

## Complications of regional anaesthesia with special reference to spinal, Epidural and caudal anaesthesia

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(Journal of BSA, 2008; 21(2): 80-85)

Excellent anaesthesia and analgesia by either intradural (subarachnoid, spinal, intrathecal) or extradural (epidural, peridural, Caudal) injection is among the most versatile regional blocks available today. Either method can be used for a variety of operations on the lower part of the body, the abdomen, the chest and upper extremities. These blocks are used not only for surgery but for pain relief in the postoperative period and during labour and for diagnostic and therapeutic purposes. Compared to general anesthesia, regional anesthesia offers numerous opportunities for better pain control and patient satisfaction. Modern regional anaesthesia offers low morbidity and mortality rates. As regional anesthesia continues to gain acceptance, providers must be prepared to diagnose and treat any complications that may arise with the use of blocks. In France, the number of procedures performed annually has increased twelve fold between 1980 and 1996 associated with numerous advantages and with very few severe complications<sup>1</sup>. Many anesthesiologists perceive regional anesthesia to be a safer and shorter recovery times compared to general anesthesia<sup>2,3</sup>.

However, significant morbidity may directly result from regional anesthesia. The incidence of cardiac arrest associated with spinal blockade has been reported to be as much as 0.06% and frequently results in death or brain damage<sup>4,5</sup>.

The term 'Spinal Anaesthesia' was coined in 1885 by J. Leonard Corning a New York neurologist. Fourteen years passed before spinal anaesthesia was performed in a surgery. Renowned German surgeon Professor August Bier introduced spinal anaesthesia by allowing his assistant, Dr Hildebrandt, who volunteered to be the subject of second attempt, for cocaine injection into his own spine. He also gave classical description of the post dural puncture headache (PDPH) which he latter suffered<sup>3</sup>. Ferdinand Cathelin and Jean Sicard introduced caudal epidural anaesthesia in 1901. Lumbar epidural anaesthesia was described first in 1921 by

Fidel Pages and again in 1931 by Achille Dogliotti. Complications from the use of regional anesthesia have been reported from the onset of its use. 'Aseptic meningitis' were described as early as 1936; it was not until the now infamous 'Wooley and Roe' cases in 1947 that these complications were highly publicized and in 1954 led to the almost virtual abandonment of spinal and epidural techniques in Britain for more than two decades<sup>2</sup>. In these cases, two relatively young healthy males became paraplegic after spinal anaesthesia secondary to contamination of the syringes and spinal needles by an acidic descaler<sup>4</sup>. Ever since, Anaesthesiologist continues to improve and modify this technique to increase safety and reduction of complications.

### Complications are

- Technical- Related to insertion of the needle/ catheter.
- Associated with positioning of the patient.
- Local anaesthetic toxicity.
- Excessive spread.
- Those of specific techniques.
- Infection and inflammation.
- Due to bleeding

Patients must be informed regarding risks associated with regional anaesthesia from block failure to neurological injury and death. As one recites this list, the actual likelihood of suffering this complication is often not well communicated to the patient.

A report from Chadwick, et al. in 1991 looked at malpractice claims filed against anaesthesiologists in a 10-year period from 1975-1985<sup>6</sup>. A comparison was made between obstetric and non-obstetric claims related to general and regional anaesthesia. A total of 1,541 cases were reviewed, of which 12% were obs-related and 88% were non-obs related claims. The following comparisons were made regarding the types of injuries claimed.

**Table-I**  
*Malpractice claims against anaesthesiologists:*

Complications	non-ob claim	ob claims	ob-regional	ob-general %
	% (n=1,351)	% (n=190)	% (n=124)	(n=62)
Patient death	39(524)	22(41)	12(15)	42(26)
Neonatal brain damage		20(38)	19(23)	24(15)
Headache	1(10)	12(23)	19(23)	0(0)
Neonatal death	<0.5(1)	9(17)	7(8)	10(6)
Pain during anaesthesia	<0.5(5)	8(16)	13(16)	0(0)
Patient nerve damage	16(209)	8(16)	10(12)	7(4)
Patient brain damage	13(174)	7(14)	7(9)	8(5)
Emotional distress	2(30)	6(12)	7(9)	5(3)
Back pain	1(8)	5(9)	7(9)	0(0)

This Meta analysis demonstrated that patient's death, nerve injury and brain damage were more common in the non-obstetric population due to general anaesthesia. However among the obs-population, claims more for trivial events-headache, pain during anaesthesia, emotional distress and back pain receiving regional anaesthesia. Major complications are more frequent in general anaesthesia. Report on Confidential Enquiries into

Maternal Deaths in the United Kingdom 1988-1990, there were 4 deaths directly attributable to anaesthesia<sup>7</sup>. One was due to pulmonary complications which occurred after aggressive treatment of hypotension in a patient with an underlying cardiac arrhythmia. This patient had an epidural anaesthetic and it was felt that the sympathectomy could have contributed to the failure at resuscitative efforts<sup>7</sup>.

### Swedish experience:

**Table-II**  
*Several complications from intrathecal, epidural and caudal blockades reported to the Swedish patient insurance during 1980-1984.*

Complications	Type of Anaesthesia			
	Epidural blockade	Intrathecal blockade	Caudal blockade	Blockade and general anaesthesia in combination
Deaths	1	-	-	-
Brain damage	1	-	-	1
Symptoms of cauda equina lesion	12	20	2	5
Spinal or epidural haematoma	2	-	-	-
Subdural haematoma	-	2	-	-
Subarachnoid haemorrhage	1	-	-	-
Significant paresis	10	7	-	-
Purulent meningitis	-	2	-	-
Deep local infection	-	1	-	-
Somatosensory disturbances	18	21	-	4
Chronic back pain	7	8	1	2

During 1980 – 1984 about 500,000 epidural, intrathecal and caudal blocks were performed in Sweden. Out of 157 complaints 77 were considered well founded as regards the relationship between injury and anaesthetic method; 52 complications were considered to be serious. The cauda equina syndrome appeared in most cases within 24 hours of operation. One year after the injury 27 of 39 patients still had neurological dysfunctions in clinical significance.

### **Transient Complications:**

**Spinal headache:** was the first complication reported in 1899 by August Bier on his own experience using a Quincke cut needle. In 1979, Kortum et al reported postspinal headache in 34% of 2592 patients. It occurs most frequently in young adults including obstetric patients with an incidence rate of 14% compared to 7% in individuals older than 70years<sup>8</sup>. The size of the needle is thought to be of importance. The use of smaller needles with pencil point tip has markedly reduced the incidence of PDPH. Intense headaches occur when CSF escapes through the dural puncture site, resulting in intracranial tension on meningeal vessels and nerves. Treatment with Large volumes of fluid and caffeine intravenously has been tried with success. It does not cause prolonged suffering and the symptoms normally disappear spontaneously within 2-3 weeks.

**Bladder disturbance:** Transient problems with bladder dysfunction are not unusual. The patient may require bladder catheterization or intermittent emptying of the bladder.

**Back pain:** Temporary pain is commonly seen after operation with spinal anaesthesia. Unfortunately some patients develop long lasting back-pain, the causal relationship is difficult to interpret. In this connection psychosocial interactions are very common as either cause or effect.

### **Serious Complications.**

**The incidence of hypotension:** following SA is 10-40%. The hypotension is related to the extent of sympathetic blockade, which is responsible for a decrease in systemic arteriolar and venous tone. Cardiac output may fall as a result of decreased venous return<sup>9</sup> consequent to venous dilatation. Hypotension may be exacerbated by bradycardia and

sedative drugs. Bradycardia may be due to sympathetic cardiac innervations and vagal stimulation during surgery. Hypoxic brain damage may occur as a consequence of an extreme decrease in blood pressure during regional anaesthesia.

**Epidural abscess:** has been reported in a frequency of 1:505,000 patients who had epidurals. The incidence is 2:10,000 in patients without regional anaesthesia<sup>10</sup>.

**Anterior spinal artery syndrome:** Spinal cord ischemia and Infarction due to anterior spinal artery insufficiency following profound prolonged hypotension after spinal or extradural anaesthesia. The injury occurs more often in the anterior horns and the anterior and lateral columns. Motor activity normally disappears whereas tactile and temperature sense may be retained.

**Epidural hematoma:** The actual incidence is unknown. It is reported to occur spontaneously in patients who have not received regional anaesthesia<sup>11</sup> and in patients who have received regional anaesthesia<sup>12, 13</sup>. In a review of the literature from 1906-1994 by Vandermeulen et al. identified 61 cases of spinal - epidural hematoma, 46 of which were associated with epidural anaesthesia. Twenty three of the 46 epidural cases were associated with the use of anticoagulants, 4 were associated with thrombocytopenia and the remaining 19 cases had no risk factors reported. Five of these cases were in pregnant women. Two of these were reported to have thrombocytopenia, 1 had an epidural ependyma and 2 had no identifiable risk factors. Risk factors for epidural hematoma have included difficult or bloody tap, pre existing coagulopathy and use of anticoagulants. The risk of a bloody tap in the obstetric population has been reported to be as high as 18%. Thrombocytopenia is identified as a risk factor, however the platelet count below which it is risky to use regional anaesthesia is still somewhat controversial. In the review by Owens et al<sup>9</sup> no patients were identified with hematoma and a platelet count was >50,000. Current dogma uses a platelet count >100,000 as the safe threshold. The symptoms appear gradually and start usually with severe pain in the back. Then there is progressive paresis. If suspected, Myelography and CT scan should be undertaken immediately. Permanent neurological damage may occur if surgical decompression is delayed > 8-12h. When questioning

the use of regional anesthesia for fear of epidural hematoma one must always consider the risks of general anesthesia.

**Aseptic meningitis:** The most benign neurologic syndrome usually presents within 24 hours of SA and is characterized by fever, nuchal rigidity and photophobia. The genesis is usually unknown. Often it may be due to chemical irritation caused by detergents or disinfectants introduced during needle manipulation. Aseptic meningitis requires only symptomatic treatment and usually resolves within a few days. Arachnoiditis has been seen as a delayed complication.

**Septic meningitis:** with permanent sequelae is now an unusual complication. Sequelae may be avoided if the patient is treated adequately but persistent adhesive arachnoiditis has in fact been described. Death may occur (kilpatrick, 1983)<sup>14</sup>.

Adhesive arachnoiditis and chronic adhesive arachnoiditis:

The most serious neurologic complication usually occurs several weeks, months or years after the insult. The syndrome is characterized by pain, a gradual progression of sensory deficits and motor weakness in the lower limbs. Antiseptic solutions and preservatives in the drug solutions have been implicated. Characterized by proliferation of the pia mater followed by fibrosis and stricture of nerve tissue. Demyelination of the nerve tissue and the subdural as well as subarachnoid space may become contracted by swollen meninges. Within a few weeks after block myelography shows a narrow spinal canal. Usually seen in connection with intrathecal block but has been observed even after epidural block. Boiardi, et al<sup>15</sup> described four cases. Response to treatment is generally poor.

**Cauda equina syndrome:** Syndromes of leg weakness, perineal sensory loss, disturbances or loss of sphincter control in the bladder and rectum in addition to erection problems<sup>16</sup>. The cause is not yet established. Possible mechanisms of injury include direct trauma, intraneural injection, epidural haematoma and high concentrations of local anaesthetics. It has been suggested that cauda equina nerve fibers are more vulnerable to damage because they lack protective sheaths. Symptoms may appear soon after surgery and may be permanent or it may regress slowly over weeks or

months<sup>17</sup>. Cauda equina syndrome and adhesive arachnoiditis share a common etiology. Treatment is palliative and is generally of a rehabilitating character. Traumatic injury to the spinal cord and nerve roots is a rare cause of neurologic deficit.

Spinal cord ischemia and infarction may occur after prolonged periods of arterial hypotension<sup>15</sup>.

**Intracranial hemorrhage:** Are a much rarer but decidedly more serious complications of spinal or epidural anaesthesia. There are a few reports most of them are sub-dural haematoma formation<sup>18</sup>. If the headache is atypical or lasts for more than week; CT scan is indicated, especially if treatment with blood patch has proved to be without effect.

With the increasing use of regional anesthesia, providers must be prepared to evaluate patients for neurologic complications. What makes these rare regional anesthesia complications so unsettling is that the risk of permanent neurological damage associated with the technique is often out of proportion to the surgical risk incurred by the patient. However, the benefits of regional anesthesia experienced by the vast majority of patients, particularly from a postoperative pain perspective, justify use of the procedure. The majority of neurologic injuries noted after regional anesthesia are not secondary to the block but result from preexisting conditions, patient positioning, or from the surgery itself. Nevertheless, anesthesia providers will increasingly be called upon to evaluate nerve injury patients for diagnosis and treatment.

**Remaining cannula and catheter:** Only rarely is the cannula broken in the epidural or subdural space. When this does happen, however, surgical intervention is necessary. The catheter may shear; if it is pulled out of the Touhy needle. It has been claimed that the catheter can remain in the epidural space without causing injury.

**Total intrathecal block:** An experienced anaesthetist will have to accept a 2.5 % accidental dural puncture in the epidural anaesthesia and a 1.2% accidental dural puncture with caudal anaesthesia<sup>19</sup>. If dural puncture is not discovered there is a risk of total intrathecal block with local anaesthetic injection. The patient then unconscious and develop severe respiratory and cardiovascular collapse. Oxygenation with Intubations and controlled ventilation are normally required in



addition to volume substitution and vasopressors. If treatment is adequate, sequelae rarely occur.

**Caudal anaesthesia:** Complications are as for extradural anaesthesia but much less common. Insertion of needle into the rectum or presenting part of the fetus has been reported.

The relationship between regional anaesthesia and sequelae: General Consideration

Marinacci and Courville 1958 described 542 patients who had all notified neurological disturbances thought to be caused by intrathecal block. By means of electromyography, however, it was established that only 4 patients could justifiably ascribe their complaint to the block. The incidence of severe neurologic deficit following SA is low. In a prospective study of 40,640 cases of SA, the authors reported as an incidence rate of serious neurological deficits of 0.5 per 10,000. These have been in association with epidural hematoma, epidural abscess, adhesive arachnoiditis, anterior spinal artery syndrome or cauda equina syndrome. When one discusses these complications, it is important to keep in perspective those are of very low incidence. This is worth remembering as both patient and surgeon often blame the damage on the anaesthetic technique. Routine postoperative check up at an early stage to establish the true frequency and nature of complications is one way of preventing a misjudgment of the causal relationship. There is also a need to search for new predictors, triggers and risk factors. The best defense against nerve injury induced by regional anesthesia is following proper procedures: slow, careful needle technique; spare use of epinephrine; and careful physical examination of the patient prior to the block.

#### Conclusion:

Through continued study, training and experience in regional anesthesia, the significant benefits of this technique can be achieved with maximal safety to patients. Despite the great benefits of regional anesthesia, providers may be tempted to think, "If I had just done a general anesthetic, I would not have this problem." To prevent complications, strict indications should be observed. Pain is an important warning signal. If pain occurs the anaesthetic procedure should be discontinued.

The neurological injury causes the most serious disability. Diagnostic tests are of importance at an

early stage. Repeated EMG and CT scan are recommended.

Postoperative routines to deal with complications in time comprise an important part of the anaesthetist's work. Who follow up the patient should not forget to refer early to the anaesthetist any complaints from the patient. Everybody profits from a swift and detailed analysis of complications.

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