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Paradigm shift in MRI for sciatica

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Chapter 10

Summary

Sciatica is one of the most common lumbar-spine disorders and ranks, certainly in the industrialized countries, as one of the most costly medical problems. The main objective of this thesis was to uncover the relationship between MRI findings and clinical outcome in patients with sciatica.

The basis of this study was the Sciatica Trial: a multicentre prospective randomized controlled trial among patients with 6-12 weeks sciatica. An early surgery strategy was compared to prolonged conservative care for an additional 6 months followed by surgery for patients who did not improve or who did request it earlier because of aggravating symptoms. The trial showed faster recovery after early surgery as compared to a strategy of prolonged conservative care with surgery if needed, but there were no significant differences in clinical outcomes after one year. The randomized patients were part of a larger group of patients with sciatica who underwent a baseline MRI to assess the eligibility for the Sciatica Trial. All patients who underwent MRI (regardless of participation in the randomized controlled trial) were followed up for one year. Furthermore, the patients who were randomized underwent MRI both at baseline and after one year.

Chapter 1 gives an introduction and some historical facts about sciatica. Despite many etiological explanations being proposed since ancient time, it was until 1934 when Mixter and Barr overcame the scientific confusion and asserted that sciatica was caused by a herniated disc pressing against a nerve root. However, the scientific confusion revived when modern imaging modalities such as MRI were introduced which allowed many investigators to detect an enormous variety of previously unappreciated anatomical variations in patients undergoing diagnostic workups for sciatica. Several MRI studies showed a high prevalence of disc herniations ranging from 20 to 76% in persons without any symptoms. Even in patients who were re-imaged after earlier disc surgery, MRI studies have found herniations in up to 53% of persons who at the time of the re-imaging had no symptoms. Despite the scientific debate MRI is considered the imaging procedure of choice for patients suspected of lumbar disc herniations and is frequently performed in patients with persistent or recurrent symptoms of sciatica. Moreover, abnormal MRI findings frequently result in surgical treatment or other invasive procedures such as epidural injections.

Chapter 2 describes interobserver agreement among two neuroradiologists and one neurosurgeon with regard to MRI characteristics in patients with sciatica who were potential candidates for lumbar disc surgery on clinical grounds. The interobserver agreement was high with regard to clinically relevant parameters like most affected disc level and nerve root, probability of disc herniation and nerve root compression. However, in general considerable variation between the observers was observed regarding specific characteristics of the symptomatic disc level (like signal intensity on T2 images, absence of epidural fat and flattening of the dural sac or the emerging root sheath) and the disc herniation (like its location, size and whether it should be classified as a protrusion or as an extrusion).

Chapter 3 reports on the implications of MRI interobserver variability among three spine specialists for the one-year outcomes in patients with sciatica who were potential candidates for lumbar disc surgery based on clinical grounds. The most favorable clinical outcome results after one year follow-up were reported by those patients in whom all three MRI observers independently agreed about the presence of disc herniation or nerve root compression, followed by those with inconsistent interpretation and finally by those in whom independent agreement was reached about the absence of those abnormalities.

Of the patients who were randomized to receive prolonged conservative care in the Sciatica Trial a considerable part of 39% ultimately received surgery during the first year. **Chapter 4** evaluates whether qualitative and quantitative MRI assessment could have predicted this delayed surgery. Qualitative MRI parameters and the baseline size of the disc herniation did not significantly differ between the surgical and non-surgical group. Patients who did undergo surgery during follow-up had at baseline smaller dural sacs and spinal canals compared to patients who did not undergo surgery. However, ROC curve analysis showed that these variables have only a poor ability to discriminate between patients who underwent surgery and those who did not.

Chapter 5 reports on the prognostic value of low back pain in relation to MRI findings in patients with sciatica. Patients who had disabling back pain at baseline reported an unfavorable prognosis at one-year follow-up compared to those with predominantly sciatica. If additionally a clear herniated disc with nerve root compression on MRI was absent, the results were even worse. Herniated discs and nerve root compression on MRI were more prevalent among patients with predominantly sciatica compared to those who suffered from additional disabling back pain. However, vertebral endplate signal changes were equally distributed between those with and without disabling back pain. Large disc herniations and extruded disc herniations were also equally distributed between the two groups.

Chapter 6 reports on the 1-year MRI findings of sciatica patients who were treated with either surgery or conservative treatment, changes of MRI findings over time, and their correlation with clinical outcome. At one year follow-up a considerable proportion of patients still had a visible disc herniation on MRI (21% of surgically compared to 60% of conservatively treated patients). However, the presence of disc herniation or nerve root compression on MRI did not distinguish patients with persistent or recurrent symptoms of sciatica from asymptomatic patients.

Chapter 7 reports on Vertebral Endplate Signal Changes (VESC) findings, changes of VESC findings over time and the correlation between VESC findings and back pain in sciatica. Undergoing disc surgery for sciatica was highly associated with progression in the extent of VESC compared to conservative (non-operative) care. In one year about two thirds of surgically and one fifth of conservatively treated patients displayed an increase of VESC. However, both at baseline and after one year follow-up, those with and those without VESC reported disabling back pain in nearly the same proportion. In addition, the proportion of

patients reporting perceived recovery after one year was also nearly equal between those with and without VESC.

Chapter 8 reports on the reliability of enhancement findings, their prevalence and their correlation with clinical outcome. The MRI observers (two neuroradiologists and one neurosurgeon) showed excellent agreement regarding the disc level of the herniated disc and the most affected nerve root. Moreover, they agreed on the presence of a disc herniation and nerve root compression. This was in contrast to their agreement on the enhancement of disc herniation and the affected nerve root, which was only fair. One year after treatment, the observers reached substantial agreement regarding the presence of a disc herniation and whether the nerve root was still compressed. However, again, they substantially disagreed on the enhancement of the herniated disc and nerve root. The observers reached moderate to substantial agreement regarding the presence of scar tissue at one year. If they judged scar tissue to be present, they nearly always regarded it as enhanced. At one year no relationship was observed between enhancement of the nerve root or disc herniation and clinical findings.

CONCLUSION

Patients who also suffered from disabling back pain in the acute stage of sciatica reported an unfavorable prognosis at one-year follow-up compared to those with predominantly sciatica. If additionally in the acute stage of sciatica a clear herniated disc with nerve root compression on MRI was absent, the results after one-year follow-up were even worse. MRI-findings in the acute stage were not acceptably able to discriminate between those who did and those who did not undergo surgery. At one year follow-up, anatomical abnormalities visible on MRI did not distinguish patients with persistent or recurrent symptoms of sciatica from patients without symptoms. Vertebral Endplate Signal Changes were not associated with disabling back pain, neither in the acute stage of sciatica nor after one year of follow-up. The reliability of Gadolinium-enhanced MRI findings was low and enhancement findings did not correlate with clinical findings at one-year follow-up.