Cauda Equina Syndrome. Current Concepts.

Implications for Clinical and Medicolegal Practice.

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Cauda Equina Syndrome.

Subclassification of CES

Clinical diagnosis

Bladder assessment

CESR in catheterised cases, CESR equivalence

MR Imaging

Evidence

Subclassification of CES.

CES Incomplete (CESI).

Alteration in bladder/urethral sensation or function,

maintenance of executive bladder control. +/- perineal sensory changes, or sexual or bowel sensory or functional change

CES with executive bladder control.

CES with neurogenic retention of urine and incontinence (CESR).

CES with a paralysed, insensate bladder, no executive control

Gleave and Macfarlane 1990

Subclassification of CES.

Name	Abbreviation	Definition
Symptom-only CES (early CES)	CESE	Some sensory loss in perineum or change in micturition frequency. Often symptom-only CES
Incomplete CES	CESI	Alteration in bladder/urethral sensation or function, but maintenance of executive bladder control. +/- perineal sensory changes, or sexual or bowel sensory or functional change
CES with retention	CESR	As in 3 but with painless bladder retention and overflow
Complete CES	CESC	Insensate bladder with overflow incontinence, no perineal perianal or sexual sensation, no anal tone

Lavy et al 2022

CES Subclassification. No Interobserver Agreement.

Woodfield.

Cohort study, 621 cases

All MRI+, all urgent surgery

Design – subclassify CESS, CESE, CESI, CESR

Poor interobserver reliability (k = 0.31)

Subclassification abandoned

Woodfield 2023

CES Subclassification. No Interobserver Agreement.

BJJ. Rater study

100 CES cases (from Cohort study)

Raters medical students (4)

neurosurgery registrars (5)

Consultant spinal surgeons (4)

Definition CES 4 papers

Poor reliability (k = 0.29)

Hoeritzauer 2023

CES Subclassification. Used Everywhere.

Clinically.	CESI => emergency MRI and surgery Avoiding deterioration to CESR
	CESR – no benefit to more urgent surgery Some defer surgery eg next day
Medicolegally.	Surgery after CESR => no better outcome No causation, C loses, D wins

If subclassification inaccurate can we rely upon other doctors?

Is the literature reliable?

Can we base decisions on unreliable classifications?

Assess issues separately, not as groups

Clinical Diagnosis of CES.

3 phenomena.	Bladder function, perianal sensation (PAS), anal sphincter function
2 symptoms.	Change in pattern of micturition Reduced saddle sensation, subjectively
2 signs.	Reduced PAS, objectively Anal tone (AT), anal squeeze (AS)

No single symptom or sign predicts CES

MRI+ best predicted with combination of PAS, AT, AS + BCR (Zusman 2022)

PAS the most subjective sign
AT/AS abnormal in most MRI+ cases
Normal AT does not exclude CES (27% of Cohort study)
AT accurate in 66% cases (Sherlock 2015, Tabrah 2022)

Clinical Diagnosis of CES.

Symptoms not addressed critically

“No saddle anaesthesia” not

“Is there any change in saddle sensation?”

Paraesthesia/hypoaesthesia relevant

All signs (PAS, AT, AS) often not measured

Signs not quantified (reduced but present, absent etc)

Assessed by juniors (ED, Orthopaedic)

Not repeated by seniors (even in Spinal Unit)

Clinical Diagnosis of CES. Recommendations.

Clinical.	Questions about all potentially relevant symptoms
	Assess all signs (PAS, AT, AS) and quantify
	Repeat Hx and Ex by most senior doctor in DGH
	Repeat Hx and Ex in Spinal Unit
	Deterioration in CE function indicates emergency surgery
	No repeat Ex => deterioration not identified
Medicolegal.	With incomplete history, lack of all signs, no repeat Ex
	Poor interobserver reliability
	How confident can we be that this case is CESE
	Or CESI not deteriorating
	Or CESI, deteriorating
	Or CESR
	Failure to assess all symptoms, all signs and repeat Ex
	Not Bolam negligent
	Possibly Bolitho negligent – new head of negligence?

Bladder Function Assessment.

Bladder ultrasound

BUS in ED determines:
Urinary retention, volume of urine in the bladder
Post-void volume (PVR) = extent of emptying

Retention < 500 ml 82% (Woodfield 2023)

Normal PVR 0-50 mls (up to 100 mls in elderly women)
MRI- if PVR < 200 mls **and no signs** (Katzouraki 2020)
MRI+ with PVR < 100 mls 33% (Hoeritzauer 2018), 47% (Cohort study)
MRI+ with PVR < 200 mls 59% (Woodfield 2023)
50 M/L MRI+ cases 50% had PVR < 200 mls (Todd 2022)

Marked bladder distension not found in most MRI+ cases
PVR < 200 mls common (may be majority)

An Illustrative M/L Case.

33 year-old woman

LBP and unilateral sciatica 4 months

Bilateral sciatica 4 days

Reduced saddle and urethral sensation, normal bladder sensation + control

O/E = reduced PAS + AT

Pre-void BUS = 137 ml

PVR = 0 mls

Neurosurgery advice - no retention, full voiding = no CES

no MRI, discharged

2 days later urinary and bowel incontinence, drop feet

MRI+

Emergency surgery with no recovery

CESR Equivalence.

CESR = painless urinary retention with incontinence

Early BUS and catheter => many are catheterised before incontinence

They will never satisfy the traditional definition of CESR

We cannot say when they went from CESI to CESR

What is CESR equivalence in cases catheterised before incontinence?

CESR Equivalence.

Hewes

50 year old man

0100 PU'd normally

0500 saddle numbness

1040 normal PAS and AT

1203 BUS = 621 mls, painless, could not PU

1445 catheterised, no sensation, 625 mls

MRI L4/5 PLID 95% canal occlusion

2300 surgery

Judgement. 625 mls painless retention = CESR equivalence

As "CESR" before surgery took place

Hewes lost case

CESR Equivalence.

Overflow at 1,000 mls women, 1,200 mls men

Normal urinary production = 33-88 mls/hr

If drinking 50 mls/hr Hewes would have become incontinent

at 1,200 mls = 11.5 hrs later = 0215 next day

surgery at 2300 = before CESR = CESI

CESI = more favourable outcome

Hewes wins

If nil by mouth does not reach 1,200 mls for much longer

CESR Equivalence.

Unrelieved pressure causes increased damage:

Unrelieved compression CE nerve roots

And bladder wall

Causes further harm

625 mls in bladder probably less harm

than 1,200 mls 11.5 hrs later

(catheter => less direct damage to bladder wall)

CESR Literature.

Outcomes commonly poor

No benefit earlier surgery after CESR

Literature:

Single centre, retrospective studies

Notes made by juniors, often when tired

No forensic note “a day”, “24h”, “y’day”

On these notes outcomes in CESI or CESR determined

Accuracy?

Esp as we now know subclassification poor

CESR in the Catheterised Patient.

In the modern era (Woodfield 2023)

182 catheterised pre-op

At one year only 14% catheterised

Modern era = surgery in one day of referral (90%)

one day of admission (99%)

On balance (86% probability) bladder recovers

If catheterised before incontinence

And surgery delayed beyond 1 day

If no recovery of bladder function

Delay causative

As recovery expected, C wins

Previously (Hewes) on same facts, D wins

Magnetic Resonance Imaging.

Pomphrey	CES requires: >75% canal occlusion (Balasubramanian) And loss of CSF around nerve roots
Both incorrect	
Canal occlusion	< 50% 12.5% (Quereshi 2007) 60% (+/- 18, range 29-98%) (Kaiser 2018) > 50% all, 70% > 75% (Woodfield 2023)
CSF	53% have CSF around roots (Woodfield 2023)

Larger disc prolapses + lack of CSF more likely MRI+

Prolapse 50% - 75% with CSF does not exclude CES

Evidence.

Evidence is a matter for the Court

Evidence of the records and lay witness evidence

Often in conflict

Judges often favour medical records

Symptoms reported by patients

2 days earlier than recorded in notes (Woodfield)

In an, often rapidly, progressive condition

Notes may underplay duration/severity of CES

Low Back Pain
A New Head of Damages in CES?

Delayed surgery does not change pathophysiology of lumbar disc

Discectomy halves LBP (Stromqvist 2013, Iorio-Morin 2021)

LBP worse in CES: 57% and 67% severe (Hazelwood 2019, Barker 2021)

LBP worse: fatigue, depression, weakness, neuropathic pain

50 M/Ls: LBP worse 64%, increased severity 5.2 VAS (eg 3 => 8.2)

Fatigue 94%
Depression 78%
Weakness 76%
Neuropathic pain: leg 68%, pelvis 32%

If LBP worse after CES consider causation

Cauda Equina Syndrome. Conclusions.

Subclassification of CES is not accurate
Treat on individual symptoms/signs
Literature based upon this may not be valid

Clinical diagnosis all relevant symptoms
And, especially, signs
Repeat examination at senior level

BUS important
Understand limitations

CESR becoming uncommon
CESR equivalence in catheterised cases
Before incontinence
Needs careful thought

MRI
There is no lower limit for prolapse size
Most > 50% canal occlusion
CSF around roots 53%

Evidence of patients: CES onset
2 days before medical notes