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Purpose

The British Association of Spine Surgeons (BASS) (Germon et al., 2015) produced guidelines relating to the management of patients with suspected Cauda Equina Syndrome (CES). These are detailed as “A patient presenting with acute (de novo or as an exacerbation of pre-existing symptoms) back pain and/or leg pain with a suggestion of a disturbance of their bladder or bowel function and/or saddle sensory disturbance should be suspected of having a CES. Most of these patients will not have critical compression of the cauda equina. However, in the absence of reliably predictive symptoms and signs, there should be a low threshold for investigation with an emergency scan.”

This clinical study reviews the management of patients triaged by a national telephone service subsequently referred to A&E for suspected CES relative to BASS guidance.

Introduction

The presentation and management of CES remains contentious in medical literature. Classification and recognition of CES is complex as the clinical features are heterogenic. Some of the literature suggests looking towards CES as a clearly identifiable pathology, yet many studies have revealed large inconsistencies with its clinical presentation (Fraser, Roberts, & Murphy, 2009; Domen, Hofman, van Santbrink, & Weber, 2009; Podnar, 2007; Korse, Jacobs, Elzevier, & Vleggeert-Lankamp, 2013; Angus, Elmajee, Verma, Mohammad, & Siddique, 2015; Venkatesan, Nasto, Haddad, & Tsegaye, 2017) and suggest huge variability in timelines associated with symptom development.

Todd and Dickson (2016) suggest five characteristic features of CES

- Bilateral neurogenic sciatica
- Reduced perineal sensation
- Altered bladder function ultimately to painless urinary retention
- Loss of anal tone
- Sexual dysfunction

The precise mechanisms and pathological influences around this widespread variability are unknown, but may be related to several factors:

- 1) The variety of pathological causes include: lumbar disc prolapse (accounting for 45% of all cases) (Fraser, et al., 2009), spinal haematomas, metastasis, epidural abscess, traumatic compression, or acute transverse myelitis (Small, Perron, & Brady, 2005).
- 2) Medication and/or pain levels may produce masquerading symptoms of CES in patients (Jalloh & Minhas, 2007; Woods, et al., 2015).
- 3) The location of compression – portions of the CES will vary with respect to relative areas of hypo-vascularity and this may contribute to variation or severity of symptoms (Lavy, et al., 2009).
- 4) CES also presents challenges with presenting a robust evidence base, with an estimated prevalence of 1.9 per 100,000 (Woodfield, et al., 2018).

It is widely agreed throughout literature that CES requires emergency medical attention. Axonal compression for any longer than 6 hours sees a rapid decline of nerve function, consequently the level of neurological function at the time of surgery is probably the most significant determinant of prognosis (Chau, et al., 2014). The need to avoid delays in care is therefore critical, as early surgical decompression significantly improves the outcomes for those related to herniated discs (Lavy, et al., 2009; Podnar, 2007). Physiotherapists will often refer suspected cases to A&E departments for emergency medical review in order to safeguard patient safety.

The clinical work up of patients in an A&E department is however a process that is fraught with debate and inconsistencies. Assessment may include a rectal examination for tone and sensation,

along with post void residual bladder volumes, all having questionable diagnostic validity (Dionne, et al., 2019; Domen, et al., 2009; Gardner, et al., 2011; Korse, et al., 2013; Podnar , 2007).

Ahad et al (2015) investigated patients with suspected CES undergoing spinal MRI. Out of 79 patients that presented with CES symptoms, 26% reported lower limb muscle weakness, 20% reported numbness or altered sensation, but only 8.9% reported saddle anaesthesia and bladder incontinence, with 7.6% reporting urinary retention. Only 5 patients that received an MRI scan had results which confirmed CES. The study demonstrates that no single clinical feature could predict the presence of CES on an MRI scan. This suggests that the majority of MRI's performed in A&E will be negative, and would also suggest that the diagnostic utility of signs and symptoms for CES is challenging due to its variability and heterogeneous presentations.

Todd (2009) detailed a clinical algorithm that could be used to assess suspected cases for CES. Todd (2009) proposed a clinical work up such that all patients presenting with subjective or objective evidence of CES who do not have bladder paralysis (so called 'Incomplete CES') require emergency MRI, with view to decompress the cauda equina prior to further symptom progression. For patients that do have bladder paralysis at presentation, the urgency of surgical decompression in light of known poor prognostic factors presents a more complicated approach for management.

The British Association of Spine Surgeons (BASS) (Germon et al., 2015) have produced guidance to assist with identification and management of CES. This is detailed as "A patient presenting with acute (de novo or as an exacerbation of pre-existing symptoms) back pain and/or leg pain with a suggestion of a disturbance of their bladder or bowel function and/or saddle sensory disturbance should be suspected of having CES. Most of these patients will not have critical compression of the cauda equina. However, in the absence of reliably predictive signs and symptoms, there should be a low threshold for investigation with an emergency scan."

With this in mind, this study aimed to investigate the management of patients referred to A&E for suspected CES triaged on a national telephone service, and understand consistency of care in this environment based on the above BASS recommendations for emergency investigations.

Method

Data was obtained retrospectively from a national telephone triage service that screen for a range of musculoskeletal conditions referred by various private medical insurance companies. All individual call handlers on the service were qualified physiotherapists, registered with the Health Care Professions Council, and members of the Chartered Society of Physiotherapy. There were approximately 10,000 calls per month between January 2017 and June 2017, the dates for this study, including a mixture of new and follow-up appointments.

Where a potential serious pathology, of which CES is one, is identified this is immediately highlighted to the clinical leads for the service and referral pathways are in place for individual patients to access their local A&E department. The triage service provides national coverage, and thus relies on different A&E locations for any emergency onward referrals. All known escalations to A&E for suspected CES that aligned to the BASS definition of CES between January and June 2017 from the national telephone triage were included in the current study. It should be noted that along with the referral to A&E each patient also received a verbal explanation of signs and symptoms, likely natural history including time scales, an emailed copy of the CES "credit card" to the patient (Greenhalgh , et al., 2015) and letter to take with them to the A&E department. Separate to this the triaging clinician would phone ahead to the local A&E department to provide a handover.

All escalations were logged on a database by relevant clinical leads who oversee the day to day running of the service and were experienced physiotherapists. Three of these clinical leads worked together to provide consistency with symptom analysis by reviewing the clinical case records and telephone assessment recordings of suspected CES cases for the purpose of this study. Symptoms of CES were noted and logged according to the CES warning signs detailed on the 'credit card' published by Greenhalgh et al (2015).

Every patient referred to A&E for suspected CES had a follow up call from the triage team the next working day so that outcomes of the referral could be discussed and further action undertaken if required.

Exclusion criteria to the study included poor call quality preventing the formation of any transcripts.

A total of 17 patients with symptoms of CES were identified in this study, they were dichotomised for analysis i) those that had symptoms of CES, escalated to A&E and investigated with MRI (n=8), ii) those that had symptoms of CES, escalated to A&E, and not investigated with MRI (n=9).

Results

Table 1: Patients that were investigated with an MRI scan at A&E

Age	37	43	38	49	48	38	57	29
Sex	F	F	F	M	M	M	F	F
Loss of feeling / pins and needles between your inner thighs or genitals	x	x			x	x		
Numbness in or around your back passage or buttocks								
Altered feeling when using toilet paper to wipe yourself				x		x		
Increasing difficulty when you try to urinate	x							x
Increasing difficulty when you try to stop or control your flow of urine		x						
Loss of sensation when you pass urine			x				x	
Leaking urine or recent need to use pads								x
Not knowing when your bladder is either full or empty	x		x				x	
Inability to stop a bowel movement or leaking								
Change in ability to achieve an erection or ejaculate				x	x			
Loss of sensation in genitals during sexual intercourse		x		x				
Bilateral symptoms						x		
Constipation Bowel								
Confirmed CES on MRI	N	N	N	N	N	N	N	N

Table 2: Patients that were not investigated with MRI at A&E

Age	46	49	57	35	21	44	47	50	62
Sex	M	F	F	F	F	F	M	M	F
Loss of feeling / pins and needles between your inner thighs or genitals	x		x	x	x	x			
Numbness in or around your back passage or buttocks	x		x	x					
Altered feeling when using toilet paper to wipe yourself		x		x		x			
Increasing difficulty when you try to urinate			x				x		
Increasing difficulty when you try to stop or control your flow of urine			x						
Loss of sensation when you pass urine		x			x				

Leaking urine or recent need to use pads						x			x
Not knowing when your bladder is either full or empty		x	x	x	x				
Inability to stop a bowel movement or leaking						x		x	
Change in ability to achieve an erection or ejaculate		x						x	
Loss of sensation in genitals during sexual intercourse	x								
Bilateral symptoms		x	x	x	x	x	x		x
Constipation Bowel			x						

17 patients (11 females, 6 males) that conformed to the BASS definition of CES that were escalated to A&E over a six month period between January 2017 and June 2017 were included for evaluation in this study. Table 3 data shows the between group comparisons.

Both the MRI and non-MRI groups had similar group sizes (8 : 9) and mean ages (42.4 years +/-8SD and 45.7 years +/-12SD). Overall, there were more females (11) compared to males (6) referred to A&E, however there was no reason identified in the study to account for this.

The results indicate that approximately half (53%) of the patients that exhibited CES symptoms conforming to the BASS definition of meeting the requirement for diagnostic imaging were not investigated with an MRI scan.

The number of symptoms did not appear to indicate whether a patient received an MRI in A&E or not. The group that were investigated with MRI had on average 2.5 identified CES symptoms whilst the non-investigated group had on average 4 symptoms.

The loss of sensation in the genitals during sexual intercourse was the only symptom indicating a patients was more likely to receive an MRI (11.8%) than not (5.9%). Interestingly the presence of bilateral limb symptoms with or without other recognised CES symptoms revealed a 41.2% chance of not being investigated with MRI.

Table 3: Between group comparison

	Investigated by MRI	Not investigated by MRI
group size	8	9
Age (yrs)	42.4	45.7
Gender (Male : Female)	3 : 5	3 : 6
average number of reported symptoms for person	2.5	4
Loss of feeling / pins and needles between your inner thighs or genitals	23.5%	29.4%
Numbness in or around your back passage or buttocks	0.0%	17.6%
Altered feeling when using toilet paper to wipe yourself	11.8%	17.6%
Increasing difficulty when you try to urinate	11.8%	11.8%
Increasing difficulty when you try to stop or control your flow of urine	5.9%	5.9%
Loss of sensation when you pass urine	11.8%	11.8%
Leaking urine or recent need to use pads	5.9%	11.8%
Not knowing when your bladder is either full or empty	17.6%	23.5%
Inability to stop a bowel movement or leaking	0.0%	5.9%
Change in ability to achieve an erection or ejaculate	11.8%	11.8%

Loss of sensation in genitals during sexual intercourse	11.8%	5.9%
Bilateral symptoms	5.9%	41.2%
Constipation Bowel	0.0%	5.9%

Discussion

Management of CES is complex requiring timely investigation and intervention to prevent long-term disability. BASS advocate emergency MRI investigations for patients that display symptoms of CES which may include back pain and/or leg pain with a suggestion of a disturbance of their bladder or bowel function and/or saddle sensation (Germon, et al., 2015). Delays in diagnosis and thus surgical intervention has many causes, most notifiable the challenge presented around heterogeneity of clinical presentations (Jalloh & Minhas, 2007). Therefore a safety first approach offers clarity in a confusing clinical picture. This may however contribute to a high number of negative MRI scans in people presenting with CES symptoms, yet the clinician is bound by their duty of care to the patient to exclude CES as a first priority (Greenhalgh, et al., 2018).

This study examined the A&E management of patients that had been referred with CES symptoms in an attempt to review the clinical work up made in relationship to symptoms reported by patients. The study was unable to look into the decision making in A&E, and in particular the rational as to whether MRI was undertaken or not.

As previously mentioned BASS make note that in relation to CES, there should be a low threshold for investigation with an emergency scan due to an absence of reliably predictive symptoms and signs (Germon, et al., 2015). The results of this study demonstrate that the CES group investigated with MRI had a lower average number of symptoms of CES (2.5), whilst those not investigated by MRI had a higher average number of symptoms (4). These results seem in conflict with evidence that says the current red flags are the best tool available for health care practitioners to screen for CES (Dionne, et al., 2019) and that MRI is the preferred investigation in suspected CES (Germon, et al., 2015; Ahad, et al., 2015; Bell, et al., 2007).

A further notable difference between the 2 groups was in relation to bilateral symptoms, 41.2% of the group that did not receive an MRI reported this symptom compared to only 5.9% in the group that received an MRI. This would potentially be in conflict to current thinking (Wilkes, 2019; Finucane, et al., 2020) especially where concurrent other CES symptoms are present.

The only symptom that was more commonly investigated by MRI was loss of sensation in genitals during sexual intercourse at 11.8% compared to 5.9% in the not investigated by MRI. As with the point above, the reasoning behind these decisions is beyond the scope of this study but should be included in any further research.

Within the group that did receive an MRI, it should be noted that none had a diagnosis of CES confirmed on MRI. In specialist centres MRI's were found to be normal in 43% to 86% of cases referred for suspected CES (Bell, et al., 2007; Domen, et al., 2009). This coupled with the small sample size in this study may account for the results. It must be stressed though current medical opinion is for a low threshold for investigation in suspected CES (Germon, et al., 2015; Hutton, 2019) so it must be considered that onward referral was appropriate in these cases from the telephone triage service.

In this study there appears to be variation in the emergency management of patients within A&E reporting CES symptoms that align with the BASS definition. The difference in management pathway exhibited between the two cohorts of patients in this clinical study (those investigated and those not investigated with MRI) does not appear to be symptom led, as the non-investigated group presented with a greater number of symptoms that warrant investigation according to the BASS criteria (Germon, et al., 2015).

Questions regarding the variability exist. Firstly, we are unsure of the supporting clinical rationale to not investigate patients with these reported symptoms. Although there is a lack of consensus regarding which physical tests should be used to aid diagnosis of CES, current guidelines recommend that in order to provide comprehensive care and reduce the risk of litigation, a full neurological examination including saddle sensory testing and anal tone examination are completed by clinicians who are competent (Greenhalgh, et al., 2018; Finucane, et al., 2020).

As the patient journey within the telephone triage service was over a limited period of time, we are unsure if any of the non-investigated group later experienced repeated episodes or further deterioration of symptoms at a later date. This would have provided a longitudinal viewpoint of the patient journey and may have assisted in future research by determining episodes of CES that may have been prevented by imaging at an earlier stage in their presentation. Further research is recommended on the decisions made at point of presentation to A&E, based on completed patient journeys over a much longer period of review.

When looking at the incidence rate of CES indicated by Woodfield et al (2018) of 1.9 per 100,000 cases, the referral rate of 17 from roughly 60,000 telephone consultations (equates to approximately 28 per 100,000), it is likely that a proportion of cases referred to A&E in this study would have demonstrated masquerading symptoms that would never have developed into CES. Following the BASS criteria (Germon, et al., 2015), issues with delayed in diagnosis (Jalloh & Minhas, 2007) and the 'safety first' approach, all of the patients identified during the triage process were appropriately managed with referral to A&E. There is however understandably also a need within public health and emergency departments to carefully manage finite resource against demand. As such, there is a need to provide value-based healthcare. It may therefore be 'reasonable' based on specific clinical presentations not to immediately investigate some patients. It is considered acceptable as such to closely monitor the group of 'non-investigated' patients with watchful waiting (Cook, et al., 2017; Finucane, et al., 2020). Ideally, this would consist of providing the patient with clear symptom explanation and education of 'what to do' and 'where to go' should this be required. Greenhalgh et al. (2015) have produced a valuable resource to guide patients in this area, (<https://www.eoemskservice.nhs.uk/advice-and-leaflets/lower-back/cauda-equina>) and best practice would be to distribute these to this group of patients while 'watchful waiting'.

Secondly, the size of the data sample in this study is small. As the examined patient cases span a national footprint of A&E departments across the country, it may not be a true reflection of consistent clinical culture and behaviours in each of the A&E departments, but may represent isolated events. Nevertheless, as CES is rare in presentation in MSK physiotherapy this number still represents a useful volume of patients presenting with symptoms of a potentially concerning and serious pathology. This volume also still shows variation from the BASS guidance that suggests having a low threshold for emergency investigation.

Thirdly, there is a need to understand the beliefs of medical colleagues throughout healthcare of how CES may present, including whether symptoms that may be experienced with early onset of CES are interpreted well. The challenge for medical staff is to display judicious action with investigating CES in the early stages on onset, to prevent long term disability, yet recognising CES at this stage in

development will naturally return more false positives with imaging. It may be possible that clinical suspicion of CES is currently only suspected when present with concurrent, multiple late stage signs and symptoms, by which time it may be too late to provide successful surgical outcomes (Chau et al., 2014). Thus, there is a need to raise the profile of this pathology across healthcare staff and educate on the complexities of the heterogeneous presentation and when to intervene.

Conclusion and Recommendations

Managing suspected CES patients is complex and clinicians should for this reason adhere to guidance provided by BASS and most recently the framework published by Finucane, et al (2020). Finucane et al (2020) provide a framework to aid early assessment and initial management of people who present with potential serious spinal pathology of which CES is one. This includes a series of decision tools to help early identification of potential serious spinal pathology and outlines testing that should be undertaken in both primary and secondary care in suspected CES, including the recommendation that referral should be made for emergency MRI and surgical opinion in such cases. The framework has further offered guidance in relation to duration of presenting symptoms and whether the patient could be classified as either emergency or urgent. This will be of benefit for all service personnel both within the UK and internationally who are involved in triaging and managing patients with suspected CES so that ultimately as a profession we can do best by our patients and reduce the chance of them developing long term, life changing physical and psychological conditions (Finucane, et al., 2020).

The authors are also aware of a recently published multidisciplinary Framework for early recognition of CES for primary care clinicians, developed by the National Backpain Pathway- Clinical Network (2020). This in combination with the international framework (Finucane, et al., 2020) and expanding evidence within the field of CES (Dionne, et al., 2019; Greenhalgh, et al., 2018; Hutton, 2019; Venkatesan, et al., 2017; Woodfield, et al., 2018) will assist further research on whether the management of suspected CES patients has been optimised.

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Declaration of competing interest

None declared.

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