CAUDA EQUINA CONUNDRUM

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THE CHALLENGES OF CES

How did we get to today?

What are the issues we face?

Research trials - what does the evidence tell us?
Definitions: Fraser

• 100% unanimity
• 75-99% consensus
• 51-74% majority
• 0-50% no consensus

• No unanimity or consensus in 105 papers
• Majority view: bladder and sensory disturbance (74% 66%)
5 CHARACTERISTIC FEATURES;

- Bilateral neurogenic sciatica
- Reduced perianal sensation
- Altered bladder function
- Loss of anal tone
- Sexual dysfunction

Not all will be present; Low sensitivity and specificity

(Todd and Dickson, 2016)
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 or developing a cauda equina syndrome.

Most of these patients will not have critical compression. However, in the absence of reliably predictive symptoms and signs, there should be a low threshold for investigation with an EMERGENCY MRI scan. The reasons for not requesting a scan should be clearly documented.
All felt patients are at risk of harm if presenting with bilateral sciatica. Rapid access to urgent same-day MRI is needed to add to the existing standard of that where traditional “red flags” are present.
## Cauda Equina Syndrome Groups

*(Todd & Dickson, 2016)*

<table>
<thead>
<tr>
<th><strong>CESS</strong></th>
<th>Bilateral radicular pain (progressing unilateral)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CESI</strong></td>
<td>Urinary difficulties of neurogenic origin, altered urinary sensation, loss of desire to void, poor urinary stream, need to strain to micturate</td>
</tr>
<tr>
<td><strong>CESR</strong></td>
<td>Painless urinary retention and overflow incontinence</td>
</tr>
<tr>
<td><strong>CESC</strong></td>
<td>Loss of all CE function, absent perineal sensation, patulous anus, paralysed insensate bladder and bowel</td>
</tr>
</tbody>
</table>
A Disconnect with Connect Health: A Reasoned View of Bilateral Leg Pain and Cauda Equina Syndrome

05/03/2019
• Bilateral leg pain with normal neurology, normal neurodynamic tests and no other CES symptoms- treat as per symptoms and monitor progress. Safety net with CES card or similar.

• Bilateral leg pain with normal neurology, positive neurodynamic tests and no other CES symptoms- treat as per symptoms. Safety net with CES card or similar- if already had conservative treatment then may refer for scan on a routine basis.

• Bilateral leg pain with abnormal neurology and normal/positive neurodynamic tests and no CES symptoms. If gross motor weakness or deteriorating neurology, then refer for an urgent scan (but not same day) and safety net patient re CES.

• Bilateral leg pain with any other CES symptoms- refer on for emergency scan.
ASSESSMENT

- Most information gained in the subjective

- Physical tests have limited validity and reliability
57 patients in one year in Derby, 13 positive on MR
DRE did not predict CES on MR
odds ratio 1.43 p= 0.89 diagnostic accuracy 51%

No combination of factors (UP TO 8) combined to predict the
presence of CES on MR
Test with lowest predictive value for CES was anal tone. Almost half of non-compression group had reduced anal tone (Angus et al, 2018)
SADDLE SENSATION; LIGHT TOUCH AND PIN PRICK?

Sensitivity of the following tests is relatively poor;

• Perianal sensation
  • Altered urinary and perineal sensation
  • Loss or diminution of the bulbocavernosus reflex (Bell et al, 2007; Fairbank et al, 2011 Delitto et al 2012).

Peri-anal sensation not different between groups with and without radiologically confirmed CES. Subjective report helpful (Angus et al, 2018)
RESIDUAL BLADDER VOLUME

>500ml retention correlates with +ve MRI in CES (bilat sciatica, retention)

>400ml pre void - >200ml post void
BLADDER POST VOID U/S RESIDUAL VOLUME SCAN?

- Venkatesan BASS Spine 17,3,S7 2017 92 pts over 6 months
- 18% positive CES; emergency surgery
- 60% perineal PP sensory loss
- 40% reduced anal tone
- >400mls pre void >200mls post void
- 87% sensitivity (61-98)
- 76% specificity (65-85)
- Odds ratio 20.7
ASSESSMENT

• Thorough subjective history
• Safety net patient

• Physical tests to include neurological examination
• Saddle sensation testing, anal tone testing
Common Back Pain

Many patients have a combination of back pain, leg pain, leg numbness and weakness. These symptoms can be distressing for you but don’t necessarily require emergency medical attention. A rare but serious back condition, Cauda Equina Syndrome, can lead to permanent damage or disability and will need to be seen by an Emergency Specialist Spinal Team. See other side of card for some warning signs of Cauda Equina Syndrome.

Cauda Equina Syndrome Warning Signs

- Loss of feeling/pins and needles between your inner thighs or genitals
- Numbness in or around your back passage or buttocks
- Altered feeling when using toilet paper to wipe yourself
- Increasing difficulty when you try to urinate
- Increasing difficulty when you try to stop or control your flow of urine
- Loss of sensation when you pass urine
- Leaking urine or recent need to use pads
- Not knowing when your bladder is either full or empty
- Inability to stop a bowel movement or leaking
- Loss of sensation when you pass a bowel motion
- Change in ability to achieve an erection or ejaculate
- Loss of sensation in genitals during sexual intercourse

Any combination seek help immediately

https://www.macpweb.org/Cauda-Equina-Information-cards
RECENT RESEARCH

- **Animal studies: Spine Sept 2019**
- **CES negative patients: Hoeritzhauer J Neurology 2018**
- **Long term outcomes; Hazlewood 2019 ActaNeurochir**
- **Guidelines: BASS and SBNS Dec 2018**
- **Scales: Todd B&JJ 2018**
- **Kaiser and Korse studies 2017-2018**
- **UCES study: 600+ UK patients Julie Woodfield**
Experimental spinal cord injury Meta-Analysis of Pre-Clinical Studies of Early Decompression in *Acute Spinal Cord Injury: A Battle of Time and Pressure*  

\[ Y = 743.17x - 0.443 \]

Peter E. Batchelor, Taryn E. Wills, Peta Skeers, Camila R. Battistuzzo, Malcolm R. Macleod, David W. Howells, Emily S. Sena
EXPERIMENTAL ANIMAL STUDIES IN CES

• systematic review and meta-analysis

Compressive Pressure Versus Time in Cauda Equina Syndrome

A Systematic Review and Meta-Analysis of Experimental Studies

Savva Pronin, MBChB (Hons),* Chan Hee Koh, MBChB,† Edita Bulovaite, BSc (Hons),‡ Malcolm R. Macleod, PhD FRCP,† and Patrick F. Statham, FRCS (SN) (Ed), FRCS (Eng)‡
Figure 1. Models of compression studies. (A) By duration; (B) by pressure.
Figure 5. Schematic of proposed pathophysiology of acute cauda equina compression. EP indicates electrophysiological function; MABP, mean arterial blood pressure.
We analyzed data on 17,850 adults 20 years old or older who participated in the 2001 to 2008 cycles of the National Health and Nutrition Examination Survey. Any urinary incontinence was defined as a positive response to questions on urine leakage during physical activity, before reaching the toilet and during nonphysical activity. During this

The age standardized prevalence of urinary incontinence in the combined surveys was 51.1% in women and 13.9% in men. Prevalence in women increased from 49.5% in 2001 to 2002, to 53.4% in 2007 to 2008 ($P_{trend} = 0.01$) and in men from 11.5% to 15.1%, respectively ($P_{trend} = 0.01$). In women increased prevalence was partially explained by differences in age, race/ethnicity, obesity, diabetes and select chronic diseases across the survey periods. After adjustment the prevalence OR for 2007 to 2008 vs 2001 to 2002 decreased from 1.22 (95% CI 1.03–1.45) to 1.16 (95% CI 0.99–1.37). In men adjustment for potentially associated factors did not explain the increasing prevalence of urinary incontinence.
Painful lumbar disc prolapse: ‘scan negative, but root compression’ 

Scan negative no root compression: Functional neurological disorder 

Cauda equina compression: scan positive: urgent intervention
The clinical features and outcome of scan-negative and scan-positive cases in suspected cauda equina syndrome: a retrospective study of 276 patients


The Journal of Neurology, Neurosurgery, and Psychiatry 1998-10-01

276 retrospective patients

scan positive CES

scan negative CES with root compression

scan negative no root compression
<table>
<thead>
<tr>
<th></th>
<th>scan +ve</th>
<th>scan -ve root compression</th>
<th>scan -ve no root compression</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>bladder normal</td>
<td>22 (28%)</td>
<td>15 (17%)</td>
<td>9 (9%)</td>
<td>ns p&lt;0.0005</td>
</tr>
<tr>
<td>bilateral sciatica</td>
<td>32 (41%)</td>
<td>17 (20%)</td>
<td>22 (21%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>nerve root numbness</td>
<td>48 (61%)</td>
<td>24 (28%)</td>
<td>38 (36%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>saddle numbness</td>
<td>50 (64%)</td>
<td>47 (54%)</td>
<td>54 (52%)</td>
<td>p&lt;0.04</td>
</tr>
<tr>
<td>non dermatomal numbness</td>
<td>2 (2%)</td>
<td>16 (18%)</td>
<td>16 (15%)</td>
<td>p&lt;0.001 p&lt;0.004</td>
</tr>
<tr>
<td></td>
<td>scan +ve</td>
<td>scan -ve root compression</td>
<td>scan -ve no root compression</td>
<td>p</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
<td>---------------------------</td>
<td>-----------------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>functional disorder comorbidity</strong></td>
<td>7(9%)</td>
<td>26(30%)</td>
<td>39(37%)</td>
<td>p&lt;0.0007 p&lt;0.0001</td>
</tr>
<tr>
<td><strong>functional neurological disorders</strong></td>
<td>0</td>
<td>10(11%)</td>
<td>13(12%)</td>
<td>p&lt;0.0014 p&lt;0.0005</td>
</tr>
<tr>
<td><strong>depression</strong></td>
<td>17(22%)</td>
<td>34(39%)</td>
<td>55(53%)</td>
<td>p&lt;0.02 p&lt;0.0001</td>
</tr>
</tbody>
</table>
Quantifying the clinical aspects of the cauda equina syndrome – The Cauda Scale (TCS)

Nicholas V. Todd

To cite this article: Nicholas V. Todd (2018) Quantifying the clinical aspects of the cauda equina syndrome – The Cauda Scale (TCS), British Journal of Neurosurgery, 32:3, 260-263, DOI: 10.1080/02688697.2018.1441975

To link to this article: https://doi.org/10.1080/02688697.2018.1441975

Table 1. TCS Scoring.

The Cauda Score (TCS 0–9)

<table>
<thead>
<tr>
<th>Perineal sensation&lt;sup&gt;a&lt;/sup&gt; (S)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No history of reduced sensation, normal examination</td>
<td>3</td>
</tr>
<tr>
<td>History of reduced sensation reported, normal examination</td>
<td>2</td>
</tr>
<tr>
<td>Objectively reduced (one/both sides)</td>
<td>1</td>
</tr>
<tr>
<td>Objectively absent (one/both sides)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anal tone and squeeze (T)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>2</td>
</tr>
<tr>
<td>Reduced</td>
<td>1</td>
</tr>
<tr>
<td>Absent</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bladder (B)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>4</td>
</tr>
<tr>
<td>Altered (e.g. urgency, hesitancy but normal sensation and control)</td>
<td>3</td>
</tr>
<tr>
<td>Reduced bladder or urethral sensation with normal control of micturition</td>
<td>2</td>
</tr>
<tr>
<td>Straining but no incontinence</td>
<td>1</td>
</tr>
<tr>
<td>Painless retention (&gt;500 mls) or incontinence of urine</td>
<td>0</td>
</tr>
</tbody>
</table>

<sup>a</sup>Test for both light touch and pinprick.

<sup>b</sup>If not catheterised bladder scan and record volume (mls).

<sup>c</sup>if catheterised record as C plus bladder function at the time of catheterisation e.g. C4.
CES: SMART SCALE?

- **sensory**: perineal sensory loss, pain
- **motor**: voluntary anal contraction, bladder neck competence,
- **autonomic**: bladder residual volume > 200ml, rectal distention, ejaculation, orgasm
- **reflex**: anal wink, rectal manometry, bulbocavernosus reflex
- **trophic**: pressure sore not relevant to acute presentation
CES SCALES: ? PSYCHOSOCIAL AND BIOLOGICAL/ ANATOMICAL

- Functional disorder comorbidity
- Functional neurological disorder
- Depression
BACK PAIN: START BACK

The Keele STarT Back Screening Tool

Patient name: ______________________ Date: ________________

Thinking about the last 2 weeks tick your response to the following questions:

<table>
<thead>
<tr>
<th>Question</th>
<th>Disagree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My back pain has spread down my leg(s) at some time in the last 2 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I have had pain in the shoulder or neck at some time in the last 2 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I have only walked short distances because of my back pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. In the last 2 weeks, I have dressed more slowly than usual because of back pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. It’s not really safe for a person with a condition like mine to be physically active</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Worrying thoughts have been going through my mind a lot of the time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I feel that my back pain is terrible and it’s never going to get any better</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. In general I have not enjoyed all the things I used to enjoy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Overall, how bothersome has your back pain been in the last 2 weeks?

Not at all  | Slightly  | Moderately  | Very much  | Extremely  |
            | 0         | 1           | 0          | 0          | 1           |

Total score (all 9): __________________ Sub Score (Q5-9): ______________

The STarT Back Tool Scoring System

Total score

- 3 or less: Low risk
- 4 or more: Sub score Q5-9

Sub score Q5-9

- 3 or less: 4 or more
- 4 or more: High risk

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Funded by Arthritis Research UK
BIOPSYCHOSOCIAL SCALE

- sciatica uni or bilateral
- nerve root distribution numbness
- saddle numbness
- normal bladder (?)
- non dermatomal numbness (negative)
- depression, IBS, functional neurological disorder
Time Factor and Disc Herniation Size: Are They Really Predictive for Outcome of Urinary Dysfunction in Patients With Cauda Equina Syndrome?
**FIGURE 6.** Box plots showing the PCR in patients without (No) and with (Yes) urinary symptoms persistence ($P = .537$, Linear regression).
FIGURE 4. Kaplan-Meier event curves for surgery over time from the beginning of CES symptoms in patients without (No) and with (Yes) urinary symptoms persistence. Cox regression, $P = .96$, hazard ratio $1.02$, 95% confidence interval: $0.94; 1.8$. 
**TABLE 2**

<table>
<thead>
<tr>
<th>Timing</th>
<th>CESI Normal Bladder</th>
<th>CESI Abnormal Bladder</th>
<th>P</th>
<th>CESR Normal Bladder</th>
<th>CESR Abnormal Bladder</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24 hr</td>
<td>32</td>
<td>4</td>
<td></td>
<td>10</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>&gt;24 hr</td>
<td>55</td>
<td>48</td>
<td>0</td>
<td>6</td>
<td>26</td>
<td>0.163</td>
</tr>
<tr>
<td>&lt;48 hr</td>
<td>54</td>
<td>10</td>
<td></td>
<td>13</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>&gt;48 hr</td>
<td>33</td>
<td>42</td>
<td>0</td>
<td>3</td>
<td>13</td>
<td>0.5</td>
</tr>
<tr>
<td>&lt;72 hr</td>
<td>61</td>
<td>25</td>
<td></td>
<td>13</td>
<td>34</td>
<td>0.642</td>
</tr>
<tr>
<td>&gt;72 hr</td>
<td>27</td>
<td>26</td>
<td>0.018</td>
<td>3</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

*CESI indicates incomplete cauda equina syndrome; CESR, complete cauda equina syndrome with retention.*
Audit of documentation of sexual function in 120 patients with potential CES, 25 had CES.

Only 3% had documented sexual function improved to 11% on re-audit.
SEXUAL FUNCTION

- doctors not good at asking about it; patients often in too much pain
- patients may prefer to be asked
- other factors may be causing the inhibition of sexual function
- recovery of sexual function poor
- dysfunctional Korse 2017 Eur Sp J
PATHWAY FOR CES

• Record history and findings, and negative findings
• Examine carefully
• Use information cards
• Refer where clinical suspicion appropriate to existing guidelines; as an emergency if need be
• Follow up on the referral; be clear who is going to act on the result
PRACTICAL ASPECTS

- Have a high index of suspicion; the referring doctor (A&E, GP, Physiotherapist) is worried.

- Incontinence of urine is very common but not a sole discriminant.

- Functional deficits are more likely with IBS, depression, non-dermatomal sensory loss, previous spinal surgery, particularly for ?CES, and true CES.

- Bilateral sciatica, particularly progressing, saddle numbness, dermatomal numbness are discriminants.
DAILY RECORDING OF SENSORY FUNCTION
WHAT IS THE STUDY?

>18 years old with clinical CES and structural compression of the cauda equina

- Prospective observational cohort study
- Identification during emergency admission
- Trainee data collection to describe clinical presentation, investigation & treatment
- Outcome measures by email questionnaire at 6 and 12 months
UCES RESULTS

- BRITSPINE meeting 2020
- Glasgow SECC 1-3rd April 2020
PRE-DECOMPRESSION FUNCTION VS RECOVERY

Figure 4. Models of pre-decompression function versus recovery, with relationship to MABP displayed. (A) Using absolute measure; (B) using mean difference, with 95% confidence intervals. MABP indicates mean arterial blood pressure.
An assessment of patient-reported long-term outcomes following surgery for cauda equina syndrome

J. E. Hazelwood\textsuperscript{1,2,3,4} • I. Hoeritzauer\textsuperscript{1,2,4} • S. Pronin\textsuperscript{1,2,3,4} • A. K. Demetriades\textsuperscript{1,2,3,4}

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Table 1 Patient characteristics at follow-up

<table>
<thead>
<tr>
<th>Measure</th>
<th>$n$</th>
<th>%</th>
<th>Mean score ($\pm$SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary Symptoms Profile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Urinary Dysfunction Score</td>
<td>35</td>
<td>76</td>
<td>7.15 ($\pm$ 7.17)</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>18</td>
<td>39</td>
<td>1.20 ($\pm$ 2.07)</td>
</tr>
<tr>
<td>Overactive bladder</td>
<td>33</td>
<td>72</td>
<td>4.37 ($\pm$ 4.72)</td>
</tr>
<tr>
<td>Low stream</td>
<td>19</td>
<td>41</td>
<td>1.59 ($\pm$ 2.70)</td>
</tr>
<tr>
<td>Neurogenic Bowel Dysfunction Score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very minor</td>
<td>40</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>4</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Arizona Sexual Experiences Questionnaire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td>18</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Physical function</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>29</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Working in a reduced capacity</td>
<td>6</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Not working</td>
<td>6</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>5</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 3 Patients’ symptom for which they would most value treatment

Fig. 4 Patients’ reported post-discharge healthcare service use
Cauda Equina Syndrome:

presentation, outcome and predictors with focus on micturition, defecation and sexual dysfunction

<table>
<thead>
<tr>
<th></th>
<th>Presenting symptoms % of n</th>
<th>Follow up 2 (median 60 days)</th>
<th>Follow up 3 (median 225 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micturition dysfunction</td>
<td>92 (n=75)</td>
<td>47.7 (n=49)</td>
<td>57.9</td>
</tr>
<tr>
<td>Altered Defecation</td>
<td>72 (n=61)</td>
<td>41.8 (n=39)</td>
<td></td>
</tr>
<tr>
<td>Altered saddle sensation</td>
<td>93.3 (n=75)</td>
<td>56.5 (n=50)</td>
<td></td>
</tr>
<tr>
<td>Sciatica</td>
<td>97.3 (n=73)</td>
<td>47.5 (N=51)</td>
<td></td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td>98 (n=26)</td>
<td>53.3 (n=15)</td>
<td>80 (n=4)</td>
</tr>
</tbody>
</table>