Comparison of referrals for lumbar spine magnetic resonance imaging from physiotherapists, primary care and secondary care: how should referral pathways be optimised?

V. Parmar a,*, L. Thompson b, H. Aniq a

a Department of Radiology, Royal Liverpool and Broadgreen NHS Trust, Liverpool, UK
b Department of Physiotherapy, Royal Liverpool and Broadgreen NHS Trust, Liverpool, UK

Abstract

Objective To compare sensitivity of pathology on imaging between referrals from primary care, physiotherapists, spinal surgeons and other secondary care providers.

Design and setting A retrospective review of 200 consecutive magnetic resonance imaging (MRI) scans of patients’ first presentations to radiology for MR lumbar scanning at a tertiary orthopaedic centre. A scan report was defined as positive if there was any evidence of neural compromise. Fisher’s exact 2 × 2 contingency analyses were performed.

Results Eighty-seven (44%) scans were positive and 113 (57%) were negative. Forty-four percent of scans requested by general practitioners (GPs) were reported as positive compared with 57% of scans requested by physiotherapists. Only 40% and 20% of scans requested by specialist spinal surgeons and non-spinal team secondary care providers were positive, respectively. Physiotherapist referrals for MRI lumbar spine scans were significantly more likely to be positive compared with GPs (P = 0.05), spinal surgeons (P = 0.03) and others (P = 0.004).

Conclusion When appropriate, referrals via the extended physiotherapy service should be encouraged, rather than referrals directly from GPs. With appropriate training and in the appropriate clinical context, extended physiotherapy services could include inpatients and could accept outpatient referrals from other secondary care providers and not just from GPs; this would improve efficiency and reduce the workload of the radiology department and the spinal surgical unit.

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Introduction

Lumbar disc disease was first described in 1934 [1]. In 1991, it was postulated that disease compressing the spinal root nerves is correlated with pain and neural dysfunction of that specific neural region [2]. Lower back pain is very common, with 80% of people experiencing back pain at least once in their lifetime [3].

Neurological symptoms and lower back pain are frequently investigated by magnetic resonance imaging (MRI). This is the preferred method for investigating many types of clinical problems involving disc pathology [4]. MRI is of value to primary care clinicians by assisting in patient management decisions. It has been recommended that all primary care clinicians should have direct access to MRI [5]. Evidence has shown a similar diagnostic yield between spinal MRI scans performed at the request of primary care clinicians compared with secondary care hospital clinicians [6]. Additionally, there has been a greater emphasis on treating patients directly from primary care to improve cost efficiency, preserving the use of specialist spinal units for more complex spinal care.
The drawback of providing primary care clinicians with direct access to lumbar spine MRI is that they may be more likely to request inappropriate lumbar spine imaging than other physicians [7]. The overuse of MRI has become an increasingly recognised problem, as demonstrated by Emery [8].

Physiotherapists have been shown to be as effective as post-Fellowship junior staff and clinical assistant orthopaedic surgeons in the initial assessment and management of new referrals to outpatient orthopaedic departments [8]. This generates lower initial direct hospital costs [8]. Additionally, greater interaction of physiotherapists in the management of patients in primary care has been shown to be beneficial for management of the orthopaedic caseload [9–11]. Interaction of physiotherapists in managing patients in primary care has been considered feasible and acceptable [9–11]. Inman evaluated the extended role of physiotherapists in referring for MRI, and found that physiotherapists’ practice was comparable to that of orthopaedic surgeons in a centre without a spinal service [12].

At the authors’ institute, an extended physiotherapy service [musculoskeletal assessment service (MCAS)] was introduced in 2007 to reduce the pressures on spinal services and reduce waiting times. MCAS is a primary care triage service that aims to exclude serious pathology, identify surgical need and determine non-surgical management.

Four clinical physiotherapists work within the spinal MCAS team and refer patients for MRI, non-surgical intervention or spinal surgical consultation. The clinical physiotherapists have access to spinal surgical and musculoskeletal radiology opinion at a weekly spinal surgical multidisciplinary team (MDT) meeting, which also gives insight into the appropriateness of referrals. Their work solely consists of managing spinal patients, both within physiotherapy clinics and in clinics alongside spinal surgeons’ outpatient clinics. There are currently five MCAS clinics per week.

MCAS physiotherapists accept referrals from primary care if patients have had pain of spinal origin for more than 4 weeks. Following appropriate clinical assessment of patients, patients are either discharged, referred for physiotherapy, referred for an orthopaedic consultation, or if there are clinical concerns or if patients’ symptoms do not improve with physiotherapy, referred for MRI (alongside radiographs and nerve conduction studies if indicated).

All the clinical physiotherapists have completed Master’s level training in spinal assessment, that included learning the inclusion and exclusion criteria for spinal MRI and interpretation of spinal MRI results. The physiotherapists regularly undertake ionising radiation medical exposure regulations training, and can identify if radiographs or computed tomography are indicated. All patients that have been referred for MRI by MCAS are reviewed in the physiotherapy clinic following the patient’s scan. During this time, patients are given the results of the scan and management options are discussed. This also provides the opportunity for physiotherapists to evaluate the suitability of each referral for spinal MRI.

An internal departmental study of MCAS demonstrated that over a 5-month period, 194 (9%) out of 2191 patients referred to MCAS for spinal assessment were referred for an MRI scan; of these, 81 (42%) were subsequently referred to a spinal consultant. The study validated the role of extended physiotherapists in referring for MRI given the high proportion of patients who were subsequently referred to a spinal consultant based on the MRI result. The results suggested that MCAS was a good discriminator to distinguish which patients would benefit from an MRI scan and subsequent spinal consultant opinion. The study also demonstrated that MCAS plays an important role in managing a large number of spinal referrals [13]. The attendance of physiotherapists at the weekly spinal MDT meeting enables physiotherapists to discuss patients directly with spinal surgeons and musculoskeletal radiologists, with the options of referring patients for image-guided nerve root injections when clinically appropriate, or to a specialist spinal surgery outpatient appointment.

Although a previous study has validated the role of physiotherapists in referring for spinal imaging [12], to the authors’ knowledge, no studies have compared the referral patterns of the increasing volume of MRI workload from primary care clinicians for lumbar spine imaging with those from established physiotherapist services such as MCAS.

It is important to appreciate that a negative result from an MRI scan can still provide useful information for patients’ future medical and physiotherapy management. The goal of MRI is sometimes not to obtain a positive result, but to exclude a pathology. This study focused on reducing the number of negative results in patients with specific clinical concerns for neural compression, rather than including patients who had been scanned to exclude a pathology.

The aim of this study was to compare sensitivity of pathology on imaging between different referral groups, with the ultimate aim of improving efficiency of the MRI service and avoiding overuse.

It was hypothesised that the diagnostic yield from MRI requests from physiotherapists would be higher than that from referrals from primary care clinicians.

The null hypothesis was that there would be no statistical difference between the sensitivity of neural compromise (and therefore diagnostic yield) between scans requested by physiotherapists and those requested by primary care clinicians (in patients with neurological symptoms clinically thought to arise from the lumbar spine).

If this hypothesis were true, this study would agree with previous studies that there is an overuse of imaging from primary care clinicians [7]. The authors’ radiological experience of reporting MRI scans suggests that there is a disproportionately higher proportion of negative scans from primary care clinicians, and this is most likely a national trend rather than regional. Other than the study performed by Emery, there are no further studies to validate this observation [7]. These requests comprise a significant proportion of the MRI workload in a radiology department. The information could help in
managing patients referred by primary care clinicians towards the extended physiotherapy services (if clinically appropriate), thus reducing the number of unnecessary scans referred by primary care clinicians.

Methods

This retrospective study investigated 200 consecutive MRI scans of patients’ first presentations to radiology for MR lumbar scanning. Appropriate scans were identified on the radiology healthcare software system from the start date of the study (29 November 2012), and then consecutively each day prior to this until 200 patients with suitable MRI scans were identified. Two hundred patients was thought to be an appropriate number to yield useful statistical analysis, representative of the lumbar spine imaging performed in the authors’ radiology department.

To avoid confounding the results, patients who had undergone previous imaging within the last 3 years or those with previous spinal surgery were excluded. Patients with back pain, without any neural symptoms to the lower limbs were excluded as this study assessed the diagnostic yield of MRI in patients with neurological symptoms. A scan for back pain was considered a scan for the broad exclusion of pathology. Additionally, scans to assess for metastasis in patients with known malignancy, patients having scans post trauma, and scans for the assessment of infection were excluded. These exclusion criteria were in place to ensure that only scans which reflect routine referral patterns to the radiology department for neural compromise were included in this study, and to allow a more appropriate comparison between different referral pathways.

In total, 345 patient scan reports were originally assessed for eligibility for this study; 145 of these were excluded. These scans did not fit the inclusion criteria, and the most common reason for exclusion was that the patients had undergone previous imaging within the last 3 years. Given that the study centre has a tertiary spinal surgery unit, many imaging requests were also excluded because patients had undergone previous spinal surgery, or the clinical information was for back pain without any indication of neurological symptoms to the lower limbs.

Scan requests were vetted and given a protocol by one of three musculoskeletal radiologists prior to acceptance to minimise inappropriate referrals.

Clinical details, radiology report, patient’s age and the referral pathway were recorded for each patient. The referral pathways were categorised into those from general practitioners (GPs), spinal surgeons, physiotherapists and other secondary care clinicians.

If a report was positive, the clinical information was assessed to determine if the positive findings would correlate with the radiological findings. A scan report was defined as positive if there was any evidence of neural compromise. Neural compromise was defined as any neural impingement or neural compression. Patients with disc disease that abutted a nerve were not considered positive for the purposes of this study. If there was ambiguous terminology within the radiology report, the scan was reviewed by a radiologist with an interest in musculoskeletal imaging in order to clarify whether the report was positive.

This study was performed as a clinical audit to retrospectively evaluate the efficiency of the radiology service.

Results

Of the 200 patients analysed, 73 patients were referred by GPs, 58 by spinal surgeons (scans were excluded from this referral group due to the exclusion criteria), 48 by physiotherapists and 20 by other secondary care providers (Tables 1 and 3).

From the 200 scans analysed, 87 (44%) scans were positive and 113 (57%) were negative. The average age for patients with a positive scan was 52.6 years, compared with 50.1 years for patients without positive findings; however, this discrepancy of 2.5 years was not considered to be significant in data interpretation.

Three scans had positive findings that did not correlate with the clinical information (neural compromise was reported on the contralateral side to the clinical symptoms). Two of these scans were referred by physiotherapists, and one was referred by a GP. These scans were considered to be negative as the clinical concerns did not correlate with the radiological findings, which limited the diagnostic yield of the scan. Any clinical neurological deficit that could correlate with MRI features of neural compromise on the ipsilateral side was considered positive, even if the exact neural level of concern from the request was not the same as the level of neural compromise on MRI. A scan demonstrating neural compromise at a level different to that originally considered by the referral (where specified) is still likely to be of diagnostic value if the findings correlate to the same side. This is because of the anatomical variability of dermatomes between patients, and variations in motor function of each nerve between different patients. Only two patients had a positive scan that demonstrated neural compromise on MRI on the same side but at a different level to that specified in the clinical information. Furthermore, most
referrals were not specific regarding the exact level of the patient’s neurological concern, but commented on whether the neurology was in the right or left lower limb. It is not considered that this will have confounded the findings of this study.

Taking into account the three scans where the clinical concerns were contralateral to the MRI findings, 44% of scans requested by GPs were reported as positive compared with 57% of scans requested by MCAS. Secondary care referrals for MRI yielded less diagnostic yield. Only 40% and 20% of scans referred by the specialist spinal surgeons and non-spinal specialist secondary care providers were positive, respectively (Fig. 1).

Fisher’s exact $2 \times 2$ contingency analyses with exact hyper-geometric probability were conducted on the data obtained [14,15] (Table 2). Compared with GPs ($P = 0.05$), spinal surgeons ($P = 0.03$) and other secondary care clinicians ($P = 0.004$), physiotherapists were found to be more likely to refer patients for MRI lumbar spine scans with positive results. No significant differences were found in the positivity rates of MRI lumbar spine scans between those referred by spinal surgeons and those referred by GPs ($P = 0.13$) and other secondary care clinicians ($P = 0.06$).

![Number of Scans](image)

**Fig. 1.** Scan result by referrer.

### Discussion

To the authors’ knowledge, this is the first study to compare the positive yield of MRI scans of the lumbar spine requested by extended physiotherapists compared with GPs.

There are multiple channels for accepting requests for lumbar sacral MRI scanning at the study institute. Previous studies have demonstrated the value of direct access of MRI lumbar spine scans to GPs [5], and validated their use compared with hospital clinicians [6]. Recent evidence suggests that there is an overuse of MRI by primary care [7], as this technology becomes more readily available and clinicians become more risk averse.

At the study institute, MCAS was set up in 2007 with physiotherapists having an extended role in requesting MRI

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scans following appropriate clinical assessment of patients. An internal departmental audit demonstrated that only 9% of spinal-related problems attending MCAS are subsequently referred for MRI scanning [13]. Other studies have also validated the extended role of physiotherapists in requesting MRI lumbar spine scans compared with conventional secondary care providers [9–12].

This study disproves the null hypothesis that physiotherapists and GPs have similar sensitivity rates for neural compromise on MRI scan requests. The study demonstrates that requests for MRI lumbar spine imaging from physiotherapists had a significantly higher diagnostic yield ($P = 0.05$). Surprisingly, physiotherapists also had a higher diagnostic yield for sensitivity of neural compromise compared with spinal surgeons ($P = 0.03$) and other secondary care providers ($P = 0.004$).

These results validate the extended role for physiotherapists in referring for MRI lumbar spine scans. Also, given the results of the MCAS referral patterns compared with GPs, GPs should be encouraged to make use of MCAS rather than refer for imaging (when clinically appropriate). MCAS physiotherapists have specialist roles in assessing patients with spinal symptoms, and these results have shown that they are the most appropriate referral pathway for improving the efficiency of the MRI services. Given that the MCAS departmental audit showed that 2191 patients were referred to MCAS for spinal assessment over a 6-month period [13], encouraging use of this service will inevitably require investment in staff to expand service. However, given the current inefficiencies in the number of negative scans from primary care, the cost of this investment in MCAS may be offset by reducing the number of unnecessary MRI scans, and may result in a better quality of care.

This study also highlights that with appropriate training and within the appropriate clinical context, MCAS could be expanded to inpatient assessment of patients and acceptance of outpatient referrals from secondary care providers, to reduce the high number of negative scans from secondary care providers. The aim of this intervention was to reduce inefficiencies in the healthcare system, providing a better quality of care to patients and raising the standards of referrals.

This study found poor selectivity of patients for imaging by the specialist spinal surgical team compared with physiotherapists ($P = 0.03$). Spinal surgeons, in a clinically appropriate setting, should make more use of MCAS to relieve workload pressures on the spinal surgical department and radiology department, with the overall aim of providing more efficient health care.

**Limitations**

This study does not take into account the clinical context in which the patient’s scan was requested. For example, patients seen by spinal surgeons, particularly as inpatient referrals from other secondary care providers, are likely to be more unwell then patients typically presenting to an outpatient MCAS. Spinal surgeons may therefore have a lower clinical threshold for requesting an MRI scan. This study does not account for this variable. Patients presenting to primary care may prefer to have an MRI scan rather than physiotherapy (i.e., for diagnosis rather than treatment); this would not be accounted for in this study, and may have skewed the results.

This study also does not take into account that some patients referred by secondary clinical teams may be scanned for general exclusion of pathology on imaging without any specific neurological clinical concerns. This would help in patient management, and may help guide clinicians in their patient’s inpatient or outpatient discharge (i.e., a negative scan is still useful in patient management decisions). This may be a contributing factor for a number of negative scans.

**Key points**

1. Compared with GPs ($P = 0.05$), spinal surgeons ($P = 0.03$) and other secondary care providers ($P = 0.004$), physiotherapists’ referrals for MRI lumbar spine scans are more likely to have positive findings.
2. When appropriate, referrals via MCAS should be encouraged rather than direct referrals from GPs to improve efficiencies in radiology resources.
3. To improve efficiency and reduce the workload of the radiology department and spinal surgical unit, MCAS could be extended to inpatients and accept outpatient referrals from other secondary care providers (with appropriate training and in the appropriate clinical context).

**Ethical approval:** Retrospective audit of referrals for service evaluation; therefore, no ethical approval was required.

**Conflict of interest:** None declared.

**References**


