

# Complications of regional anaesthesia

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## Abstract

Complications of regional anaesthesia can be divided into those specific to central neuraxial blockade, those specific to peripheral nerve blockade, and those that pertain to both. Fortunately, severe complications – namely, spinal cord damage, vertebral cord haematoma and epidural abscess – are rare. Here we have given an overview of these complications, with reference to updated incidences available following the 3rd National Audit Project (NAP3) of the Royal College of Anaesthetists. A thorough knowledge of anatomy and pharmacology, and a meticulous, unhurried technique are essential to prevent such complications. When considering the use of a regional anaesthetic technique, the risks and benefits for that patient should be assessed on a case-by-case basis.

**Keywords** Central neuraxial block; complications; nerve damage; peripheral nerve block; regional anaesthesia

**Royal College of Anaesthetists CPD Matrix:** 1F01, 2B04, 2G01 and 2G04.

Regional anaesthesia is by no means an advance of modern medicine. The Incas knew of the numbing effects of chewing cocoa leaves hundreds of years prior to cocaine being isolated from the coca plant. Cocaine was first used topically for eye surgery in 1884 and in 1897 the first subarachnoid block was performed by August Bier. Following the devastating Woolley and Roe case in 1947, detailing two men who became paraplegic following spinal anaesthesia possibly as a result of contamination of the spinal needle with phosphoric acid used at that time to descale autoclaves, the place of spinal anaesthesia became uncertain despite its previously good safety record.

Advances in local anaesthetic drugs and equipment have done much to improve the safety of regional anaesthesia. This, coupled with improved supervision and training in regional anaesthetic techniques, has helped to minimize complications. Reassuring data are available on major complications of central neuraxial blockade, following the Third National Audit Project (NAP3) of the Royal College of Anaesthetists. This audit estimated the risk of permanent nerve injury to be 4.2 per 100,000 and the risk of death or paraplegia 1.8 per 100,000 following central neuraxial blockade (CNB).<sup>1</sup> Szyplula et al. looked at the extent, patterns and cost associated with litigation claims related

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## Learning objectives

After reading this article, you should:

- be aware of the potential risks and complications of regional anaesthesia
- understand the mechanisms resulting in severe complications
- be able to explain the benefits and risks of regional anaesthetic techniques to patients, aiding them to give informed consent for the proposed procedure

to regional anaesthesia in England. Regional anaesthesia itself was the largest clinical category within the NHS Litigation Authority (NHSLA) database. Eighty-nine percent of claims were related to CNB, with epidurals being the main culprit in 81% of these claims.<sup>2</sup>

We hope to give a broad overview of the potential complications of regional anaesthesia, which include those specific to either central neuraxial or peripheral nerve blockade, or complications relevant to both (Table 1).

## Central neuraxial blockade

### Post-dural puncture headache (PDPH)

This is the most common complication following CNB, during which the dura is breached – whether intentionally or accidentally. The resultant cerebrospinal fluid leak causes sagging of intracranial structures, with traction and vasodilatation in the meninges. The

## The incidences of major complications of regional anaesthesia

Complication	Incidence
<b>Central neuraxial block</b>	
• Post-dural puncture headache:	
Following spinal block	1 in 100
Following epidural dural tap	7 in 10 <sup>a</sup>
• Infective complications:	
Epidural abscess	1 in 47,000 <sup>b</sup>
Meningitis	1 in 200,000 <sup>c</sup>
• Vertebral canal haematoma	1 in 117,000
• Spinal cord injury	1 in 100,000
• Transient neurological symptoms	Up to 3 in 100 <sup>d</sup>
<b>Peripheral nerve block</b>	
• Peripheral nerve injury	1.9 per 10,000
<b>Complications common to both central and peripheral nerve block</b>	
• Local anaesthetic toxicity	Unknown
• Total spinal block	Unknown
• Failed block	1 in 100

<sup>a</sup> Incidence following accidental dural puncture with 16G Tuohy needle, in obstetric population.<sup>11</sup>

<sup>b</sup> Incidence for all adult epidurals, including perioperative, acute and chronic pain and obstetric epidurals.

<sup>c</sup> Incidence for all adult perioperative and obstetric spinal anaesthesia, epidural and combined spinal/epidural anaesthesia.

<sup>d</sup> Incidence with bupivacaine.

Table 1

onset of the headache is usually within 2–3 days following dural puncture, but can occur sooner or later. Patients may complain of a searing frontal or fronto-occipital headache, exacerbated by sitting up and relieved by lying down. Additional symptoms include neck stiffness, nausea and vomiting, hearing loss and tinnitus, vertigo, paraesthesia and visual disturbances. It is prudent to also consider the possibility of other diagnoses. These include viral, chemical or bacterial meningitis, intracranial haemorrhage, cerebral venous thrombosis, intracranial tumour, cerebral infarction and, in obstetric patients, pre-eclampsia.<sup>3</sup>

The risk of accidental dural puncture during an epidural procedure is about 1%. If a Tuohy needle breaches the dura, the incidence of headache can be as high as 70%.<sup>4</sup> The incidence of headache following spinal anaesthesia is considerably less: 0.5–1%. This reduction in PDPH is due to advances in needle design; namely, smaller gauge needles (25–27 gauge) with pencil-point tips that separate as opposed to cut the dural fibres. Cutting tip needles such as the Quincke are associated with a higher incidence of PDPH.

### Infective complications

Epidural abscess is a rare but serious medical emergency, requiring prompt diagnosis and treatment to make full recovery a possibility.<sup>5</sup> Delay in treatment can result in permanent neurological injury and even death. Factors that may predispose to the development of an epidural abscess following CNB include: immune-compromise, systemic corticosteroid drugs, diabetes and systemic sepsis.<sup>4</sup> Technical difficulty with the block can result in localized haemorrhage, which may provide a focus of infection. An epidural catheter maintains the needle tract, providing a pathway for organisms. Another obvious risk factor is failure to adhere to a strict aseptic technique,<sup>4</sup> which includes wearing a mask, cap, sterile gown and gloves, and adequate hand washing.

The incidence of spontaneous epidural abscess occurring in the population is 0.2–1.2 per 10,000.<sup>5</sup> data from the NAP3 report the incidence of epidural abscess in patients following CNB as 2.1 per 100,000 (1 in 47,000), with permanent harm occurring in 1.3 per 100,000 (1 in 88,000) and paraplegia occurring in 0.42 per 100,000 (1 in 236,000).<sup>5</sup>

Meningitis is another complication of CNB, most commonly following spinal block. The same risk factors for epidural abscess apply to the risk of meningitis. This complication is rare (incidence within the UK is less than 1 per 200,000<sup>5</sup>) but potentially fatal if not promptly diagnosed and treated.

### Vertebral canal haematoma

Vertebral canal haematoma is also a medical emergency: delay in diagnosis and treatments beyond 8 hours will result in paraplegia. Patients at risk include those with disordered coagulation, patients on antiplatelet or anticoagulant drugs, and patients in whom the procedure proved technically difficult, resulting in multiple attempts. Most case reports are associated with the use of epidural catheters, and often the only sign is inappropriate motor weakness, or progressive weakness and sensory disturbance. The incidence of vertebral canal haematoma is 0.85 per 100,000<sup>5</sup> for all CNBs, with permanent harm occurring in 1 in 140,000 patients.<sup>5</sup> However, the incidence of permanent harm in patients who receive a perioperative

epidural was estimated as high as 1 in 19,500 in the NAP3 UK National Audit.<sup>5</sup>

### Spinal cord injury

Traumatic injury of the spinal cord, nerve root or peripheral nerve may be caused by the block needle or by an indwelling catheter. These injuries need to be differentiated from neurological injury cause by cord compression (e.g. epidural abscess or haematoma). Early radiological imaging is essential to exclude the latter two.

Establishing a causal link between procedural trauma and nerve damage is rarely straightforward. Confounding or contributing factors such as surgical positioning, the operation itself, the pathology under treatment and pre-existing conditions such as diabetes mellitus or spinal canal stenosis need to be considered.<sup>5</sup> Nerve injury from needle or catheter trauma may or may not be associated with pain or paraesthesia during the procedure, but it is still prudent to perform CNBs on conscious or lightly sedated patients so that they may report these symptoms.<sup>5</sup> There are three scenarios that could potentially increase the risk of injury to the spinal cord:<sup>6</sup>

- Failure to identify the correct vertebral interspace. This is notoriously difficult to do when using surface anatomical landmarks such as Tuffier's line. The spinal cord may terminate anywhere from T12 to L4. The combination of performing a subarachnoid block at a higher level than estimated, in a patient whose conus medullaris ends lower than usual may result in spinal cord puncture.
- The ligamentum flavum may not fuse in the midline, which can alter the customary 'feel' of performing a central neuraxial block, particularly an epidural block.
- The anterior-to-posterior diameter of the epidural space decreases from 5 mm in the lumbar region to 1–2 mm in the upper thoracic and cervical region, which can result in an accidental puncture of the dura and cord when performing a high epidural block.<sup>6</sup>

Permanent nerve injury is rare following CNB. NAP3 reported the incidence of permanent harm from nerve or spinal cord damage to be 1 per 100,000.

### Transient neurological radiculopathy (TNR)

This is a symptom complex that may occur after spinal anaesthesia. Typically, there is complete recovery from the spinal block, followed by dysaesthesia in the back and buttocks, radiating to the thighs. Symptoms can last up to 72 hours. It is unclear whether the pain is related to local anaesthetic toxicity or if it is musculoskeletal or myofascial in origin. This complication has occurred with different local anaesthetics, of differing baricity. The incidence following hyperbaric lidocaine 5% (no longer licenced for subarachnoid anaesthesia) is up to 37%, compared with 3% with bupivacaine.<sup>4</sup> Another possible aetiological factor is patient position: lithotomy position can stretch the lumbosacral nerve roots. This compromises perfusion, placing nerves at increased risk of injury.

### Peripheral nerve blockade

#### Peripheral nerve injury

The incidence of transient neuropathy after peripheral nerve block may be as high as 10–15%<sup>7</sup> but the actual incidence of

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