Prognostic value of MRI findings in sciatica

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Abstract The natural course of sciatica due to disc herniation is generally favourable but individually unpredictable. Some patients recover only after prolonged conservative therapy or surgery. This study aims to ascertain whether magnetic resonance (MR) imaging features can be used to predict outcome of sciatica and help to identify patients unlikely to respond to conservative management. For a transversal diagnostic study 274 primary care patients underwent early MR imaging for leg pain. One hundred and thirty-three patients with sciatica were followed for 3 months, both patients and physicians being unaware of MR imaging findings. At 12 weeks a favourable prognosis was indicated by the following features: annular rupture \((P = 0.02)\) and nerve root compression on MR imaging \((P = 0.03)\). Poor prognosis was indicated by disc herniation in the foramen \((P = 0.004)\). Our findings show that early MR imaging features are related to prognosis. However, the associations are not strong enough to justify routine use of early MR imaging to predict the prognosis of sciatica.

Introduction

The natural course of sciatica due to disc herniation is favourable [1, 2] and the major management challenge at first is adequate pain reduction [3]. Magnetic resonance (MR) imaging is the standard ancillary investigation. In the Netherlands a consensus is reached that MR imaging is only indicated in later stages of disease when surgical treatment arises as a therapeutic option [4]. Of course, an additional indication is when another pathological condition besides disc herniation, such as vertebral metastasis, is suspected. The present study investigated whether there may be an indication for early MR imaging to predict the further course of disease. Ordering of MR scans in an early stage of disease, possibly by general practitioners, might allow the recognition of patients likely to have unfavourable courses and might improve patient selection for additional procedures.

An investigation of the prognostic value of MR imaging in primary care patients has not been done. Carragee et al. [5] have retrospectively studied clinical and MR findings that might predict unfavourable outcome. In this study, patients must have been selected on the basis of a sufficient duration and an unfavourable course of disease to have had an indication for MR imaging, as it is not standard practice to perform MR imaging at first presentation of sciatica.

As part of a diagnostic and patho-anatomical study, 274 patients were seen in the neurological outpatient clinic within 3 days of the first consultation with their general practitioner for an episode of pain radiating into the leg. All these primary care patients had a standardized history and physical examination and underwent MR imaging. Both patient and physicians were blind to the results of MR imaging. The results of this transversal study are reported elsewhere. In 183 of the 274 patients with leg pain, a clinical diagnosis of sciatica due to disc herniation was made, and a prospective evaluation of the outcome was undertaken. These patients were the subjects of a study to investigate whether the initial concealed MR findings could predict outcome.
Methods

Study population

Between February 1995 and December 1996, 50 general practitioners (GPs) in Maastricht and surrounding villages referred patients to the Department of Neurology at Maastricht University Hospital for a study on sciatica. Included were patients with pain radiating into the leg below the knee. Exclusion was based on previous spinal surgery, pregnancy, unavailability for follow-up visits and co-morbidity such that well-being was primarily determined by this co-morbidity. Patients were also excluded if there was an indication for immediate surgery (morphine-dependent, intractable pain, progressive or severe paresis of limited duration or cauda equina syndrome). All patients selected entered a transversal study of the value of history and physical examination in patients with pain in the leg, the results of which have been published elsewhere [6].

For the present study additional inclusion criteria were applied. Only included were patients with a new episode of pain radiating into the leg below the gluteal fold, of sufficient intensity to justify further treatment, and with at least two of the following signs or symptoms: typically radicular pain distribution, pain in the leg increasing with coughing/sneezing/straining, decreased muscle strength, sensory loss, reflex loss, positive straight leg raising test. In these patients the outcome was prospectively followed.

Baseline investigations

All patients selected were examined within 2 days of GP referral. This included a standardized history and physical examination, the technique and inter-observer variability of which are reported elsewhere [6], and MR imaging.

MR imaging assessment

The MR imaging assessment is shown in Fig. 1

The gold standard in all patients was MR imaging of the lumbar spine (for study purposes, within 12 h of the clinical examination). This was performed with a 0.5-T system according to the following scanning protocol: (1) sagittal and transverse T1-weighted spin-echo sequences (TR/TE 400–600/20 ms) with 4- and 5-mm slice thickness, respectively, and (2) a sagittal proton density-T2-weighted fast spin-echo sequence (TR/TE) with 5-mm slice thickness. Additionally, MR radiculography was performed consisting of two heavily T2-weighted fast spin-echo sequences (TR 6,000, TE 450 ms), orientated about 20° left- and right-oblique to the coronal plane, reformatted by maximum intensity projection [7]. One neuroradiologist assessed all MR scans. Nerve root compression was graded as absent, uninterpretable or present on the standard MR images and MR radiculography, separately. Nerve root compression on the standard axial and sagittal MR images was estimated on the basis of deformation of the dural sac, root sleeve and/or extradural root segment, by displaced disc material and/or narrowing of the central spinal canal, lateral recess or intervertebral foramen. Obliteration of epidural fat around the root sleeve or epidural root segment was also looked for.

On MR radiculography images, compression of the border of the dural sac and root sleeve was looked for, as well as kinking and/or swelling of the intradural root segment. A more detailed and illustrated description of the assessment of nerve root compression on sectional and radiculographic images is given in the references [7, 8]. The site of nerve root compression was registered as follows: none/dural sac/shoulder of nerve root sleeve/axilla of nerve root sleeve/dorsal root ganglion. There were additional assessments with regard to annular rupture (absent/uninterpretable/present), degeneration of nucleus pulposus (one level/none/all levels), and disc herniation (type: none/bulge/protrusion/extrusion/migration and site: none/median/paramedian/medialateral/intraforaminal/extraforaminal). The clinical investigator and the neuroradiologist were unaware of MR and clinical findings, respectively. Intra-observer variability was established by re-grading 80 MR scans.

Outcome parameters

Outcome was assessed at 2 and 12 weeks for patients treated conservatively up until the second follow-up at 12 weeks as follows:

1. Patients were asked to register the global perceived effect after 2 weeks on a 5-point scale (strong worsening/worsening/no change/ improvement/strong improvement). In the statistical analysis, variables that might predict the category “strong improvement” were investigated. None of the patients underwent surgery in this 2-week period.

2. Patients were asked to register the global perceived effect again after 12 weeks (in comparison with their condition at 2 weeks).

In order to define the outcome as favourable or unfavourable the global perceived effect was dichotomized. The categories improvement and strong improvement after 12 weeks were termed “favourable”. Also, if there had been “no change” but the complaints had already improved greatly at the 2-week assessment, the outcome was termed “favourable”.

Treatment during the evaluation period

Additional therapies were carried out during the follow-up period. Only if surgery seemed indicated on the basis of the clinical picture, were the MR findings revealed to the treating physician. Because surgery is known to alter outcome and because the final indication for surgery is also based on MR findings, patients treated surgically were not investigated in the final analysis. The relationships between MR findings, surgery and outcome were investigated, however.

Statistical analysis

The percentage of patients with a favourable outcome was calculated for patients with and without the MR finding. None of these patients were operated on. For the bivariate analysis of MR findings versus outcome, chi-square analysis was used. The effect of excluding patients treated surgically from the analysis was investigated (because of the bias that might result from this exclusion). Also, the percentage of patients with a favourable outcome of surgical treatment was determined to see whether surgery might be a confounding variable in the prediction of outcome. For those MR findings with a higher percentage of patients treated surgically, a logistic regression model was constructed with the particular MR finding, the occurrence of surgery and a product term of surgery and the MR finding.

Results

Two hundred and seventy-four patients with pain radiating into the leg had been included in a transversal diagnostic study. Of these, 183 patients had had a clinical diagnosis of nerve root involvement. Twenty-two patients could not undergo MR scanning due to MR contra-indications (e.g. metal-containing foreign body, pacemaker, claustrophobia). The baseline characteristics for these patients were not significantly different from