

SHORT COMMUNICATION

Predictive value of clinical characteristics in patients with suspected cauda equina syndrome

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Background and purpose: Overlooking a potential diagnosis of cauda equina syndrome (CES) can result in severe long-term neurologic deficits. There is a growing trend to order urgent magnetic resonance imaging (MRI) scans of the lumbar spine in any patient presenting with signs suspicious for CES. A substantial number of these MRI scans do not show cauda compression. The purpose of this study is to assess whether clinical characteristics can predict MRI-confirmed cauda compression. **Methods:** We retrospectively studied 58 consecutive cases of suspected CES who presented at our hospital's emergency room. **Results:** Eight of 58 patients had cauda compression on MRI. When measured, MRI + CES patients (6) had more than 500 ml urinary retention. Moreover, when these patients had at least two of the following characteristics: bilateral sciatica, subjective urinary retention or rectal incontinence symptoms, MRI was more probable to demonstrate cauda compression with an OR of 48.00, 95% (CI 3.30–697.21), which was also significant (*P* of 0.04). The presence of other symptoms or signs alone was not significantly different between both groups. **Conclusion:** In our series, urinary retention of more than 500 ml alone or in combination with two or more specific clinical characteristics were the most important predictors of MRI confirmed cauda compressions.

Introduction

Acute cauda equina syndrome (CES) is a rare, but serious condition, as it can cause devastating permanent neurological defects, when left untreated [1]. The fully pronounced CES consists of a combination of low back pain and the clinical triad of saddle anaesthesia, bowel or bladder dysfunction and muscular weakness of the lower extremities. The CES is often caused by a herniated intervertebral disc and a definite diagnosis is reached with a magnetic resonance imaging (MRI) scan of the lumbar spine [2,3]. When diagnosed early, prompt surgical treatment usually restores neurological functions of the patient [4–6].

Overlooking a potential diagnosis of CES can thus result in severe long-term neurological deficits [7]. There is a growing trend to order urgent MRI scans of the lumbar spine in any patient presenting with signs suspicious for CES [8]. It is our experience that many of these emergency MRI scans turn out to be negative. We hypothesized that the presence or absence of cauda compression can be accurately predicted by certain

clinical characteristics, and perhaps a substantial number of urgent MRI scans can be avoided. We retrospectively analyzed all 58 patients in our hospital who underwent urgent MRI scanning of their lumbar spine because of suspected CES in 2003–2007.

Patients and methods

Case records of all patients who had been referred to the Department of Neurology of the Maastricht University Medical Centre, because of suspected acute CES, were retrospectively reviewed. In the Netherlands, the only indication for urgent lumbar MRI imaging is the suspicion of the presence of cauda equina compression [9]. From the Radiology department records all patients were identified, who had had an urgent MRI and/or computer tomography scan of the lumbar spine from January 2003 till December 2007. These patients' records were retrieved from the hospitals' central archive and/or the digital information system. These were used to collect the clinical characteristics of the patients at time of presentation. Urinary retention was measured after micturition with a BladderScan (BVI 3000; Verathon Medical, IJsselstein, the Netherlands) [10]. These characteristics were compared with the radiologist' lumbar MRI evaluation reports, which were used as the gold standard to determine the presence of cauda

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compression on MRI. Patients with a pre-medical history of recent or extensive malignant disease in the past were excluded. All statistics were done in SPSS, version 17.0.0 (SPSS Inc., Chicago, IL, USA).

All MRI examinations had been acquired on the same 1.5-T clinical MRI scanner (Intera; Philips, Best, the Netherlands). The following sequences were investigated according to in-house lumbar protocol: sagittal T1-weighted MRI (12 slides, SL 4.00 mm, TR 550 ms, TE 13 ms), sagittal T2-weighted MRI (12 slides, SL 4.00 mm, TR 3191 ms TE 130 ms), axial driven-equilibrium (T2) MRI (50 slides, SL 2.00 mm, TR 700 ms, TE 1010 ms) and MR cauda-myelography [11].

Results

Ninety-eight patients underwent urgent lumbar MR imaging during the study period, 58 of these patients underwent the scan because of suspected acute CES, matching the inclusion criteria. The clinical characteristics of these patients are shown in Table 1. Thirty-six patients had had an urgent lumbar MRI for other reasons than CES. Four suspected patients were excluded because metastatic cancer was the cause of clinical cauda syndrome.

Eight of the included patients had cauda compression on MRI, in six of them caused by a massive central or centro-lateral herniated disc, mostly occurring (5/8) at the L4-5 level. One patient had a central disc herniation in combination with canal stenosis. In one patient, the cauda compression resulted from multiple lumbar

epidural haematomas extending on multiple disc levels. The mean duration of urinary retention or other alarming symptoms varied widely with 5.8 days on average (SD 5.8) in the group with compression on MRI. All eight patients underwent emergency laminectomy to decompress the cauda within 24 h (mean 13.2 h with an SD of 4.7 h).

Three patients recovered from urinary retention, respectively 4, 5, and 12 months after surgery. Three patients still had some urinary retention respectively 1, 4, and 5 years after surgery and needed intermittent bladder emptying with a catheter. One patient developed a chronic pain syndrome and kept urinary retention in the 4 years follow-up despite multiple lumbar surgical procedures. One patient (with the multiple lumbar epidural haematomas) did not improve after surgery and died 2 years later due to cardiac disease.

Fifty patients did not have cauda compression on the MRI, of whom nine had normal MRI scans. Ten patients showed only degenerative changes on MRI. Thirty patients had evidence of a herniated lumbar disc without cauda compression on MRI; most of these occurred at the L5/S1 (14) level and at the L4-5 (8) level. One patient did not have cauda compression on MRI, but did have several lesions in the central nervous system suspect for a lymphoma. Six of the seven CES which were caused by lumbar disc herniation had a massive central or centro-lateral disc herniation and one patient had a large lateral disc herniation. The patient with CES caused by lumbar epidural haematomas had compression centrally on the cauda equina on multiple levels.

Table 1 Signs and symptoms of 58 patients with a clinical suspicion of cauda equine syndrome, of which eight have compression of the cauda equine on MRI

	Value/(percentage)				
Clinical characteristics	MRI + (8)	MRI−(50)	Odds ratio	95% CI	P-value (Chi-square)
Symptoms					
Decreased sensation of micturition	2 (25.0%)	19 (38.0%)	0.5	0.1–3.0	0.47
Rectal incontinence	2 (25.0%)	7 (14.0%)	2.0	0.3–12.2	0.42
Bilateral symptoms	5 (62.5%)	14 (28.0%)	3.6	0.8–16.4	0.09
Urinary retention	7 (87.5%)	30 (60.0%)	4.7	0.5–41.7	0.13
Frequent micturition	0 (0.00%)	6 (12.0%)			0.30
Urinary incontinence	3 (37.5)	20 (40.0%)	0.9	0.2–4.2	0.89
Low-back pain for < 1 month	6 (75.0%)	37 (74.0%)	1.0	0.2–5.9	0.95
Signs					
Urinary retention more than 500 millilitres	6 of 6 tested^a(100%)	2 of 33 tested (6%)	4.0	1.2–13.3	0.00
Saddle anaesthesia	3 (37.5%)	18 (36.0%)	1.7	0.3–9.4	0.53
Decreased anal sphincter tonus	2 (25.0%)	11 (22.0%)	1.2	0.2–6.7	0.85
Decreased anal sphincter reflex	3 (37.5)	20 (40.0%)	0.9	0.2–4.2	0.89
Lasègue's straight leg test positive	4 (50.0%)	24 (48.0%)	1.1	0.2–4.8	0.91
Loss of motor function in leg	4 (50.0%)	25 (50.0%)	1.0	0.2–4.4	1.00
Loss of motor function in foot raisers	2 (25%)	17 (34.0%)	0.7	0.1–3.6	0.62
Decreased ankle reflex	3 (37.5%)	14 (28.0%)	1.5	0.3–7.4	0.58

^aUltrasound bladder volume measurement was not performed in two MRI+ patients. Statistically significant values are in bold.

Table 1 shows the occurrence of signs and symptoms in all patients. Not all neurological tests were done in all patients: where relevant we indicated this in the table. Six MRI + CES patients had more than 500 ml urinary retention, as measured with the BladderScan. The odds ratio (OR) was 4.0 (95% CI 1.2–13.3). If the urinary retention was at least 1000 ml, the OR ratio was 15.5 (95% CI 1.8–132.5). Other clinical characteristics had no independent prognostic value for MRI confirmed cauda equina compression. In patients with a measured urinary retention volume of at least 500 ml and also two or all three of the following characteristics: bilateral sciatica, subjective complaints of urinary retention or rectal incontinence symptoms, the MRI was more probably to demonstrate cauda compression, with OR of 48.00, (95% CI 3.3–697.2, $P = 0.04$ by chi square test).

The neurologist accurately predicted the eight MRI + CES patients, but had also reached a definite diagnosis of CES in another 39 without MRI-confirmed cauda compression. In the other 11 MRI-negative patients the neurologist considered the probability of cauda compression low, but could not rule it out on clinical grounds alone.

Discussion

This study tried to identify clinical characteristics which predict cauda compression on MRI. To the best of our knowledge, this is the first diagnostic study in a secondary neurology referral centre. The other diagnostic study, with five MRI-confirmed cauda compressions in 23 suspected CES patients, was done in a tertiary neurosurgical referral centre by Bell *et al.* [12]. These authors were not able to identify clinical characteristics that accurately predicted cauda compression on MRI. Based on these results they recommend urgent MRI scans in every patient with new onset urinary symptoms in the context of low back pain or sciatica. Our study accords largely with Bell's as we were also not able to identify saddle sensory loss as an important predictor for the presence of cauda equina compression on MRI. Recently Podnar [13,14], found this sign to be indicative of cauda equina compression as measured with uro-neurophysiologic investigation, but as his was a different patient population, these studies are difficult to compare. We think that because of the pain and because sensory examination has a low interobserver agreement in general [15], this sign is, in our population, not very reliable to predict cauda compression. We, however, found that urinary retention of more than 500 ml alone or in combination with two or more

characteristics were more accurate predictors of MRI-confirmed CES.

We found that MRI-confirmed CES patients were more often men than women, and more often had bilateral sciatica, subjective urinary retention, rectal incontinence symptoms, and (measured) urinary retention above 500 ml. Only this last sign reached statistical significance. Many more patients complained of urinary retention than actually have this when measured. The BladderScan may thus be a valuable tool for the clinical diagnosis of CES, and hence for selection of patients to undergo an urgent MRI scan. We think that this measurement is the most promising diagnostic tool for this, as we were not able to identify any other single sign or symptom that could accurately predict the presence or absence of cauda compression on MRI. Any future prospective study in CES patients should incorporate this measurement.

At the moment the recommendations by Bell *et al.*, to scan every patient with new onset urinary symptoms in the context of low back pain or sciatica, seem still appropriate. As CES is a rare condition, the number of 'unnecessary' urgent MRI scans is still negligible when considered in the context of potential permanent sphincter dysfunction.

Disclosure

No competing interests.

References

1. Mixter JM, Barr JS. Rupture of the intervertebral disc with involvement of the spinal canal. *New England Journal of Medicine* 1934; **211**: 210–212.
2. Coscia M, Leipzig T, Cooper D. Acute cauda equina syndrome. Diagnostic advantage of MRI. *Spine* 1994; **19**: 475–478.
3. Shapiro S. Cauda equina syndrome secondary to lumbar disc herniation. *Neurosurgery* 1993; **32**: 743–746, discussion 746–7.
4. Ahn UM, Ahn NU, Buchowski JM, Garrett ES, Sieber AN, Kostuik JP. Cauda equina syndrome secondary to lumbar disc herniation: a meta-analysis of surgical outcomes. *Spine* 2000; **25**: 1515–1522.
5. Gleave JR, Macfarlane R. Cauda equina syndrome: what is the relationship between timing of surgery and outcome. *British Journal of Neurosurgery* 2002; **16**: 325–328.
6. Shapiro S. Medical realities of cauda equina syndrome secondary to lumbar disc herniation. *Spine* 2000; **25**: 348–351, discussion 352.
7. Kostuik JP. Controversies in cauda equina syndrome and lumbar disc herniation. *Current Opinion in Orthopaedics* 1993; **4**: 125–128.
8. Sylvester PA, McLoughlin J, Sibley GN, Dorman PJ, Kabala J, Ormerod IE. Neuropathic urinary retention in the absence of neurological signs. *Postgraduate Medical Journal* 1995; **71**: 747–748.

9. Netherlands Health Council. *Management of the Lumbosacral Radicular Syndrome (Sciatica)*. The Hague: Health Council of the Netherlands, 1999: 49.
10. Coombes GM, Millard RJ. The accuracy of portable ultrasound scanning in the measurement of residual urine volume. *Journal of Urology* 1994; **152**(6 Pt 1): 2083–2085.
11. Hofman PA, Wilmink JT. Optimising the image of the intradural nerve root: the value of MR radiculography. *Neuroradiology* 1996; **38**: 654–657.
12. Bell DA, Collie D, Statham PF. Cauda equina syndrome: what is the correlation between clinical assessment and MRI scanning? *British Journal of Neurosurgery* 2007; **21**: 201–203.
13. Podnar S. Epidemiology of cauda equina and conus medullaris lesions. *Muscle and Nerve* 2007; **35**: 529–531.
14. Podnar S. Saddle sensation is preserved in a few patients with cauda equina or conus medullaris lesions. *European Journal of Neurology* 2007; **14**: 48–53.
15. van de Vusse AC, Stomp-van den Berg SG, de Vet HC, Weber WE. Interobserver reliability of diagnosis in patients with complex regional pain syndrome. *European Journal of Pain* 2003; **7**: 259–265.