselves as still improved at reexamination after 5 years (Table 1). In 3 of these, another fusion on an adjacent level had been done before reexamination because of back pain, so they could not be evaluated. The patients who did not undergo operation after the test are too few to allow any reliable conclusions. However it is remarkable that 3 of those with negative tests, but who had later been operated on with fusion of the segment, reported improvement at reexamination, compared with their condition before test. However none of them were back at work. Of the patients with pain relief during test, but without lasting improvement after 5 years, most reported that pain relief remained as long as they had the external fixation frame postoperatively. Many regained their pain in a few weeks after removal of the external frame. In the beginning of the series, this was believed to be caused by remaining mobility of the segment, and the patient was immobilized for another period. However, it was later proven that pain also reappeared in spite of radiologically solid fusions.

The significance of the remaining problems in the operated on group is also demonstrated in that 31 of them had had additional back operations at the time of re-examination.

Complications to external fixation were common. 34 patients had superficial infections around the screws and 9 had screw loosening. 5 had root injury and another 2 had leakage of CSF but without signs of root damage. Regarding screw infections, prophylactic

antibiotic treatment was not used in the beginning, but was introduced during the series. Most serious are the neurological complications. This complication has also been reported from Helsinki recently (Soini and Seitsalo 1992), and it is obvious that percutaneous insertion of pedicular screws is more difficult and implies a higher risk than insertion at an open operation. In this series the screws were introduced under general anesthesia; later this procedure have been performed in local anesthesia to minimize the risk for root damage.

Conclusion

The external fixation accomplished pain relief in a majority of patients with low back pain. However, in this series, only 50% had lasting pain relief after 5 years which shows a low prognostic value of the test.

However, the mechanism for pain relief with the external fixation is obscure. It is likely that not only psychological, but also neurophysiological and other mechanism may be responsible. Further research in these respects seems justified.

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