WHAT TO DO IN CASE OF AN ACCIDENTAL SPINAL TAP DURING EPIDURAL?

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Regional anaesthesia is widely applied an accepted technique with several advantages for many of outpatients undergoing operative interventions. The physician who applies techniques of regional anaesthesia uses skills and knowledge that have been under constant refinement since the origin of this medical specialty in the second half of the 19th century. Despite its excellent reputation, regional anaesthesia has its own complications, of which accidental subarachnoid anaesthesia is one of them. These accidental spinal taps can occur when attempting to perform an epidural block, an upper extremity plexus block (anterior and posterior approach), an eye block.

Although epidural anaesthesia has an excellent safety record when used in obstetrics, complications may occur, often when it is least expected. Two potential catastrophes may be encountered when performing an epidural block in the obstetric patient: inadvertent dural puncture or "wet tap" and inadvertent intravenous injection of a local anaesthetic solution.

*True Massive Epidural Block* involves over dosage of local anaesthetic via a correctly placed needle or catheter, while systemic toxicity, subdural and total spinal block are produced by injecting appropriate amounts of local anaesthetic for epidural block into an incorrectly placed needle or catheter. An *Unintentional Subdural or Subarachnoid Injection* of local anaesthetics, producing possibly a high or total spinal block, is at best an embarrassment and at worst a live threatening complication, which, if not recognized immediately, requires prolonged resuscitation. Large volume of local anaesthetic injected in the subarachnoid space will cause not only a total spinal block but may even cause neurological deficits. Clinical signs and symptoms of a subarachnoid block will be seen showing e.g. paralysis of the preganglionic sympathetic and cardioaccelerator fibers, the intercostal muscles and the diaphragm, and finely loss of consciousness, due to decreased cerebral blood flow. An *Unintentional Intravascular Injection* of local anaesthetics, resulting in a toxic reaction, is possible in the gravid parturient near term, in which epidural veins are markedly dilated making entry even more likely. Systemic toxicity, due to action of the drugs on excitable membranes in the brain and heart, may produce numbness of the tongue, metallic taste in the mouth, light-headedness and tinnitus, visual disturbances, strange behaviour and incoherent speech, muscle twitching, unconsciousness, convulsions, vasodilatation, reduced cardiac output and a profound hypotension. Accidental rapid intravenous injection of a large amount of local anaesthetic solution will result in a grand mal convulsion and possibly cardiovascular collapse. With convulsions, effective respirations cease, and hypoxia, hypercapnia and lactic acidosis develop within 30 sec. Even maternal deaths associated with epidural anaesthesia have been reported. To complicate matters further, epidural catheters that have been functioning normally at a previous
injection may migrate into epidural veins or into the subarachnoid space. There can be a considerable movement of the skin and soft tissues over the lumbar spine with change of position in a patient, especially in obese patients.

A prudent vigilant anaesthesiologist can avoid these iatrogenic errors if meticulous attention to detail is given. How does one assure that large doses of local anaesthetics intended for epidural placement in the obstetric patient are not inadvertently injected into the subarachnoid space or into an epidural vein? One should know the indications, contra-indications and use of the local anaesthetic to be used prior to administering it. Select the optimum block – technique and always have resuscitation equipment and drugs at hand, just in case. Monitor the mother's vital signs, foetal heart rate and uterine contractions. After inserting the epidural needle, aspiration for blood or CSF should be performed before and after inserting the epidural catheter. Lower the epidural catheter below the operating table, as gravity may help blood to enter the epidural catheter when a vein is penetrated. Check the drug yourself you intend to inject into the epidural space. You can use a pharmacological test dose, containing sufficient local anaesthetic and epinephrine to rule out unintentional positions. Carefully observe the patient while injecting, and talk to the patient to detect subjective signs and symptoms of unintentional subarachnoid or intravenous injections. Fractionate the larger dose, inject slowly and allow sufficient time to elapse between the incremental doses.

What measures should we take when an inadvertent perforation of an epidural blood vessel or the dura matter? When gross blood is aspirated from an epidural catheter, the catheter should be withdrawn a few millimetres and cleared with saline until the aspirate is clear. Otherwise, the catheter should be withdrawn and re-inserted at another interspace. When symptoms of an i.v. injection occur, the injection should be stopped and 100% oxygen is given. If convulsions occur, they should be controlled and a free airway should be secured (intubation and ventilation). Therapy of a cardiac collapse include large doses of epinephrine, titrated doses of bicarbonate and anti-arrhythmic drugs (e.g. lidocaine), possibly to be given via the trachea to reach the central vascular system. Closed chest cardiac compression may not be effective in a gravid parturient near term. The baby must be delivered immediately or direct open chest cardiac massage performed with expert manual displacement of the gravid uterus. One should be prepared for a long period of cardiac resuscitation (more than one hour in case of bupivacaine toxicity may be necessary).

A dural puncture is usually obvious with a gush of fluid coming from the hub of the Tuohy needle. Spinal fluid will feel warm to the forearm and can be tested for a neutral pH or sugar content with dextrostix. In a low dose technique for vaginal deliveries, an epidural catheter can be placed at another segment. In case of a caesarean section, it is wise not to continue with an epidural technique, but to perform spinal anaesthesia, because epidurally injected local anaesthetics will always leak into the subarachnoid space through the "hole" made by the Tuohy needle. An inadvertent subarachnoid injection of local anaesthetic intended for epidural anaesthesia will rapidly produce a high or more likely a total spinal block. If the patient receives proper respiratory and cardiovascular support, the block usually regresses and dissipates with no neurological
complications. Furthermore it has been suggested to withdraw CSF as much as possible if the catheter is in the subarachnoid space and to replace it with physiologic saline. Therefore do not remove the catheter.

In case a catastrophe occurs from systemic toxicity or total spinal anaesthesia, ask for at least one knowledgeable person to help you treating the patient more effectively. Catastrophes during epidural anaesthesia for obstetrics as systemic toxicity and total spinals may occur, but should never end up with a decerebrated, paralysed or dead patient. If treated well, the outcome should be as good as perfect, with no sequelae whatsoever. Therefore the anaesthesiologist should always be highly suspicious that, in spite of a negative result, misplacement of epidural catheters can still be present. The price of safety is eternal vigilance, and the precautions taken are just step-by-step factors that are all important in performing epidural anaesthesia to the benefit of both mother and foetus.

**Recommendations in Obstetric Epidural Anaesthesia**

Central neuraxial blocks should be mastered first in the operation room as obstetric anaesthesia is not the place to try out or teach new techniques to a novice. Verify the exact position of epidural needles and catheters by passive return (gravity) and a correctly performed aspiration test (for blood and CSF). Use a pharmacological test dose (with sufficient local anaesthetic plus an I.V. marker). Subtoxic amounts of local anaesthetics produce signs and symptoms of CNS toxicity. All patients need to be monitored. Effective markers of a subarachnoid position of needles or catheters can be ruled out by using a sufficient amount of local anaesthetic to produce a safe but solid subarachnoid block. Give yourself the time to evaluate any onset of a block. Therefore test the results of any injection for its adequacy. Hypotension is not a reliable sign. Excessive sensory block/analgesia should make us alert, especially when a substantial motor block with early onset is seen.

Each injection given in obstetric anaesthesia should be done while talking to the parturient so that you can learn from the patient if anything would go wrong. Every dose given in epidural analgesia for vaginal delivery should be a test dose. Therefore check the results of any injection so that you are sure in which space the local anaesthetic was injected. Use an appropriate amount of local anaesthetic and take appropriate steps accordingly. Especially the combined spinal-epidural anaesthesia technique is a very safe technique to use in obstetric anaesthesia, in which it is not necessary to use large amounts of local anaesthetics. A small small amount is injected in the subarachnoid space, e.g. 1 to 2 mg bupivacaine + 10 – 15 µg epinephrine + a small dose of opioids (sufentanil or fentanyl), which will produce analgesia for up to +/- 90 minutes. As such a sensory block is achieved with an upper level of about T10. The epidural space can be used to administer a top-up, using also a low dose - low concentration technique, to adjust to the appropriate level. This is called the sequential CSE technique.

The CSE technique offers us the benefit of two worlds: the rapid onset of analgesia produced by the subarachnoid block combined with the flexibility of an epidural catheter. In a low dose-low
concentration technique no longer the use of a test dose per se is warranted, provided that constant vigilance is taken care of.

Whenever you would run into an accidental subarachnoid block, don't panic. Complications in regional anaesthesia do occur. Be sure that you know how to handle these complications.