Chapter 4

Predictive value of MRI in decision making for disc surgery for sciatica

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ABSTRACT

OBJECT

In a randomized controlled trial comparing surgery and prolonged conservative treatment for 6-12 weeks sciatica, more than one third of patients assigned to conservative treatment underwent surgery. The objective of this study was to evaluate whether Magnetic resonance imaging (MRI) at baseline could have predicted this delayed surgery.

METHODS

Independently evaluated qualitative and quantitative MRI findings were compared between those who did and those who did not undergo surgery during follow-up in the conservative care group. In addition, area under the receiver operating characteristic (ROC) curve analysis was used to assess how well MRI parameters discriminated those who did and those who did not undergo delayed surgery (0.5-0.7 poor discrimination, ≥0.7 acceptable discrimination).

RESULTS

Of 142 patients assigned to receive prolonged conservative care, 55 (39%) patients received delayed surgery. Of the 55 surgically treated patients 71% had definite nerve root compression at baseline compared to 72% of conservatively treated patients (P=0.76). Large disc herniations (size >50% of spinal canal) were nearly equally distributed between those who did and those who did not undergo surgery (25% vs. 21%, P=0.65). The size of the dural sac was smaller in the surgical compared to the non-surgical group (101.2 vs. 122.9 mm^2, P=0.01). However, the size of the dural sac discriminated poorly between those who did and those who did not undergo delayed surgery (area under ROC curve, 0.62).

CONCLUSION

In patients who suffered from 6 to 12 weeks sciatica MRI at baseline did not distinguish between patients who did and those who did not undergo delayed surgery.

INTRODUCTION

Magnetic resonance imaging (MRI) is widely used in diagnosis and treatment planning of patients with intervertebral disc herniations.[4] It is considered the imaging procedure of choice for patients suspected of lumbar disc herniation[19,29] and is indicated in patients with severe symptoms who fail to respond to conservative care for 6 to 8 weeks.[18] Qualitative MR-findings such as the presence of disc extrusion or severe nerve root compression have indeed been reported to be strongly associated with sciatica.[3] In addition, from MR images the size and shape of disc herniations can be measured accurately, as can the size and proportions of the spinal canal.[5] However, limited data is available concerning the predictive value of both qualitative and quantitative MRI evaluations in assisting clinical decision making for surgical or non-surgical management for sciatica.

The investigators previously reported the results of a randomized controlled trial comparing early surgery with prolonged conservative care for patients with 6 to 12 weeks sciatica over one year's follow-up.[25] Although early surgery achieved more rapid relief of sciatica than conservative care, the clinical outcome results were similar after one year. Despite efforts to the contrary, 39% of the patients assigned to the prolonged conservative treatment group did undergo surgery during the first year after randomization.[24] Reasons for performing delayed surgery were persistent or increasing drug-resistant leg pain and progressive neurological deficit.[24] In a previous study, baseline clinical parameters were tested whether they could have predicted surgery during follow up in this group.[24] Patients with higher pain intensity in the leg or higher disability scores at baseline had a higher risk of undergoing delayed surgery.[24]

The objective of this study was to evaluate the predictive value of qualitative and quantitative MRI assessments for delayed surgery. If early in the course of sciatica specific qualitative and quantitative MRI assessments prove to predict which patients will undergo surgery anyhow during follow-up, this information could be valuable for both patients and physicians as it could enable them to consider early surgery without further delay to reduce the period of suffering.

METHODS

STUDY POPULATION

Patients for this study were participants in the Sciatica Trial: a multicenter randomized controlled trial of 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.[25,26] Patients were included only if they had a dermatomal pattern of pain distribution with concomitant neurological disturbances that correlated to the same nerve root being affected on MRI. No

minimal disc size was prespecified for entry into the Trial. For the purpose of the present study, the patients who originally were allocated at random to prolonged conservative care were selected as the study cohort. The medical ethics committee at each of the nine participating hospitals approved the protocol. Written informed consent was obtained from all patients. Details of the design and study protocol have been published previously.[25,26]

TREATMENT

Prolonged conservative treatment was provided by each patient's practitioner. Patients were informed about the favourable prognosis. Prescription of pain medication was allowed and was adjusted according to existing clinical guidelines if necessary. Opiates were frequently prescribed, but no epidural or periradicular corticosteroids were injected. Patients who were fearful of moving were referred to a physiotherapist. Treatment was aimed mainly at resumption of daily activities. However if sciatica was still present at 6 months after randomization, surgery was considered. Persistent or increasing drug-resistant leg pain and progressive neurological deficit were reasons for performing surgery even before 6 months. When patients requested surgery, they were again evaluated by their treating physician and the assigned research nurse, who had to confirm that recovery had not occurred and that the repeated MRI showed an unresolved disc herniation with nerve root compression. Subsequently the neurosurgeon was consulted by the patient and surgery was performed if all the indicators did direct in sciatica resistant to medical treatment.

MRI PROTOCOL AND IMAGE EVALUATION

MRI scans were performed in all 9 participating hospitals using standardized protocols tailored to a 1.5 Tesla scanner. Sagittal T1 and axial T1 spin echo images of the lumbar spine were acquired. In addition, T2 weighted sagittal and axial series, and contrast-enhanced (gadolinium) T1 fat suppressed sagittal and axial images were obtained.

Two neuroradiologists (BK and GL) and one neurosurgeon (CV) independently evaluated all MR images. The readers hold senior positions in busy spinal clinics with a focus on advanced spine surgery, and are confronted with spinal MRIs on a daily basis. The readers were not provided any clinical information and have not been involved in the selection or care of the included patients. Definitions of imaging characteristics were based on the recommendations from the combined task forces of the North American Spine Society, the American Society of Spine Radiology, and the American Society of Neuroradiology for classification of lumbar disc pathology.[13] Vertebral end plate changes were defined according to criteria of Modic.[20,21] Before the start of the study, the readers met in person to evaluate and refine the definitions. Standardized case record forms with final definitions were used to evaluate the images (Table 1).

First, all readers had to choose the disc level with the most severe nerve root compression. At this disc level, a four point scale was used for both the presence of disc herniation and

Table 1 MRI study variables

Disc level	Variable	Category
Disc level with the most severe nerve root compression	Disc level	1. Not applicable: no nerve root compression 2. L2L3 3. L3L4 4. L4L5 5. L5S1
	Disc contour at this level	1. Bulging: presence of disc tissue circumferentially (50-100%) beyond the edges of the ring apophyses 2. Herniation: localized displacement of disc material beyond the normal margins of the intervertebral disc space
	Certainty about the presence of disc herniation	1. Definite about the presence: no doubt about the presence 2. Probable about the presence: some doubt but probability > 50% 3. Possible about the presence: reason to consider but probability < 50% 4. Definite about the absence: no doubt about the absence
	Loss of disc height at this level	1. Yes 2. No
	Signal intensity of nucleus pulposus on T2 images at this level	1. Hypointensity 2. Normal 3. Hyperintensity
	Certainty about the presence of nerve root compression	1. Definite about the presence: no doubt about the presence 2. Probable about the presence: some doubt but probability > 50% 3. Possible about the presence: reason to consider but probability < 50% 4. Definite about the absence: no doubt about the absence
	Spinal canal stenosis	1. Yes 2. No
	Disappearance of epidural fat	1. Completely disappeared 2. Partly disappeared 3. No disappearance
	Presence of impaired discs at more than one level	1. Yes 2. No
If a disc herniation is considered	Location	1. Central zone: zone within the vertebral canal between sagittal planes through the medial edges of each facet 2. Sub-articular zone: zone, within the vertebral canal, sagittally between the plane of the medial edges of the pedicles and the plane of the medial edges of the facets, and coronally between the planes of the posterior surfaces of the vertebral bodies and the under anterior surfaces of the superior facets. 3. Foraminal zone: zone between planes passing through the medial and lateral edges of the pedicles 4. Extra-foraminal zone: the zone beyond the sagittal plane of the lateral edges of the pedicles, having no well-defined lateral border

Table 1 (Continued)

Disc level	Variable	Category
	Side	1. Right 2. Left 3. Right and left
	Size disc herniation in relation to spinal canal	1. Large stenosing, size >75% of the spinal canal 2. Large, size 50-75% of the spinal canal 3. Average, size 25-50% of the spinal canal 4. Small, size <25% of the spinal canal
	Form disc herniation	1. Protrusion: localized displacement of disc material beyond the intervertebral disc space, with the base against the disc of origin broader than any other dimension of the protrusion. 2. Extrusion: localized displacement of disc material beyond the intervertebral disc space, with the base against the disc of origin narrower than any one distance between the edges of the disc material beyond the disc space measured in the same plane, or when no continuity exists between the disc material beyond the disc space and that within the disc space.

nerve root compression ranging from definitely present to definitely absent. Clinically relevant characteristics of the disc level and disc herniation were scored.

In addition quantitative measurements were performed by an independent researcher (AB), blinded to the treatment ultimately received and any other clinical information. He was not involved in the clinical treatment of these patients. Scans were examined with attention to the intervertebral disc with the most severe nerve root compression according to the three observers. On T2-weighted axial views the following parameters were quantified (in square millimeters): (i) cross-sectional size of the intervertebral disc prolapse, (ii) basis of the disc herniation, (iii) cross-sectional size of the dural sac, and (iv) cross-sectional size of the spinal canal not occupied by the disc herniation and without ligamentum flavum (Fig. 1). Next two herniation ratio's (HR) were defined: HR 1, which represents the ratio of the size of the herniated disc to the dural sac and HR 2, which represents the ratio of the size of the herniated disc to the remaining size of the spinal canal not occupied by the herniated disc. When a disc herniation was absent no quantitative measurements were performed.

OUTCOME

The occurrence of surgery performed during one-year follow-up was the event of interest. The patients were assessed by means of the Roland Disability Questionnaire for Sciatica (RDQ, scores range from 0 to 23, with higher scores indicating worse functional status),[23] the 100-mm visual-analogue scale (VAS) for leg and back pain (with 0 representing no pain and 100 the worst pain ever experienced),[9] and a 7-point Likert self-rating scale of global perceived recovery given by the question whether the patient experienced recovery, with answers ranging from completely recovered to much worse. Perceived recovery on the 7-point Likert scale for global

perceived recovery was used in dichotomized form: "Complete" or "nearly complete disappearance of symptoms" was defined as "perceived recovery", while a score in the remaining five categories was marked as "no recovery".[25,26] Outcome measures were assessed at baseline, 2, 4, 8, 12, 26, 38 and 52 weeks. For the purpose of the present study only outcome data from the baseline measurements and 52 weeks were used.

STATISTICAL ANALYSIS

The majority opinion of the three readers regarding the (qualitative) MRI characteristics (answer independently given by minimum 2 out of 3 readers) was used in the statistical analysis. Patients were categorized in two groups according to the occurrence of surgery performed during the first 12 months after being randomized to prolonged conservative care. Between-group comparisons for both clinical and MRI variables were performed with Student's t-tests for continuous data and Chi-square tests for categorical data. If a variable proved to be significantly different between patients who did and those who did not undergo surgery during follow-up the sensitivity and specificity of this variable was determined by using Receiver operating characteristic (ROC) curve analysis. The area under the ROC curve (AUC) ranges from 0 to 1 and provides a measure of a test's ability to discriminate between those subjects

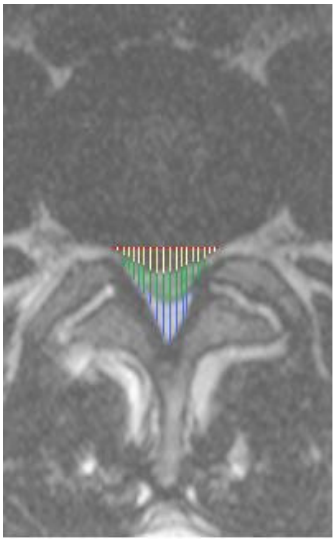

Figure 1 Methods of measuring the different parameters
Red line represents the size of the basis of the disc herniation, the *yellow shaded area* represents the size of the disc herniation, the *green shaded area* represents the size of the dural sac, the *green and blue shaded areas combined* represent the size of the remaining spinal canal.
Herniation ratio 1 (disc herniation in relation to the size of the dural sac) = yellow shaded area/green shaded area.
Herniation ratio 2 (disc herniation in relation to the size of the remaining spinal canal) = yellow shaded area/(green and blue shaded area combined).

who experience the outcome of interest versus those who do not. To derive the AUC value of 2 or more variables combined, these variables were first subjected to a logistic regression model with the occurrence of surgery as the event of interest, and the predicted probability from that model was included in the ROC-curve Analysis.[17] We used the traditional following thresholds for the area under the ROC curve: 0.5 no discrimination; 0.5 to 0.7 poor discrimination; ≥0.7 acceptable discrimination; ≥0.8 excellent discrimination; ≥0.9 outstanding discrimination.[14]

In a subanalysis characteristics were compared between the patients who did not undergo surgery, those who did undergo surgery between 0 and 6 months, and those between 6 and 12 months. The one-way analysis of variance (ANOVA) was used to test for mean differences in continuous data (with Post-hoc analysis using the Bonferroni analysis for the variables which showed a statistically significant difference). A P value of <0.05 was considered statistically significant.

RESULTS

Of 142 patients assigned to receive prolonged conservative care, 55 (39%) patients received surgery after a mean period of 18 weeks (22 [15%] within 3 months, 20 [14%] between 3 and 6 months, 9 [6%] between 6 and 9 months and 4 [3%] after more than 9 months). At baseline, age, gender, duration of sciatica and Body Mass Index and level of the herniated disc were comparable in the "delayed" surgical and non-surgical group. At baseline, in 39 (71%) of 55 surgically treated patients there was no doubt about the presence of nerve root compression compared to 63 (72%) of 87 conservatively treated patients (P=0.76) (Table 2). No significant differences existed in prevalence of Vertebral Endplate Signal Changes between the "delayed" surgical and non-surgical group (29% vs. 40%, P=0.37). Large disc herniations (size >50% of spinal canal) were nearly equally distributed between those who did and those who did not undergo surgery (25% vs 21%, P=0.65). Central or subarticular located disc herniations were also nearly equally distributed between those who did and those who did not undergo surgery (91% vs 90%, P=1.00). Extruded disc herniations were observed in 59% of surgically treated patients compared to 70% of conservatively treated patients (P=0.12).

An example of a patient who had a large disc herniation and definite nerve root compression but who still did not undergo surgery during follow-up is shown in Figure 2.

At baseline, the size of the herniated disc was comparable in the surgical and non-surgical group (76.9 vs. 75.7 mm^2, P=0.86) (Table 3). The size of the dural sac was smaller in the surgical compared to the non-surgical group (101.2 vs. 122.9 mm^2, P=0.01). However, the ratio of the size of the disc herniation to the dural sac was 0.97 for the surgical group compared to a ratio of 0.89 for the non-surgical group (P=0.65). The size of the remaining spinal canal was smaller in the surgical group compared to the non-surgical group (159.4 vs. 189.0 mm^2,

P=0.007), although the ratio of the size of the disc herniation to remaining spinal canal was not significantly different between those who did and those who did not undergo surgery (0.57 vs. 0.49, P=0.33).

The mean RDQ score at baseline was higher in the surgical group compared to the non-surgical group (16.9 vs. 13.5, P<0.001). The baseline VAS leg pain was also higher in the surgical group compared to the non-surgical group (63.8 vs. 49.2, P<0.001).

The subanalysis comparing characteristics between patients who did not undergo surgery, those who did undergo surgery between 6 and 12 months, and those between 6 and 12 months,

Table 2 Comparison of baseline characteristics between patients who did and those who did not undergo surgery for sciatica**.** Values are n (%) or means ± SD

	Surgery (n=55)	No surgery (n=87)	P-value
Age at baseline MRI	43.6±10.1	43.2±9.3	0.83
Male gender	39 (71)	58 (67)	0.60
Duration of sciatica in weeks	9.6±2.1	9.5±2.2	0.72
Characteristics of the most impaired disc level			
Disc level			
L3L4 or L4L5	21 (38)	35 (40)	0.81
L5S1	34 (62)	52 (60)	
Presence of disc herniation			0.37
Definite	49 (89)	78 (90)	
Probable	3 (6)	8 (9)	
Possible	1 (2)	0 (0)	
Definite absent	2 (4)	1 (1)	
Presence of nerve root compression			0.76
Definite	39 (71)	63 (72)	
Probable	11 (20)	18 (21)	
Possible	5 (9)	5 (6)	
Definite absent	0 (0)	1 (1)	
Loss of disc height	51 (93)	76 (87)	0.64
Hypo intense signal intensity of nucleus pulposus on T2 images	50 (91)	77 (89)	0.97
Completely disappearance of epidural fat	36 (66)	54 (62)	0.89
Spinal canal stenosis	7 (13)	8 (9)	0.55
Presence of impaired discs at other disc levels	44 (80)	63 (72)	0.49
Characteristics of the herniated disc			
Located on the right side	23 (43)	45 (52)	0.31
Size>50% in relation to spinal canal	13 (25)	18 (21)	0.65
Extrusion	31 (59)	60 (70)	0.12
Central or subarticular located	48 (91)	77 (90)	1.00

Fig. 2A T2-weighted sagittal baseline image

Fig. 2B T2-weighted axial baseline image

Fig. 2C T2-weighted sagittal image after one year follow-up

Fig. 2D T2-weighted axial image after one year follow-up

Figure 2 Sagittal and axial T2 weighted MR images of a patient with sciatica who had a large disc herniation at disc level L4-L5 at baseline, compressing nerve roots L5 bilaterally and narrowing the spinal canal (A and B). This patient did not undergo surgery during the first year and reported complete clinical recovery after one year. Repeated MRI after one year follow-up showed decrease of the herniation at disc level L4-L5 (C and D).

also showed that the three groups only significantly differed in baseline RDQ, VAS-leg pain and size of the dural sac and remaining spinal canal (Table 4).

With surgery as the event of interest, the area under ROC curve for the size of the dural sac was 0.62 (95% Confidence Interval [CI] 0.53-0.72), for the size of the spinal canal 0.62 (95% CI 0.53-0.72), for the VAS of leg pain 0.67 (95% CI 0.58-0.77) and for the RDQ score 0.70 (95% CI 0.61-0.79). Combined the two MRI variables had an area under ROC curve of 0.63 (95% CI 0.53-0.72) compared to 0.72 (95% CI 0.64-0.81) when combining the RDQ and VAS-leg pain. All four variables combined had an area under ROC curve of 0.76 (95% CI 0.68-0.84).

Despite baseline differences, one year after randomization no significant differences were observed between the surgical group and the non-surgical group regarding the clinical outcome scores as assessed by VAS of leg pain, VAS of back pain, RDQ and global perceived recovery (Table 5). One year after randomization a disc herniation was considered (definite, probable or possible present) in 26% of the patients who had undergone surgery compared to 61% of the patients who had undergone non-operative care (P=0.001).

Of the 16 surgical patients who at baseline did not have definite nerve root compression 87.5% reported perceived recovery at one year as compared to 87.2% of the 39 surgical patients who at baseline did have definite nerve root compression (P=0.97).

Table 3 Baseline quantitative MRI measurements and clinical characteristics in the group that underwent surgery and the group that did not undergo surgery for sciatica. Values are n (%) or means ± SD

	Surgery (n=55)	No surgery (n=87)	P-value
Measurements on axial view			
Disc herniation (mm^2)	76.9±37.6	75.7±38.9	0.86
Basis disc herniation (mm)	20.0±5.8	19.3±6.8	0.54
Dural sac (mm^2)	101.2±44.6	122.9±53.8	**0.01**
Remaining spinal canal (mm^2)	159.4±57.0	189.0±65.7	**0.007**
Ratio disc herniation to dural sac	0.97±0.70	0.89±1.15	0.65
Ratio disc herniation to remaining spinal canal	0.57±0.40	0.49±0.52	0.33
Clinical outcomes			
Roland disability score¶	16.9±4.1	13.5±5.0	**<0.001**
Visual-analogue scale of leg pain‡	63.8±23.5	49.2±22.9	**<0.001**
Visual-analogue scale of back pain‡	41.9±31.8	33.4±25.7	0.08

¶ The Roland disability questionnaire for sciatica is a disease-specific disability scale that measures functional status in patients with pain in the leg or back. Scores range from 0 to 23, with higher scores indicating worse functional status.

‡ The intensity of pain was indicated on a horizontal 100 mm visual analogue scale, with 0 representing no pain and 100 the worst pain ever experienced.

Table 4 Clinical, qualitative and quantitative MRI evaluations of the two surgical groups and the group that did not undergo surgery for sciatica. Values are n (%) or means ± SD**.**

	Surgery within 6 months (n=42)	Surgery between 6-12 months (n=13)	No surgery (n=87)	P-value
Clinical outcomes				
Roland disability score	17.4±3.9	15.5±4.6	13.5±5.0	**<0.001** ¶
Visual-analogue scale of leg pain	64.2±24.6	62.6±20.2	49.2±22.9	**0.002** ‡
Visual-analogue scale of back pain	44.2±32.1	34.6±30.8	33.4±25.7	0.13
Characteristics of the most impaired disc level				
Disc level				
L3L4 or L4L5	18 (43)	3 (23)	35 (40)	0.43
L5S1	24 (57)	10 (77)	52 (60)	
Presence of disc herniation				0.43
Definite	37 (88)	12 (92)	78 (90)	
Probable	3 (7)	0 (0)	8 (9)	
Possible	1 (2)	0 (0)	0 (0)	
Definite absent	1 (2)	1 (8)	1 (1)	
Presence of nerve root compression				0.96
Definite	29 (69)	10 (77)	63 (72)	
Probable	9 (21)	2 (15)	18 (21)	
Possible	4 (10)	1 (8)	5 (6)	
Definite absent	0 (0)	0 (0)	1 (1)	
Loss of disc height	40 (95)	11 (85)	76 (87)	0.44
Hypo intense signal intensity of nucleus pulposus on T2 images	39 (93)	11 (85)	77 (89)	0.45
Completely disappearance of epidural fat	27 (64)	9 (69)	54 (62)	0.94
Spinal canal stenosis	5 (12)	2 (15)	8 (9)	0.79
Presence of impaired discs at other disc levels	33 (79)	11 (85)	63 (72)	0.71
Characteristics of the herniated disc				
Located on the right side	19 (46)	4 (33)	45 (52)	0.43
Size>50% in relation to spinal canal	9 (21)	4 (33)	18 (21)	0.64
Extrusion	23 (56)	8 (67)	60 (70)	0.23
Central or subarticular located	36 (88)	12 (100)	77 (91)	0.45

¶ Bonferroni post-hoc analysis showed P<0.001 for the no surgery group compared with the 0-6 months surgical group, P=0.43 for the no surgery group compared with the 6-12 months surgical group, and P=0.64 for the 0-6 months surgical group compared with the 6-12 months surgical group
‡ Bonferroni post-hoc analysis showed P=0.002 for the no surgery group compared with the 0-6 months surgical group, P=0.16 for the no surgery group compared with the 6-12 months surgical group, and P=1.00 for the 0-6 months surgical group compared with the 6-12 months surgical group

Table 5 Clinical and MRI parameters at one year follow-up in the group that underwent surgery and the group that did not undergo surgery for sciatica. Values are n (%) or means ± SD

	Surgery (n=54)	No surgery (n=82)	P-value
Clinical Outcome			
Roland disability score¶	3.2±5.2	3.5±4.9	0.71
VAS leg pain‡	9.5±19.9	10.9±17.0	0.67
VAS back pain‡	13.6±23.2	16.4±20.6	0.47
Perceived recovery one year╫	47 (87)	64 (78)	0.09
Qualitative MRI finings			
Presence of disc herniation			0.001
Definite	6 (11)	22 (27)	
Probable	7 (13)	21 (26)	
Possible	1 (2)	7 (9)	
Definite absent	40 (74)	32 (39)	
Presence of nerve root compression			0.09
Definite	2 (4)	5 (6)	
Probable	4 (7)	6 (7)	
Possible	5 (9)	21 (26)	
Definite absent	43 (80)	50 (61)	
Measurements			
Disc herniation (mm^2)	21.3±30.6	37.3±29.7	0.003
Dural sac (mm^2)	147.7±61.6	141.5±54.4	0.54
Remaining spinal canal (mm^2)	233.1±77.1	211.1±74.7	0.10
Ratio disc herniation to dural sac	0.2±0.4	0.3±0.4	0.07
Ratio disc herniation to remaining spinal canal	0.1±0.2	0.2±0.2	0.02

Clinical outcome data at one year was available for 136 of the 142 patients

¶ The Roland disability questionnaire for sciatica is a disease-specific disability scale that measures functional status in patients with pain in the leg or back. Scores range from 0 to 23, with higher scores indicating worse functional status.

‡ The intensity of pain was indicated on a horizontal 100 mm visual analogue scale, with 0 representing no pain and 100 the worst pain ever experienced.

╫ Perceived recovery was defined as complete or nearly complete disappearance of symptoms according to the Likert-7 point scale.

DISCUSSION

Baseline qualitative MRI findings and the size of the disc herniation did not predict future inevitable surgery in patients who were subjected to a wait-and-see policy for sciatica. Patients who did undergo surgery during follow-up had at baseline higher RDQ scores, more intense leg pain and smaller dural sacs and spinal canals compared to patients who did not undergo

surgery. The overall results of the current study suggest that MRI is not suitable to distinguish between patients who will and those who will not undergo surgery for sciatica.

The natural history of acute sciatica is in general favourable, with spontaneous resolution of the leg pain within 18 weeks in the overwhelming majority of cases.[25,28,30] When patients fail to recover during conservative care, surgery might be considered. The optimal duration of conservative care is not well known though. The absolute indications for acute surgery of lumbar herniated discs are symptoms of a cauda equina syndrome, presence of acute and severe motor deficits, and intractable pain.[27] However, these absolute indications rarely occur. In all other cases the indications for operation are relative and clear clinical guidelines are lacking. Some studies retrospectively evaluated the MRI differences between patients who did and those who did not undergo surgery. Carlisle et al. observed that sciatica patients who underwent surgery had larger disc herniations and smaller spinal canals compared to nonoperative patients.[4] A limitation of this study is the retrospective case-matched design and surgical case selection that may have been biased towards larger herniations. Cheng et al. retrospectively observed that patients with either severe disc herniation or severe spinal stenosis were more likely to be classified as surgical candidates compared to those with mild to moderate findings.[6] Carragee and Kim also observed that patients who underwent surgery had larger disc herniations and smaller sizes of the remaing spinal canal compared to patients who underwent conservative treatment.[5]

Surgical treatment rates for lumbar discectomy vary widely between countries and even within countries.[8,18] Currently no objective measures are available to determine when to perform surgery for sciatica. The current study only thoroughly assessed the predictive value of MR imaging for disc surgery. However, the decision for surgery does depend on many factors including the pain disability, psychological factors, occupation, expectations, fear of surgery, economic and social considerations, sociocultural preferences and even the preference of the treating surgeon.[8,10,11,15,18,24] The contribution of this present study is that in contrast to the earlier mentioned studies[4,5,7] MR imaging has no value in the prediction of future surgery among patients with sciatica for 6 to 12 weeks. Patients with clear sciatic symptoms and on MRI a large herniated disc with clear nerve root compression might still not undergo surgery. As published earlier, RDQ scores and VAS intensity of leg pain were better able to discriminate between surgical and non-surgical patients,[24] although these variables did also not reach excellent discrimination in the current ROC analysis. Valid tools for appropriate patient selection for disc surgery are therefore still desirable.

We previously reported the 1-year follow-up MRI results of all patients who participated in the randomized clinical trial.[12] 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). Compared to baseline, nerve root compression had disappeared in 82% of surgically treated patients compared to 60% of conservatively treated patients. However, visible MRI abnormalities at one year follow-up did not distinguish between patients with persistent or recurrent symptoms of sciatica from asymptomatic patients. Other studies have reported

similar results.[2,16] Jensen did not observe any correlation between improvement in symptoms and improvement of disc herniations and nerve root compression on MRI at 14 months in 154 conservatively treated patients.[16] Bath observed a high incidence (approximately 67%) of extrusions and protrusions 2 years postoperatively.[2] However, postoperative extrusions or protrusions did not correlate with clinical outcomes. A recent systematic review concluded that even in the acute setting of sciatica evidence for the diagnostic accuracy of MRI is not conclusive.[29] This is a well-known paradox in imaging research of sciatica. Although there is poorly evidence that imaging findings relate to clinical symptoms, surgery by means of microsurgical discectomy often proves helpful for these patients.[1,22,25,31] So far there are no studies that assessed the role of MRI in decision making for patients with acute or persistent sciatica, in particular if treatment strategies according to MRI findings lead to different clinical outcomes. Further research is needed to assess the value of MRI in clinical decision making for patients with acute and also in those with persistent or recurrent sciatica.

An important limitation of the current study is that the study population consisted of patients who had severe sciatic symptoms for at least 6 weeks and who were referred by their primay care physician. These patients were willing to undergo surgery, so patients with a clear preference for conservative treatment are underrepresented. Also, surgical treatment rates may have been relatively low because patients were encouraged to persist with the randomized prolonged conservative strategy. Not all patients might have had similar conservative treatments. One may get more information out of a prospective cohort study where patients are treated with similar nonoperative treatment modalities and then followed for a certain time period (for example one year). Baseline MRI findings should then be compared between those who decide to have surgery and those who decide not to have surgery during the follow-up period. Another limitation is that in this study patients already did experience a sciatic pain period of several weeks, before MRI was performed and therefore early anatomical changes might already have been occurred since the acute stage. This makes the assessed MRIs in this study less baseline than in experimental conditions could have been reached. Besides the limitations this is the first study that thoroughly analyzed the predictive value of MR imaging in patients with severe sciatica who were subjected to a wait-and-see policy. Furthermore, all MRI scans were blindly examined by in total four observers who were not involved in the study before.

CONCLUSIONS

MRI showed a poor ability to discriminate between patients who did and those who did not undergo delayed surgery for sciatica. As such the role of MRI remains limited to depict the anatomical features and the level of a herniated disc, necessary for the surgical technical approach, and should not be used as a prognosis tool in the shared decision making discussion for surgery versus wait-and-see.

DISCLOSURE

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