# Spinal anesthesia

**Spinal anesthesia** involves the injection of small volumes of local anesthetic solution into the subarachnoid space at the level of the lumbar spine.

**1. Anatomy and placement**

Anatomy for epidural and spinal anesthesia.

**a.** Using sterile technique, and after local anesthetic infiltration of the skin and subcutaneous tissues, a small (22- to 27-gauge) **spinal needle is passed between two adjacent lumbar spinous processes**. The needle is passed through the following structures: supraspinous ligament,
interspinous ligament, ligamentum flavum, dura mater, and arachnoid mater. Cerebrospinal fluid (CSF) is aspirated, and the appropriate local anesthetic solution is injected.

**b.** The needle can be removed (single-shot method), or a catheter can be placed to allow repeated dosing for potentially longer procedures (continuous spinal).

**2. Level of analgesia**

**a. Multiple variables** affect the spread of analgesia. The **baricity** of the agent (solution density compared to that of CSF) and the position of the patient immediately after injection are major determinants of level. The **total dose injected** (increased dose results in higher spread) and the **total volume injected** (increased volume results in higher spread) are also important determinants of anesthetic level.

**b. Older patients** tend to have greater spread of anesthesia by a few dermatomes. Such a difference may not be clinically significant.

**3. Onset and duration of analgesia**

**a.** The **specific characteristics of the local anesthetic** used and the **total dose injected** are the primary determinants of onset and duration of action. Epinephrine added to the solution increases the duration of analgesia.

**b. Variability in length of analgesia** is significant, ranging from as little as 30 minutes (lidocaine) to up to 6 hours (tetracaine with epinephrine).

**4. Complications**

**a. Hypotension** may occur as a result of sympatholytic-induced vasodilation and bradycardia. It may be more severe in hypovolemic patients or in those with preexisting cardiac dysfunction. Treatment includes volume resuscitation (crystalloid, 500–1,000 mL), vasopressors (epinephrine, 5–10 µg i.v. for adults; phenylephrine hydrochloride, 50–100 µg i.v.), and positive chronotropic drugs.

**b. High spinal blockade.** Inadvertently high levels of spinal blockade may result in hypotension, dyspnea (loss of chest proprioception or intercostal muscle function), or apnea (decreased medullary perfusion secondary to hypotension). Respiratory dysfunction may necessitate intubation and ventilatory support.

**c. Headache** after spinal anesthesia or diagnostic lumbar puncture is encountered with higher frequency in young or female patients. A postural component is always present (i.e., symptoms worsened by sitting up or standing). The recent use of smaller-gauge spinal needles has reduced the frequency of this complication. Treatment includes oral or intravenous fluids,

oral analgesics, and caffeinated beverages. Severe refractory headache may require placement of an epidural blood patch.

**d. CNS infection** after spinal anesthesia, although extremely rare, may result in meningitis, epidural abscess, or arachnoiditis.

**e. Permanent nerve injury** is exceedingly rare and is seen with the same frequency as in general anesthesia.

**f. Urinary retention with bladder overdistention** occurs in patients with spinal anesthesia whose bladders are not drained by urethral catheters.

Catheters should remain in place until after the spinal anesthesia has been stopped and full sensation has returned.

**5. Contraindications**

**a. Absolute contraindications** to spinal anesthesia are localized infection at the planned puncture site, increased intracranial pressure, generalized sepsis, coagulopathy, and lack of consent.

**b. Relative contraindications** include hypovolemia, preexisting CNS disease, chronic low back pain, platelet dysfunction, and aortic stenosis.