■ SPINE

Cauda equina syndrome

IS THE CURRENT MANAGEMENT OF PATIENTS PRESENTING TO DISTRICT GENERAL HOSPITALS FIT FOR PURPOSE? A PERSONAL VIEW BASED ON A REVIEW OF THE LITERATURE AND A MEDICOLEGAL EXPERIENCE

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There is no universally agreed definition of cauda equina syndrome (CES). Clinical signs of CES including direct rectal examination (DRE) do not reliably correlate with cauda equina (CE) compression on MRI. Clinical assessment only becomes reliable if there are symptoms/signs of late, often irreversible, CES. The only reliable way of including or excluding CES is to perform MRI on all patients with suspected CES. If the diagnosis is being considered, MRI should ideally be performed locally in the District General Hospitals within one hour of the question being raised irrespective of the hour or the day. Patients with symptoms and signs of CES and MRI confirmed CE compression should be referred to the local spinal service for emergency surgery.

CES can be subdivided by the degree of neurological deficit (bilateral radiculopathy, incomplete CES or CES with retention of urine) and also by time to surgical treatment (12, 24, 48 or 72 hour). There is increasing understanding that damage to the cauda equina nerve roots occurs in a continuous and progressive fashion which implies that there are no safe time or deficit thresholds. Neurological deterioration can occur rapidly and is often associated with longterm poor outcomes. It is not possible to predict which patients with a large central disc prolapse compressing the CE nerve roots are going to deteriorate neurologically nor how rapidly. Consensus guidelines from the Society of British Neurological Surgeons and British Association of Spinal Surgeons recommend decompressive surgery as soon as practically possible which for many patients will be urgent/emergency surgery at any hour of the day or night.

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Patients with suspected cauda equina syndrome (CES) are frequently referred to orthopaedic surgeons working in District General Hospitals (DGHs). These surgeons are not specialist spinal surgeons but are expected to make crucial decisions regarding the management of CES. This article provides the evidence base for the rational management of the patient with suspected CES.

Patients and Methods

A PubMed search was undertaken using the search term cauda equine syndrome. No time delimiter was applied; selected papers ranged from 1956 to 2015. The search was restricted to papers published in English and only involving human studies. In total, 3528 potential abstracts were identified; papers were selected to address the issues set out in this paper. The author's (NVT) database of 157 medicolegal cases (2001 to 2015) was retrospectively reviewed to determine at what stage CES patients were treated and the proportion of patients who deteriorated while under medical care.

Results

Epidemiology. A significant central disc prolapse has been reported to be present in about 3% of all lumbar disc prolapses (PLID)[1] with CES occurring in about 0.07% to 0.12% of PLIDs.[2,3]

CES is a syndrome. Unfortunately there is no universally agreed definition of CES. The literature includes symptoms and/or signs from modest cauda equina irritation through to catastrophic neurological and visceral injury.[4] Symptoms and/or signs can include impairment of bladder, bowel, urethral or perineal sensation, problems in micturition, incontinence of urine or faeces, a palpable bladder and/or impairment of anal sphincter tone. Before CES there may be bilateral radicular pain and/or dermatomal sensory loss and/or motor weakness. A previous literature review noted a lack of commonality of symptoms and/or signs in 25% of the papers examined,[5] causing diagnostic uncertainty.

Classification. CES can be subdivided into three categories.[6] Firstly, CES suspected or

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suspicious (CESS), is the patient with a bilateral radiculopathy, who does not have CES but if the bilateral radiculopathies are caused by a large central PLID then the patient is at risk of developing CES. Secondly, incomplete CES (CESI), is the patient who has objective evidence of CES, typically impaired perineal sensation and some sphincter problems but retains voluntary control of initiating and stopping micturition. Thirdly, CES retention (CESR), describes the patient with a paralysed, insensate bladder; the bladder retains urine, which is painless and subsequently there is incontinence of urine. CESR does not imply complete loss of cauda equina (CE) function.

Diagnostic uncertainty. No symptom or combination of symptoms/signs reliably excludes or confirms CES.[7,8] Direct rectal examination (DRE) does not discriminate between the presence or absence of CES.[9] A clinical diagnosis of CES is most likely to be correct when the lesion is severe.[10] If the clinician waits for symptoms/signs of a severe lesion, such as perineal anaesthesia, urinary retention, urinary or faecal incontinence or absent anal tone, to develop, few patients will recover full function following decompressive surgery.[1,10,11]

Where to image and when? MRI is the imaging modality of choice and CT is inadequate as it does not adequately show soft tissues such as a PLID. MRI is part of triage whenever CES is suspected.[6,12,13] In many hospitals, MRIs are not available out of hours[14] so these patients need to be transferred to a spinal service. Many of these MRIs which are undertaken in these circumstances are found to be negative with low rates of CE compression on MRI ranging from 14% to 33%;[7,8,10,15] and emergency surgery being performed at an even lower incidence of 4% to 7%.[15,16] Hence transferring large numbers of patients to spinal centres for negative MRIs is both time consuming and expensive. As MRI is part of patient triage, it should ideally be performed at the DGH before contacting a spinal surgeon.

Thresholds or continuous deterioration. Thresholds for CES have been divided by time and/or neurological deficit, for example < 24 hours or < 48 hours; the deficit is typically subdivided into CESS, CESI or CESR.[1,11,17,21,27] However, there is an increasing understanding that neurological losses in CES are continuous and form part of a progressive process.[17]

When to operate. The urgency of surgical decompression remains contentious.[1,4,7-10,13,15,17-60] Emergency surgery in all CES patients has been recommended.[18,19] Others set thresholds of clinical deficit[1,20] or time to decompressive surgery,[21] suggesting that in some patients it may be reasonable to delay surgery because further harm is not caused by the delay - some patients improve, however, delays in surgery of a day or two do not adversely affect the probability of functional recovery. The advice of the National Institute of Health and Care Excellence[61] the Society of British Neurological Surgeons (SBNS)[6] and the British Association of Spinal Surgeons (BASS)[13] is to operate on the CES patient as soon as practically possible in order to prevent further neurological deterioration and to maximise the chance of recovery. However, not all patients with large central disc prolapses deteriorate. Two studies[22,23] reported a total of 50 patients with large central disc prolapses and unilateral radiculopathy who were treated conservatively. No patient developed CES and there was clinical improvement in the majority with resolution of the central disc prolapse in most patients. Only five of these patients ultimately required an operation for persistent radicular pain.[22,23] In those patients who have CES (CESS, CESI or CESR) it is impossible to predict who will deteriorate but if neurological deterioration does occur outcomes are worse.[1,11,17,20,24,25] In a large meta-analysis Ahn et al[21] suggested that the treatment of the CES patient could be delayed for up to 48 hours with similar outcomes. Two studies[17,26] repeated the analysis of Ahn et al[21] and found that the primary data, methods and statistical analysis were open to criticism. A further meta-analysis has proposed other 'safe' periods of delay 12, 24, 36, 48 or 72 hours[27] before surgical decompression in the presence of CES with urinary retention. There was a trend to the better bladder outcomes in patients treated at earlier points in time, but this did not achieve statistical significance. There is also uncertainty whether emergency decompression is needed in the patient with a paralysed, insensate bladder (CESR). Some authors have suggested better outcomes with early treatment after CESR,[11,24,25] while others have not.[1,20] It is clear that the evidence from the literature is inconsistent. There is the risk that a study that shows benefit to earlier surgery is because the 'early' patients contain a higher proportion of CESI patients, who would be expected to do well. The 'late' group are more predominantly CESR because some of the CESI patients have deteriorated to CESR.[11,28] It is uncertain what proportion of CESR patients recover bladder and/or bowel function but ranges of 22% to 79% have been reported.[1,24,25,29,30] This wide variation probably also reflects the case-mix (CESI *vs* CESR) of those reported patients. A patient with deteriorating neurological function should be operated upon as an emergency.[28] There is progressive loss of CE function after CESR.[36] The predictors of good outcomes are the least neurological deficit at the time of surgery, shortest duration of compression and a slow onset of compression.[17] There are potential disadvantages to operating as an emergency on all patients who have, or could, develop CES. It is not known what proportion of patients who present in CESS or CESI deteriorate to CESR, and presumably some can recover spontaneously. The advice of the SBNS and BASS is to operate promptly if there is a risk of neurological deterioration.[6,13]

Outcomes following treatment. The principle is that any function that has not been lost at the time of decompression will be preserved. Therefore, in the event that the CESS patient does not have CES, they will have no long-term problems with bladder, bowel or sexual function. There is also an 85% chance of improvement in radicular leg pain, but there is no predictable improvement in back pain.[1,11,17] The CESI patient in the long-term typically has normal

control of the bladder and bowel.[1,11,17] Recovery of function can occur following CESR[1,24,25,29,30] and there can be recovery with delayed surgery,[31,32] but often this does not extend to full function.[1,11,17,31,32]

Medicolegal cases. The author's database of medicolegal reports in patients with CES was reviewed in order to see whether patients deteriorated while under medical care. It was found that in 39 patients there was intra- or post-operative injury (the latter typically caused by a post-operative haematoma) to the CE roots, plus there were three patients with no CES, leaving 118 patients for analysis. At first clinical contact 100 (85%) patients were CESS or CESI and 18 (15%) were CESR. At the time of treatment 98 (83%) were CESR and only 20 (17%) were CESI, none were CESS. Delay in diagnosis and treatment leading to long-term harm occurred in the majority of patients. Of the 100 patients presenting with CESS or CESI ten (10%) deteriorated to CESR within 12 hours, 16 (16%) 12 to 24 hours and 74 (74%) > 24 hours after the first medical contact.

Discussion

It is incorrect to believe that there is a clear clinical picture of CES. There is no combination of clinical symptoms and/or signs that reliably predict CE compression. DRE does not predict MR-positive CE compression unless and until the CE lesion is severe and irreversible.[9,10] If CES is suspected (CESS, CESI or CESR) a detailed history and clinical examination (including DRE) and MRI should be performed. The medicolegal data presented in the current paper show that these patients can deteriorate rapidly to CESR at a rate of 1% per hour in the first 24 hours following medical contact. Given the rapid rates of neurological deterioration in some patients, best practice would be for an MRI to be undertaken within one hour of a clinical diagnosis of suspected CES. This will lead to increased demand for MRI and more negative MRIs, which can be justified if patients are diagnosed and treated before CESR.

The human studies[1,4,7-10,13,15,17-60] are retrospective single-centre reports of low power. A number of studies that have attempted to compare data from the different papers[11,17,21,26,27] suffer from the problem that the populations are heterogeneous with uncorrected variables, different definitions of CES, failures to set out the nature and timing of surgery or the experience of the surgeon, along with variable reporting of outcomes and losses to follow-up. Ahn et al[21] stated that the CES patient could be treated at any time up to 48 hours after the onset of CES, implying that there is a safe time window of 48 hours for treatment. This study has been criticised on the basis of methodology and misinterpretation of the data.[26] A recent study repeated Ahn et al's[21] work and could find no difference between those treated < 48 hours or > 48 hours.[17] In that paper, the CES patients were divided by the degree of neurological deficit, whether CESS, CESI or CESR, yet these are not homogenous groups and patients were found to develop more severe deficits within a group, such as progressive motor weakness or more severe sphincter dysfunction. There is increasing recognition that deterioration in function in the CES patient is continuous and progressive.[17,33,34]

In a series of 139 patients with CESI, it was found that bladder outcomes were dependant on time. Normal bladder function was found in 88.9% of patients treated within 24 hours, 79% of cases treated within 24 to 48 hours and only 44% of those treated more than 48 hours after CESI.[36] In a small series of medicolegal patients, the probability of the patient having more severe losses of perineal sensation and/or anal tone increases from CESI to CESR and with more prolonged CESR.[36] Therefore, there is evidence that the duration of CE compression is a determinant of outcome, with progression of neurological deficits and worse outcomes where there is more prolonged compression in CESI patients. In the CESR patient there is no proof that urgent surgery produces better outcomes and no proof that delayed surgery is or is not safe. Putting patients into CES subgroups may help descriptively, but if the principle of continuous deterioration is ignored, it can lead to poor decisions.[6,13,33]

Patients with bilateral radiculopathy (CESS) do not have CES, however, they are at risk of CES if they have a large central PLID. Worse outcomes occur if patients deteriorate neurologically prior to treatment. Large central disc prolapses can safely be treated conservatively in patients with unilateral radiculopathy, but there is no evidence that this is a safe policy in patients with CES.[22,23] If all CESS patients were operated upon as an emergency, it would mean that some patients were over treated. However, it is not known which CESS patients with a large central disc prolapse compressing the cauda equina nerve roots will deteriorate to CES (CESI and/or CESR, or when). It would be reasonable to admit the CESS patient to the DGH overnight and, providing they do not deteriorate, to undertake MRI immediately in the morning. If the MRI showed a large central PLID compressing the CE roots, and the patient opted for surgery, they should be transferred to the spinal service for surgery that day. The CESI patient should be accepted for transfer and operated upon as an emergency as deterioration to CESR can occur rapidly. The principle of emergency imaging and surgery for the CES patient has been endorsed by the SBNS and BASS.[6,13] If a CESI patient is left overnight, during which time there is deterioration, there is frequently a poor long-term outcome, which is potentially preventable. Given that in our series, 26% of medicolegal CESI patients deteriorate to CESR within 24 hours, it is a high-risk strategy to leave the CESI patient until the next morning's operating list and, therefore, emergency decompression is mandatory.[33,34] For the CESR patient, clinical data are not available to show whether emergency surgery leads to better outcomes. However, clinical data suggest there is progressive damage to the CE roots which continues both before and after CESR and, therefore, delaying surgery after CESR may contribute to poor outcomes.[17,35,36] Provided the operation can be carried out by a consultant

spinal surgeon and knowing that neurological deficits progress after CESR,[36] the rational approach to maximising good outcomes is to operate upon the CESR patient as soon as possible.

In conclusion, it is recommended that a DGH orthopaedic surgeon who is assessing a patient with suspected CES, urgently reviews the patient. If the diagnosis continues to be considered, then MRI of the lumbosacral spine should be arranged locally within one hour. In the event that the MRI is positive then the patient should be transferred to a spinal surgery unit as an emergency. The best outcomes will be achieved where patients are operated upon with the least neurological deficits and the shortest duration of CE compression.

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