

How can the **spinal cord** be damaged in the course of anaesthesia?

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Spinal cord damage: *agenda*

- ▶ Neuraxial blocks
- ▶ General anaesthesia

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Spinal cord damage: *agenda*

- ▶ Neuraxial blocks
 - ▶ Spinal
 - ▶ Epidural
 - ▶ They are different! Analogous to tort and contract (both laws of obligations)
 - ▶ Combined spinal-epidural (CSE)
- ▶ Injury in the course of needle insertion
 - ▶ Chemical contamination
 - ▶ Roe v Minister of Health
 - ▶ Sutcliffe v Aintree Hospitals NHS Trust
- ▶ General anaesthesia
 - ▶ Tracheal intubation (cervical spine movement)
 - ▶ Prone positioning
 - ▶ Visual loss
 - ▶ Blood pressure, cardiac output and spinal cord perfusion
 - ▶ Hepworth v Kerr

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NEURAXIAL BLOCKS

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Spinal vs Epidural

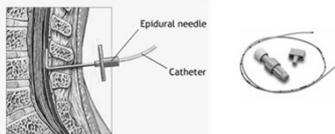
Spinal

- ▶ Direct injection into the subarachnoid space (contains cerebrospinal fluid)



Epidural

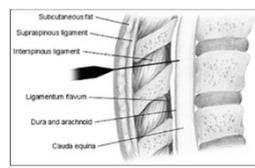
- ▶ Passage of a needle/catheter into the space just outside the meninges (from cervical to sacral regions)



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Spinal anaesthesia





Subcutaneous fat
Supraspinous ligament
Interspinous ligament
Ligamentum flavum
Dura and arachnoid
Cauda equina

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Spinal anaesthesia

- ▶ Nerve damage
 - ▶ Conus medullaris
 - ▶ Nerve roots
 - ▶ Peripheral nerves

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Ultrasound guidance

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Chesterfield, 1947

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Roe v Minister of Health [1954] 2 QB 66

- ▶ Two successive patients undergoing spinal anaesthesia developed chronic adhesive arachnoiditis
- ▶ Percolation of phenol through invisible cracks in cinchocaine ampoules
- ▶ Claim failed:
 - ▶ "We must not look at the 1947 accident with 1954 spectacles"
 - ▶ Denning LJ

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Roe v Minister of Health [1954] 2 QB 66

- Reusable spinal needles
- Descaler from boiler

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Sutcliffe v Aintree Hospitals NHS Trust [2008] EWCA Civ 179

- ▶ Caesarean Section, 2001
- ▶ Skin: iodine then chlorhexidine
- ▶ Intra-op. headache, confusion
 - ▶ GA
- ▶ Progressive motor and sensory loss
- ▶ Hydrocephalus
 - ▶ Shunt
- ▶ Chronic adhesive arachnoiditis

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Sutcliffe v Aintree Hospitals NHS Trust
[2008] EWCA Civ 179

- ▶ "The literature...supports contamination as overwhelmingly the most likely cause, and demonstrates that chlorhexidine can cause exactly this kind of outcome"



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Sutcliffe v Aintree Hospitals NHS Trust
[2008] EWCA Civ 179

- ▶ "Given the numbers of injections worldwide...it is inconceivable that there have not been occasional episodes of minute contamination."



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Sutcliffe v Aintree Hospitals NHS Trust
[2008] EWCA Civ 179

- ▶ "If there was such contamination [with chlorhexidine]...it could only have arisen through a breach of duty?" *Irwin J*



- ▶ "I believe so My Lord"

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Sutcliffe v Aintree Hospitals NHS Trust
[2008] EWCA Civ 179

- ▶ "Mr Feeny says there is such good practice here, from such professional people that I can effectively rule out contamination or, alternatively, can rule out negligent contamination or...the evidence is too doubtful and uncertain for me to come to a conclusion, to the correct standard of proof." *Irwin J*



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Sutcliffe v Aintree Hospitals NHS Trust
[2008] EWCA Civ 179

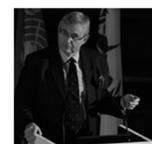
- ▶ There probably was contamination of the spinal injectate
 - ▶ Liquid-to-liquid
- ▶ Lapse or breach of duty which I cannot further specify
- ▶ Claim succeeded



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Sutcliffe v Aintree Hospitals NHS Trust
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- ▶ Claim succeeded



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Grace Wang, Sydney, 2010:
8 ml chlorhexidine injected into the epidural space

Patient Safety Alert Restricted use of open systems for injectable medication

Improvement

Actions

Incontrovertible evidence that neuraxial chlorhexidine causes arachnoiditis

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GENERAL ANAESTHESIA

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Airway management

Mask Cuff Airway Tube Bite Block Standard Connector

Drain Orifice Internal Drain Vent under Drain External Drain

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Airway management

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Airway management

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Care of the unconscious, prone patient

Foam to protect eyes & face

Foam to support arm

Foam to support chest

Foam to support legs

Foam to support leg

Spine operating table

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Prevention of corneal damage

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Anterior ischaemic optic neuropathy

- ▶ Blindness is a material risk of prone spinal surgery
- ▶ Risk factors
 - ▶ Older age
 - ▶ Peripheral vascular disease
 - ▶ Hypertension
 - ▶ Diabetes
 - ▶ Anaemia
 - ▶ Congenitally small discs
- ▶ Direct orbital pressure may or may not be a risk factor
- ▶ Intraoperative **hypotension** rarely associated

- ▶ *Wither v Essex Area Health Authority* [1988] AC 1074 (HL)
 - ▶ Retrolental fibroplasia: caused by excess oxygen?
- ▶ "The development of [AION] consequent upon failure to take a necessary precaution against one of five possible causes provides no evidence and raises no presumption that it was: **low BP** rather than one or more... other agent!"
 - ▶ paraphrasing Lord Bridge at p. 1091

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Blood pressure: systemic arterial pressure

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Brain and spinal cord autoregulation

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BP – often implicated, but rarely the whole story

- ▶ What is the Claimant's "normal" pre-operative BP?
 - ▶ Primary Care records; hospital pre-assessment; immediate pre-induction value
- ▶ Chronic (treated) hypertension?
- ▶ Hypotensive episodes under anaesthesia
 - ▶ Antecedent cause (e.g. surgical haemorrhage)
- ▶ $V = IR$ (voltage = current x resistance)
 - ▶ $BP = \text{Flow (cardiac output)} \times \text{systemic vascular resistance}$

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Blood volume, red cells, and BP

- ▶ $BP = \text{Flow (cardiac output)} \times \text{systemic vascular resistance}$
- ▶ I.v. fluid and blood management
- ▶ Urine output
- ▶ Serial point-of-care blood analyses
 - ▶ Haemoglobin
 - ▶ pH
 - ▶ Lactate

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Hepworth v Kerr (1995) 6 Med LR 139

- ▶ 40-yr-old, mastoid surgery: 1979
- ▶ Pre-operative BP 150/100
- ▶ **Induced hypotension**
- ▶ Dr Kerr's normal practice was to reduce systolic pressure to 50 mmHg
- ▶ Spinal stroke: lower limb paralysis
- ▶ Dr WR MacRae, expert witness for the defendant
 - ▶ One could not snatch a blood pressure out of the air and say "that one is safe and that one is not safe"
- ▶ **Induced hypotension**
 - ▶ A good surgeon doesn't need it... a bad surgeon doesn't deserve it

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