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QUALITY IMPROVEMENT

Implementation of a cauda equina service in a medium-sized district general hospital in the UK

Selina Graham[1]

Pradeep Madhavan[1]

on behalf of the Cauda Equina Syndrome Study Group at Somerset Foundation Trust

Author details can be found at the end of this article

Correspondence to:
Pradeep Madhavan;
pradeep.madhavan@somersetft.nhs.uk

Abstract

Aim This project explored how the implementation of national guidance for investigation and management of patients with suspected cauda equina syndrome impacted on service provision.

Methods Retrospective analysis of patients with suspected cauda equina syndrome during 12 months before the implementation of the national guidelines were compared with data from the 21 months following.

Results Monthly mean numbers of referrals for suspected cauda equina syndrome increased from 10.1 to 18.9 ($P<0.001$). Statistically significant increases were also seen in the total number of magnetic resonance imaging scans for suspected cauda equina syndrome, and the number of magnetic resonance imaging scans performed out of hours. The mean time interval, from magnetic resonance imaging scan confirming cauda equina syndrome to starting emergency decompressive surgery, reduced from 14.87 hours to 9.57 hours.

Conclusions Compliance with the national guidance for suspected cauda equina syndrome is imperative for patients to receive optimal treatment. However, this project has demonstrated challenges related to increased pressure on resources.

Key words: After hours care; Cauda equina syndrome; Guidelines; Magnetic resonance imaging; Service improvement; Spinal decompression

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Introduction

Cauda equina syndrome is a rare condition with an incidence of approximately 1.9 per 100 000 in the UK in 2010–11 (Woodfield et al, 2018). It is potentially devastating for the patient as it can lead to chronic pain, motor and sensory deficits, loss of bladder and bowel control, and sexual dysfunction. Delays in diagnosis and treatment can have a negative impact on patient outcomes.

The guidelines for cauda equina syndrome from the Society of British Neurological Surgeons and British Association of Spine Surgeons state that 'a patient presenting with back pain and/or sciatic pain with any disturbance of their bladder or bowel function and/or saddle or genital sensory disturbance or bilateral leg pain should be suspected of having a threatened or actual cauda equina syndrome' (Germon et al, 2015; Society of British Neurological Surgeons and British Association of Spine Surgeons, 2018). They recommend that any patient presenting with suspected cauda equina syndrome should have an emergency magnetic resonance imaging scan, as the reliability of clinical diagnosis for all stages of cauda equina syndrome is poor (Balasubramanian et al, 2010; Society of British Neurological Surgeons and British Association of Spine Surgeons, 2018). There are major differences between hospitals in the availability of magnetic resonance imaging scans, especially out of hours. The Royal College of Radiologists (2019) responded to the Society of British Neurological Surgeons and British Association of Spine Surgeons guidelines by pointing out the lack of NHS funding and inadequate staffing. They suggest the formation of emergency networks where a central hub hospital has a magnetic resonance imaging scanner working 24 hours a day, 7 days a week. However, this raises issues of cost, time delays, hardship to patients and potential risks from transferring patients between hospitals for scans (Fountain et al, 2019).

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This article explores the real-life impact on resources of complying with the Society of British Neurological Surgeons and British Association of Spine Surgeons guidelines in a medium-sized (700 beds) district general hospital in the UK. Practice was audited for the period before the implementation of the Society of British Neurological Surgeons and British Association of Spine Surgeons guidelines for baseline data, and compared to reaudit data following the implementation period.

Local context

The orthopaedic spinal surgery service at the index hospital covers a population of approximately 1 050 000. There are several routes that a patient with suspected cauda equina syndrome may take into the spinal service:

1. From a GP, minor injuries unit or physiotherapist in the community
2. From the local emergency department
3. From the emergency departments of other district general hospitals who do not provide a spinal service. During the period of this study, these neighbouring district general hospitals had magnetic resonance imaging provision between 9am and 5pm weekdays only. Outside of these hours, patients with suspected cauda equina syndrome were referred to the authors' hospital for an emergency magnetic resonance imaging scan
4. From another inpatient team
5. From the radiology department.

In May 2017, discussion began in the spinal service to develop a policy to formalise the pathway for patients with suspected cauda equina syndrome, in accordance with the British Association of Spine Surgeons recommendations (Germon et al, 2015). The aim was to ensure that the trust was providing the best, most effective care possible for patients with cauda equina syndrome, to prevent any missed cases and reduce or eliminate medicolegal claims. The new policy was initially discussed at the spinal multidisciplinary team meetings and later with the clinical leads of the emergency department and radiology, musculoskeletal triage services and satellite physiotherapy departments. There was some initial, valid concern, mainly from radiology, as a result of a lack of resources required to run this pathway. However, over time, with the help of the Trust and changes in work schedules in radiology, these issues have been resolved satisfactorily.

Defined criteria for referring into the spinal surgery service and magnetic resonance imaging scanning were documented in the new policy, exactly reflecting the 2015 national guidance, and later updated with the 2018 guidance. The policy also encouraged interface services (such as GPs, minor injuries units, emergency department and physiotherapy) to refer directly to the orthopaedic on-call team.

Under the new policy, if cauda equina syndrome is suspected, the assessing clinician arranges an urgent magnetic resonance imaging scan. The hospital's magnetic resonance imaging scanner is operational between 9.00 and 20.00 hours daily with resident radiographers and a radiologist. Out-of-hours magnetic resonance imaging scan requests are performed by a magnetic resonance imaging radiographer on call from home and remotely reported by a teleradiology service, allowing the hospital to provide scanning 24 hours a day, 7 days a week.

If the magnetic resonance imaging scan confirms cauda equina syndrome, then the patient is taken to theatre for emergency decompression, after consent and assessment of fitness. The normal operating period for spinal surgery runs between 9.00 and 18.00 hours, Monday to Friday. The service is delivered and led by a consultant spinal surgeon. If a case of cauda equina syndrome is confirmed, the elective list is halted and the patient with cauda equina syndrome takes precedence. Out of normal operating hours, the procedure is conducted by the consultant spinal surgeon on call assisted by the on-call orthopaedic registrar, a consultant anaesthetist and the on call orthopaedic scrub team.

Methods

This was a single centre study conducted over 33 months. Data collection periods were April 2016–April 2017 and May 2017–January 2019, before and after the introduction of the new local policy for the management of patients with suspected cauda equina syndrome.

There were a total of 517 referrals to the spinal on call service and 633 magnetic resonance imaging scans of the lumbar spine for suspected cauda equina syndrome. Ethical review was not required for this study.

A search of the picture archiving and communication system identified all the magnetic resonance imaging scans of the lumbar spine that were performed during the study periods. The list was then filtered by analysis of the request information to include only emergency magnetic resonance imaging scans done for suspected cauda equina syndrome. Scan images and reports were reviewed to find patients who had confirmed cauda equina syndrome and the time of the scan.

For patients in whom the magnetic resonance imaging scan confirmed cauda equina syndrome, intraoperative radiographs were used to determine the time of surgery. The authors' local practice is that, following positioning of the patient, a level check is performed which is date and time stamped. This was used to calculate the time interval between the magnetic resonance imaging scan and surgery.

A list of all referrals for suspected cauda equina syndrome was generated from the electronic patient record programme Epro (Bluewire Technologies, Bristol). Using the patient unique identifier numbers, it was then possible to determine which patients had had a magnetic resonance imaging scan by searching in the picture archiving and communication system.

These data were collected in Microsoft Excel and analysed using a combination of Microsoft Excel and R version 3.6.1. Poisson distribution was used to describe the distribution of each of the following events per month:

- Mean number of referrals for suspected cauda equina syndrome per month
- Mean number of magnetic resonance imaging scans for suspected cauda equina syndrome per month
- Mean number of out of hours magnetic resonance imaging scans for suspected cauda equina syndrome per month
- Mean number of cauda equina syndrome cases confirmed by magnetic resonance imaging per month
- Mean number of cauda equina syndrome cases operated on out of hours per month.

To calculate the significance of changes in these rates before and after the introduction of the new policy, the function poisson.test in the R stats package version 3.6.1 was used. A P value <0.05 was considered significant.

Results

The mean number of referrals and magnetic resonance imaging scans for suspected cauda equina syndrome is shown in Table 1. The increase in referrals and magnetic resonance imaging scans after policy change is statistically significant (P<0.001 and P=0.003 respectively). There was an increasing trend in number of referrals for suspected cauda equina syndrome and magnetic resonance imaging scans, as shown in Figure 1.

The percentage of suspected cauda equina syndrome referrals having a magnetic resonance imaging each month is shown in Figure 2. Before the introduction of the policy, 67% of referrals for suspected cauda equina syndrome had a magnetic resonance imaging scan and this increased to 80% after the introduction of the policy. The mean number of

Table 1. Average changes in referral and magnetic resonance imaging numbers for suspected cauda equina syndrome

	Mean number of referrals per month (range)	Mean number of magnetic resonance imaging scans per month (range)	Mean number of out of hours magnetic resonance imaging scans per month (range)	Mean number of cases confirmed by magnetic resonance imaging per month (range)
Before policy change	10.1 (7–17)	16.4 (9–25)	1.8 (0–4)	1.0 (0–3)
After policy change	18.9 (5–33)	20.8 (9–31)	4.9 (0–10)	1.4 (0–4)

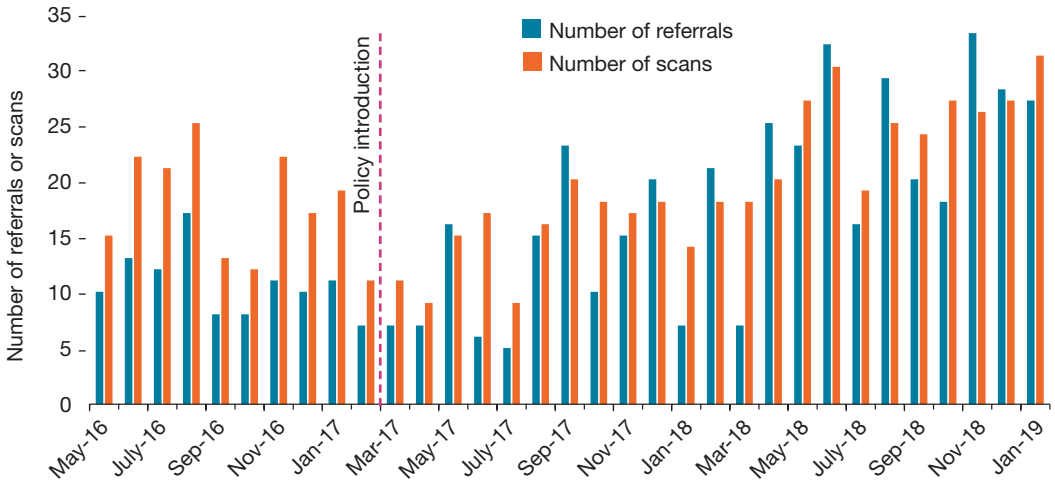

Figure 1. Numbers of referrals and magnetic resonance imaging (MRI) scans for suspected cauda equina syndrome per month.

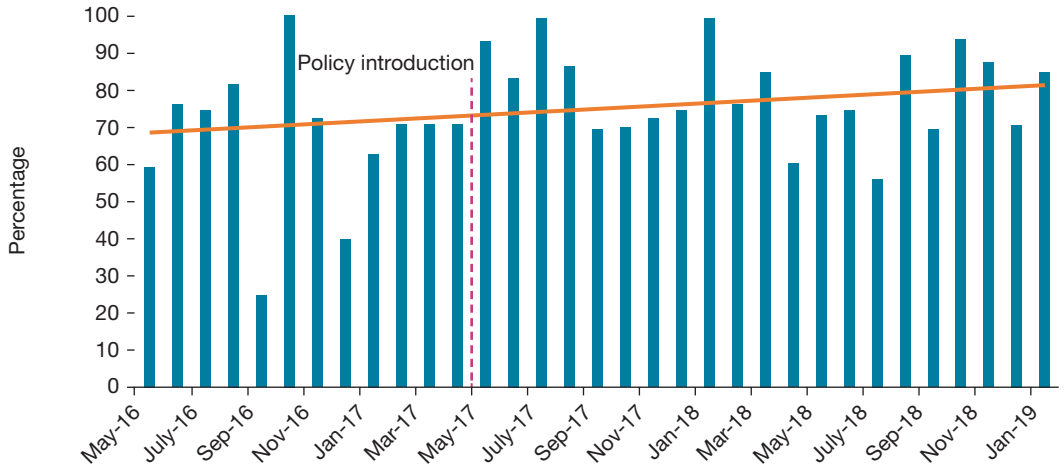

Figure 2. Percentage of referrals for suspected cauda equina syndrome having a magnetic resonance imaging scan each month.

scans performed out of hours each month for suspected cauda equina syndrome was 1.8 before the introduction of the new policy and 4.9 afterwards ($P<0.001$). However, there was no statistically significant increase in the number of magnetic resonance imaging scans performed during normal working hours ($P=0.1342$).

Before the policy change, a mean of 1 magnetic resonance imaging scan per month confirmed cauda equina syndrome. This increased to a mean of 1.4 afterwards, but this is not statistically significant ($P=0.1871$). Before the policy change, three patients with suspected cauda equina syndrome were transferred from neighbouring district general hospitals before magnetic resonance imaging and six after magnetic resonance imaging. After the policy change three were transferred before magnetic resonance imaging and four after magnetic resonance imaging.

The mean time interval between magnetic resonance imaging scan and the start of surgery for patients with confirmed cauda equina syndrome was 14.87 hours before the new policy (range 4.31–25.97 hours), which reduced to 9.57 hours (range 0.44–24.18 hours) following the introduction of the policy. A total of 22.2% ($n=2$) of operations for cauda equina syndrome were performed out of hours before the introduction of the new policy, which increased to 64.0% ($n=16$) afterwards, which was statistically significant ($P=0.018$).

Discussion

This study assessed the impact of implementing national guidelines on the management of cauda equina syndrome on service provision in a medium-sized district general hospital in

the UK. The consequences for secondary healthcare (for example orthopaedic admissions, emergency scanning provision and resource use) have been assessed.

The number of referrals for suspected cauda equina syndrome to the orthopaedic on call team has nearly doubled since May 2017. The increase in referral rate was gradual as dissemination of the new policy filtered out to all referral sources within the catchment area. In March 2018, the National Institute for Health and Care Excellence (2018) Clinical Knowledge Summary updated their red flags for sciatica. In December 2018, the Society of British Neurological Surgeons/British Association of Spinal Surgeons guidelines were updated. Both these events occurred within the data collection period and may explain some of the increase in referral rates. While the repeat audit cycle ended in January 2019, the findings of this study are still applicable in 2021, as there has been no new guidance nor changes to clinical practice since.

Although there was a significant increase in the number of referrals for suspected cauda equina syndrome, there was not a statistically significant increase in the number of radiologically confirmed cases of cauda equina syndrome. The incidence of cauda equina syndrome is not reliably recorded because of the varying definitions of this condition. Reported incidence rates vary widely, from 0.3 in 100 000 to 3.3 in 100 000 (Gardner et al, 2011). There is no reason to suspect that the incidence of cauda equina syndrome is changing on a local or national level. Broader and clearer indications for referral and magnetic resonance imaging scanning for suspected cauda equina syndrome might have led to a significant increase in diagnosis, but this has not been shown convincingly here.

The implementation of the new policy has led to focused engagement from all levels and departments of the Trust. The policy has had a profound impact on the workload of the orthopaedic on-call team and has resulted in closer involvement of the on-call spinal surgeon, who is best placed to manage such patients promptly and efficiently. The policy has, at least in part, necessitated the employment of one new spinal consultant and two magnetic resonance imaging radiographers.

There was a discrepancy between the numbers of referrals received by the spinal service and magnetic resonance imaging scans done for suspected cauda equina syndrome, indicating that some referrals were not made to and investigations did not pass through the spinal service. In addition, not all referrals met the criteria for suspected cauda equina syndrome, explaining why not all referrals had a magnetic resonance imaging scan (67% before, 80% after policy change).

The increased number of referrals has led to a statistically significant increase in the overall number of magnetic resonance imaging scans being done for suspected cauda equina syndrome. The data demonstrate that the increased burden was in out of hours radiology requests, which have seen a statistically significant, two-fold increase. This is likely to represent a change in attitude of both assessing clinicians and the radiology department. Before the change in policy, there was a reluctance to accept magnetic resonance imaging scan requests overnight, partly as it involves bringing in the radiographer from home. Such requests were often deferred to early the following day. With the release of the Society of British Neurological Surgeons and British Association of Spine Surgeons guidelines, this stance is now medically and medicolegally unacceptable. All patients with suspected cauda equina syndrome should have access to magnetic resonance imaging scanning services 24 hours a day, 7 days a week (Balasubramanian et al, 2010; Germon et al, 2015; Society of British Neurological Surgeons and British Association of Spine Surgeons, 2018).

Magnetic resonance imaging scans done during normal working hours cost the local Trust £124, and out of hours, they cost £210 per scan. However, the cost implications of the new policy are much more far reaching than just the increased spending on magnetic resonance imaging scans. The financial impact of expanding services to comply with the guidance can be offset against a potential reduction in costs arising from healthcare for the catastrophic sequelae to patients of missed cauda equina syndrome, costs to society and litigation.

Cauda equina syndrome is a significant cause of litigation in spinal surgery, both in terms of cost and claim volume. The Getting It Right First Time (GIRFT) report calculated the value of all cauda equina syndrome-related claims for 2014–16 to be £68 million (Hutton, 2019). Delay or failure of diagnosis was the most common factor cited (44%), followed

by delay or failure in treatment (17%) (Hutton, 2019); 13% specifically refer to failures in obtaining a magnetic resonance imaging scan, and 8% detail issues in referral or transfer (Hutton, 2019). However, the costs from litigation are inconsequential compared to the devastating consequences for the patient.

The number of patients with suspected or confirmed cauda equina syndrome being transferred from neighbouring hospitals has not increased. From these data, it is not possible to conclude what the explanation for this is. Hauptfleisch et al (2013) found that only 14% of hospitals in the UK had a 24/7 magnetic resonance imaging scanning service. While this is likely to have improved, this is far from perfect as it can lead to unnecessary, expensive and potentially harmful patient transfers. The Spinal GIRFT programme recommends 'Trusts (are) to follow Society of British Neurological Surgeons and British Association of Spine Surgeons guidance on the management of patients with suspected cauda equina syndrome, including urgent referral by a senior decision-maker to a 24-hour magnetic resonance imaging scanning service performed locally in the hospital of presentation, ensuring no delay' (Hutton, 2019).

There was considerable variability in the time interval between magnetic resonance imaging and surgery (range 0.44–25.97 hours) over the whole data collection period. In part, this related to the time of day when the decision for surgical decompression was made – if this was out of hours, the surgeon and orthopaedic theatre staff needed to travel in from home. The mean time of 9.57 hours after the new policy introduction was a big improvement on the previous mean of 14.87 hours. The literature does not provide a standard time to aim for and guidance simply states that surgery should be undertaken at the earliest opportunity (Society of British Neurological Surgeons and British Association of Spine Surgeons, 2018). From these data, an improvement in time elapsed from presentation to definitive management for patients with cauda equina syndrome and therefore an overall improvement in their care might be inferred. However, it was not possible to measure how soon after the initial presentation (or onset of symptoms) the scan was performed.

Since the introduction of the new policy, there has been a significant increase in out of hours operating for patients with cauda equina syndrome. Despite the risks of operating at night, delaying surgery till the next working day is no longer acceptable. Operating out of hours is costly in terms of staffing but does not impact on patients having elective surgery during the day. When emergency cauda equina syndrome surgery takes place out of hours, the on-call orthopaedic registrar is taken away from their usual duties of seeing new referrals and answering queries as they are required for surgery.

Conclusions

Implementing the guidelines is the right thing for patients but it is not easy and it requires increased resources. This study demonstrates that it is possible for a medium-sized NHS district general hospital in the UK to run a cauda equina service that meets best practice national guidelines and results in accelerated surgery with the potential for improved patient outcomes and reduced litigation costs. The continued upward trend in referrals and magnetic resonance imaging scans for cauda equina syndrome seen during the reaudit period suggests that the new policy has been adopted into practice and demonstrates the long-term sustainability of the intervention.

Spinal and radiology societies and the NHS should agree to implement a framework of 24/7 magnetic resonance imaging scanning for patients suspected of having cauda equina syndrome at any acute care hospital with an emergency department, at the request of any appropriate clinician.

Author details

[1]Spinal Surgery Service, Department of Orthopaedics and Trauma, Somerset Foundation Trust, Musgrove Park Hospital, Taunton, Somerset, UK, on behalf of the Cauda Equina Syndrome Study Group (CESSG) at Somerset Foundation Trust

Members of the Cauda Equina Syndrome Study Group at Somerset Foundation Trust: Selina Graham, Pradeep Madhavan, Paul Thorpe, Yee Leung, Ashok Subramanian, Dushan Thavarajah, Paul Burn, Danial Fox, Guru Karnati, Iain Palmer.

Key points

- Implementation of the national guidelines ensures that patients with cauda equina syndrome are treated promptly and appropriately.
- A significant increase in demands on resources is incurred during service reconfiguration to implement the Society of British Neurological Surgeons and British Association of Spine Surgeons guidelines for cauda equina syndrome.
- Effective multidisciplinary collaboration is required to reconfigure the patient pathway for cauda equina syndrome.
- This study supports previous evidence that magnetic resonance imaging should be available at all times in all acute care hospitals with emergency departments.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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