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Discogenic low back pain

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GENERAL DISCUSSION

In this Ph-D thesis, several factors involved in the origin and substaining of low back pain are discussed, focusing on role of the degenerating intervertebral disc.

In general, when surgical treatment of low back pain is considered, an exact localisation of the causing anatomical or functional structure is necessary. Any structure of the lumbar spine that is connected to the nervous system can become a source of pain when affected by disease or disorder. In case of “discogenic” low back pain a major source of the pain is thought to be modulated via nociceptive fibers in the intervertebral disc. It appears that the discs from some selected patients with chronic low back pain are more and deeper innervated than the discs from individuals without back pain symptoms (Ch 3). One of the hypotheses in this study contends that degeneration of the intervertebral disc causes motion of the involved segment to become painful. By stabilising the motion segment any movement will be eliminated and the symptoms disappear. Out of the large group of patients with chronic low back pain we have tried to select patients who fit in this “discogenic” low back pain concept and might benefit from a lumbar arthrodesis. Since undoubtedly chronic low back pain covers a complex combination of pathophysiological, psychological and social factors a strict selection was performed (Ch 5). A lumbar interbody fusion was performed in 157 patients.

Interbody fusion for “discogenic” low back pain

An important aim of this study was to evaluate the clinical outcome after lumbar interbody fusion in these patients. In other words, do patients with “discogenic” low back pain benefit from lumbar interbody fusion? We discussed the postoperative clinical results after 1-year, 3-years and more than 10 years. The initial overall clinical satisfactory result of about 70% was maintained over the years. This does not support the belief that the ongoing degeneration process of the adjacent segments of the spine causes low back pain symptoms later on. Neither do these results implicate that less mobility and natural fusion of spinal segments later in life in the aged spine leads to fewer complaints. The natural history of chronic low back pain is unknown.

In publications on non- (or less) selected low back pain patients as well as on non-surgical studies in patients with chronic low back pain clinical success rates between 60 and 70% are reported.¹⁰ A study by Rhyne⁸ even shows an improvement in 68% of patients with chronic low back pain and painful disc degeneration after discography and without any treatment. This might implicate that in our highly selected group of in patients with “discogenic” low back pain, interbody fusion was not justified as proclaimed by many clinical investigators including Nachemson.⁷ In our point of view, a surgical intervention is only to be considered when clinical success rates clearly exceed the success rates of non-surgical, less invasive, treatments (or the natural cause which is regrettably unknown).

In our study, the superior clinical outcomes were noted if the degeneration process remained limited to one level as shown by discography. Initially $\frac{3}{4}$ of these patients were satisfied with a clear tendency of further improvement over time (long-term satisfying result 86%). After a two level operation an overall satisfactory clinical outcome of approximately 65% was obtained. The latter results did not change with time. Based on these results we conclude that lumbar interbody fusion can be considered in selected patients in which degeneration is also limited to one segment of the lumbar spine.

Bony union correlates with satisfactory clinical outcome. Eighty percent of the patients with bony union, as observed by an independent radiologist, were satisfied. However, of the patients with radiological pseudarthrosis 50% also had a satisfactory clinical result. These results could confirm the inaccuracies in the determination of fusion as described by several investigators (Ch 6 and Ch 7). At present, no reliable non-invasive methods are available to confirm bony union apart from the D-RSA method as described in chapter 7. Only in presence of definitive bony trabecular bridging across a graft-host interface or clear motion on flexion-extension radiographs the fusion status is certain. Without the application of D-RSA the majority of the fusion results of interbody fusion can not reliably be assessed in the remainder of cases. We therefore strongly recommend the use of this novel technique in radiological evaluation of interbody fusion results.

In the literature superior fusion results have been reported with additional instrumentation using pedicle screws and rods. Taking in consideration the uncertainty of the virtually effected fusions, we believe that the overall fusion result of only 60% in our series could have been improved by the additional use of hardware. Another advantage of instrumentation is that the patients can be mobilised immediately after surgery and obviates wearing a lumbar spica.

In the aforementioned study we performed either an anterior or posterior interbody fusion. The surgical procedures are technically difficult. Particularly the ALIF is associated with a known high complication rate. To minimize complications, minimal invasive procedures have been developed for the anterior approach (Ch 4).

Shortcomings

In this study insight in the psychosocial situation of the patients was sought by multiple personal communications. Although personality and emotional factors were assessed as thoroughly as possible standardisation of scores was not obtained. A growing body of literature demonstrates that psychological factors, as assessed by the Minnesota Multiphasic Personality Inventory (MMPI), are significantly related to back pain.^{1,2} The MMPI is a self-administered examination of 566 true/false questions, and it focuses on three clinical scales: hypochondriasis, depression, and hysteria. Scoring high on these personality traits predicts poor outcomes of lumbar fusion operations. One of the most limiting factors of using the MMPI is the relatively high numbers of false-positive findings, as shown by Leavitt⁶. Other shortcomings of the MMPI are its nonpractical use and long administration time. Nevertheless the MMPI can be used as a predictor of poor responses to any treatment, either conservative or surgical.^{2,5,9} In patients with elevated scores on the hypochondriasis, hysteria and depression scales, one is dissuaded from surgical treatment.

In this thesis limitations in the selection and evaluation of surgical management of chronic low back pain patients have been listed. First of all, we performed interbody fusion to prevent painful motion at the degenerated intervertebral junction while objective

criteria to assess slight segmental motion between lumbar vertebrae are not present. It is therefore not possible to evaluate the effect of lumbar interbody fusion on these presumed motions. A second limitation in the management of “discogenic” low back pain patients by interbody fusion is the postoperative evaluation of the fusion status. Brodsky et al.³ and others have shown that radiological evaluation of fusion status and findings at surgical exploration only correspond in about 60% of the cases. Therefore, despite the involvement of an independent radiologist and strict fusion criteria (see Ch 5), the reliability of the fusion outcome can be questioned. This limitation was not only encountered in our study but is a common problem in studies on this issue. A third limitation is the evaluation of the clinical outcome. Some investigators such as Howe and Frymoyer⁴ have shown significant differences in the surgical outcome of the same patient population when evaluated by different criteria. The authors who claimed the best results utilised questionnaire designs that were exclusively based on subjective criteria (pain level and satisfaction with results). Therefore a combination of these subjective criteria with the use of functional criteria (e.g. Roland-Morris scale) is recommended.

Current approach

Based on current knowledge and available techniques we believe that a lumbar interbody fusion operation can be offered to a strictly selected patient group with “discogenic” low back pain. Preoperative psychological testing by an independent psychologist using standardised psychological tests such as the MMPI appears mandatory. MRI is useful in determining the levels of lumbar disc degeneration. Only the discs displaying degenerative changes on MRI are additionally tested on pain provocation by discography. In this sequence only patients with painful degeneration at one lumbar level are considered to probably benefit from interbody fusion. On theoretical basis we prefer the use of a minimal invasive anterior fusion technique in combination with a posterior pedicle screw-rod fusion system. The additional hardware is used to improve the fusion results and facilitate post-operative mobilisation. We strongly recommend the use of D-RSA to evaluate the post-operative fusion status.

Future directions

In the future more objective selection criteria need to be elaborated. In the discogenic back pain concept a “painful segmental instability” is conceived. It were useful to obtain “objective” information on not only the painfulness (discography) but but also on the segmental instability. The latter likely can be obtained by using the D-RSA technique preoperatively. After a percutaneous transpedicular placement of tantalum markers (neuronavigation) in the vertebrae the range of motion of the different segments can be assessed. This preoperative placement also allows a better insight in the immobilisation capabilities of a lumbar orthosis.

The use of human bone morphogenetic proteins (BMP's) as a osteoinductive growth factor in spinal fusion seems promising but needs further investigation in prospective randomised studies on humans. New stand-alone interbody cages are developed. Whether these cages can equal the results using grafts or cages with additional hardware has to be evaluated in prospective studies as well. For both types of studies mentioned above an

accurate follow-up of the effect of the procedures on intervertebral motion can be obtained with the use of the D-RSA technique as described in Chapter 7.

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