Spinal narcotics

Implications for nursing

By Carol Markowsky, R.N., B.S.N.

Interest in pain control has resulted in considerable study of the various techniques for providing analgesia. One such technique that is growing in popularity is the use of spinal narcotics (injection of narcotics either into the subarachnoid or epidural space). Spinal narcotics are used in the treatment of chronic or acute pain whether it be due to surgery, trauma or disease process (Buckley, 1987).

The apparent advantage of spinal administration of narcotics over systemic administration is the generation of segmental analgesia by direct spinal action so side effects commonly associated with the systemic route are avoided. However, there is evidence that spinally administered narcotics undergo supraspinal redistribution activating brain stem centers responsible for side effects such as nausea, vomiting, pruritis, respiratory depression (Moulin, 1984). This article will review anatomy, technique of injection, contraindications, mechanism of action, side effects, and the resulting implications of spinal narcotics.

Anatomy

The spinal cord is covered and protected by the three meninges that perform the same protective function for the brain. The dura mater is the outer most membrane, a strong, expandable sheath of dense, fibrous connective tissue that ends in a blind sac at the end of the second or third segment of the sacrum. (See Figure 1) The epidural space is located between the outer surface of the dura and the bones of the vertebral canal. It contains a network of blood vessels, adipose, and loose connective tissue. The subdural space is that area between the inner surface of the dura and the underlying arachnoid membrane.

Injection technique

The middle meningeal layer is the arachnoid membrane. The inner-most layer of the meninges is

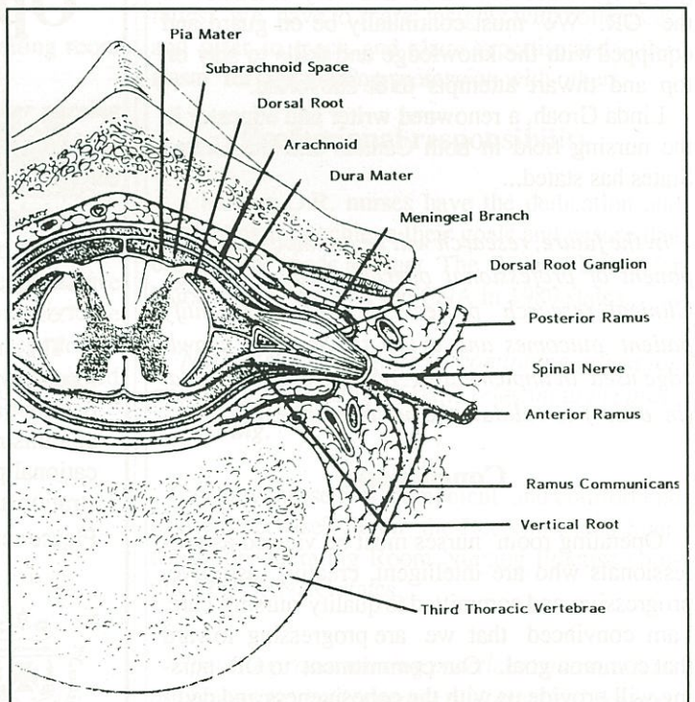

Figure 1 - The spinal cord and spinal nerves

the delicate pia mater and is very closely applied to the spinal cord. The subarachnoid space is a roomy area between the arachnoid and the pia mater. The subarachnoid space contains an abundant amount of cerebral spinal fluid (CSF) (Drain, 1987).

Whatever the site of pain, injection of epidural or subarachnoid narcotics is usually done at the lumbar level for reasons of safety. In the adult, the spinal cord terminates at the level of the first or second lumbar vertebrae. The meninges, lumbar and sacral nerve roots extend into the sacral portion of the spinal canal (See Figure 2). Thus, a needle that enters the subarachnoid space below the termination of cord cannot possibly strike the cord with resulting trauma, but will simply move the nerve roots aside.

For subarachnoid or epidural injection the patient can be in the sitting or lateral position.The patient is asked to curl up in the fetal position which opens the spaces between the spinous processes. An imaginary connecting line is drawn between the two iliac crests. This line will pass through the tip of the spinous process of L4. Injection is usually made between L2 and L4. Passage through the meninges into the subarachnoid space is detected by a slight "pop". CSF will then flow freely from the needle after the stylet is removed.

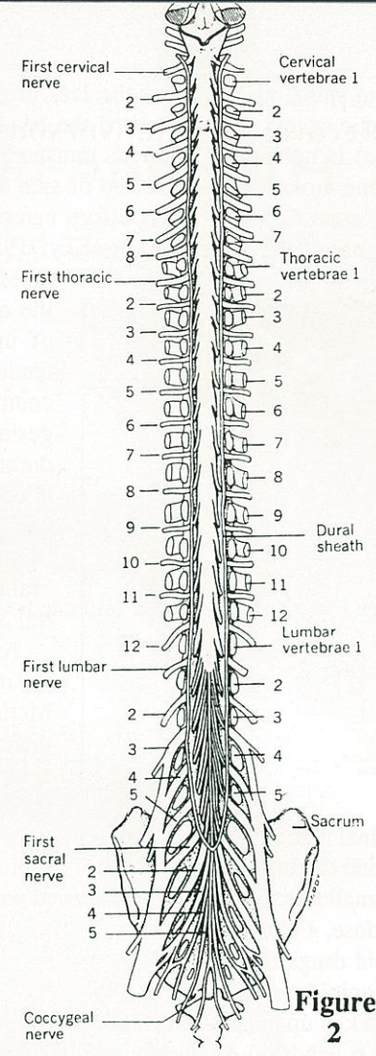

Figure 2

Infection and spinal headaches

For epidural injection, a larger, blunt-tipped needle is used. The needle is advanced until it is firmly in the interspinous ligament (a strong fibrous cord that connects the tips of the spinous processes). The stylet is removed and a 5 cc or 10 cc glass-barreled syringe is attached, filled with air or saline. The needle tip is then advanced into the ligamentum flavum (a thick band of yellow elastic fibers that connects adjacent laminae). There is considerable resistance to injection in the ligamentum flavum, with the plunger actually "bouncing" when compressed. Loss of resistance identifies the epidural space (Buckley & Brodsky, 1987).

It is common practice to insert an epidural catheter through the epidural needle, which is then left in place for subsequent injections. It is also possible to insert a subarachnoid catheter; however, this is much less common because of the risk of infection into the CSF, and because of the risk of spinal headache due to the leak of spinal fluid through the puncture site. The subarachnoid route is more suitable when a single-dose spinal anesthetic is used, and at the time of induction a narcotic is mixed with the local anesthetic (Bromage, 1982).

Contraindications

There are few contraindications to the use of spinal narcotics. Most are related to the technique of injection. A pre-existing coagulopathy is considered an absolute contraindication. There is a great risk for formation of hematomas and the resulting neurological deficit from compression of the nerve roots or spinal cord.

Systemic infection is considered a relative contraindication because of the risk of creating a focus for central nervous infection, especially if a bloody tap occurs. However, active infection at the insertion site is an absolute contraindication. Obviously, the infecting organism might be carried into the epidural or subarachnoid space.

Another absolute contraindication is patient refusal. The patient must be cooperative. There is little to gain from coercing patients into a procedure that they do not accept.

Spinal deformities, i.e., scoliosis, are relative contraindications in that they make the injection more difficult (Buckley and Brodsky, 1987).

Mechanism of action

Opioid receptors are concentrated in the substantia gelatinosa in the dorsal horn of the spinal cord. Whether administered by the epidural or subarachnoid route, opioid drugs must reach the spinal cord to activate the receptors and block pain trans-

mission is blocked. The block from spinal anaesthetics (injection of local anaesthetic agents into the epidural or subarachnoid space) is"non-selective" in that sympathetic, sensory and motor block can be accomplished. Using local anaesthetics, it is possible to achieve complete anaesthesia and muscle relaxation, but not with spinal narcotics.

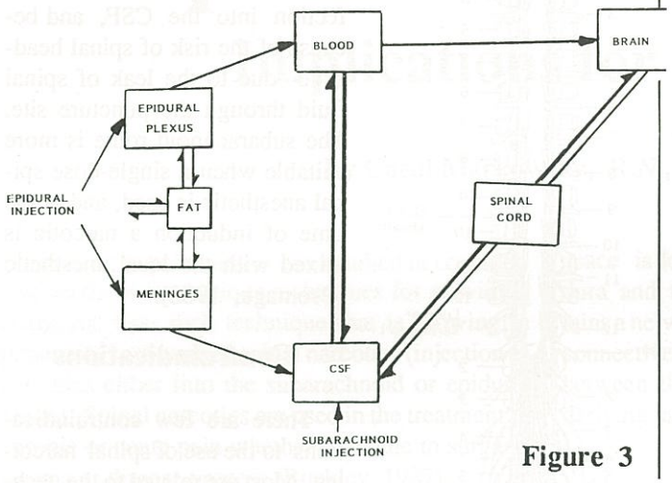

Figure 3

Subarachnoid injections are made directly into the CSF and thus require a much smaller dose, approximately 4% of the epidural dose. Following subarachnoid administration, opioid drugs diffuse into the spinal cord to occupy opioid receptor sites. Some of the narcotic is also taken up by surrounding vessels. **(Fig 3)** (Buckley & Brodsky).

Analysis of epidural uptake is more complex. Epidural fat is found throughout the epidural space and is one of the main competitors for narcotics injected into the epidural space. The other two being blood vessels and the spinal cord itself. Some of the drug is taken up by the rich epidural plexus which drains into the intracranial veins and then into the central circulation. The result being similar to that of intravascular absorption (as in I.V. injection) of the narcotics with its subsequent central effect. (Moulin, 1984). Epidural narcotics also diffuse across the meninges and into the CSF. From there the drug is taken up by the surface of the cord to opioid receptor sites **(See Figure 3).**

Drugs used

Narcotics have certain characteristics that determine their mode of action and speed of transport. Lipid solubility is one such characteristic. The more lipid soluable the drug, the more rapidly and completely it is taken up by the spinal cord and the less drug is left over to move cephalad (toward the head). The degree to which the narcotic is transported to the brain determines the incidence of side effects such as depressed respiratory effort, nausea, vomiting and puritis (Buckley and Brodsky, 1987).

Morphine, the least lipid soluble of the opiate analgesics has a slow rate of uptake into the spinal cord and tends to linger in the CSF. This accounts for the delay in onset of analgesia (30-60 min.) and the prolonged duration of action (12 to 24 hours). It allows for a greater fraction of the drug to ascend in the CSF to reach the 4th ventricle and surrounding brain stem centre responsible for central side effects (Moulin, 1984).

Available evidence suggests that the more fat soluble narcotics, such as Methadone, Fentanyl and Demerol, diffuse out of the CSF and into the spinal cord fast enough to escape the rostral spread seen with poorly lipid-soluble drugs such as Morphine. Analgesic effect is of more rapid onset and shorter duration than that achieved with Morphine. (Bromage, 1982).

Side effects

The major side effects of spinal narcotics, be they administered via the epidural or subarachnoid route, are primarily four in number:

- Respiratory depression
- Pruritis
- Nausea and vomiting
- Urinary retention

Respiratory depression

The most serious, though least frequent, is respiratory depression. Respiratory depression associated with intraspinal narcotics is biphasic in nature. Early respiratory depression (first 30 - 60 minutes) is believed to be the result of intravascular absorption of the narcotic with its subsequent central effect. This is not generally of serious significance as the patient, at this time, is usually under close observation either in the O.R. or P.A.R.

In addition, vascular absorption of a fraction of a 5 or 10 mg dose of Morphine does not result in great risk since it is common practice to administer a similar or even greater intravenous dose to

the patient in the early post operative period.

The most dangerous is the late respiratory depression. It commonly occurs from 8 - 16 hours post injection, but may occur up to 24 hours post injection. As previously stated, late respiratory problems occur chiefly with the poorly lipid soluble agents such as Morphine. Due to its limited lipid solubility not all of the drug is taken up by the spinal cord. This allows more unbound drug to reach the fourth ventricle. Respiratory centers of the brain stem are bathed in concentrations of the drug infrequently achieved with oral or parenteral administration. The delay in respiratory depression is due to the time required for the narcotic to spread rostrally (toward the head) in the cerebral spinal fluid.

Fortunately, respiratory depression, as well as other side effects of spinal narcotics may be treated with Naloxone Hydrochloride. The side effects can be reversed while not compromising the analgesia because of a greater blood flow to the brain than the substantia gelatinosa (gray matter surrounding spinal canal). (Bochenek, 1988). Naloxone is usually given in small doses (0.1 mg to 0.2 mg) via intravenous bolus. The duration of Naloxone is 15 to 20 minutes, so repetitive doses may be required (Moulin, 1984).

Pruritis

Another common side effect of intraspinal narcotics is pruritis, occurring in 10 - 30% of patients. The itching may be generalized but is usually restricted to the nose and perioral region. In most cases this pruritis is not histamine-induced; however, if the patient is allowed to scratch before treatment with Naloxone, a histamine component may be initiated and treatment with antihistamines may be beneficial.

The most recent theory with regard to the etiology of pruritis is that the ascending narcotic results in an imbalance in the sensory perception of the region, resulting in a predominance in one kind of input, perceived as itching (Bochenek).

Nausea and vomiting

Nausea and vomiting occur at a rate of 15 to 35% in patients who have received spinal narcotics. Nausea and vomiting is likely a result of direct stimulation of the chemoreceptor trigger zone in the floor of the fourth ventricle. (Bochenek, 1988). Tolerance to this side effect apparently develops rapidly as the incidence of vomiting is reduced with repetitive dosing in the patient with chronic cancer pain. Again, the most successful treatment is Naloxone Hydrochloride. (Moulin).

Urinary retention

Urinary retention is probably the only side effect of spinal narcotics due to direct action on the spinal cord. Inhibition of parasympathetic outflow from the sacral spinal cord may be the mechanism. There is a 10 - 30% incidence in males. Urinary retention, however, is the least clinically noted side effect, as most patients requiring spinal narcotics also require indwelling urinary catheters for at least 24 hours. (Bochenek, 1988).

The potential development of serious side effects generally limits the use of spinal narcotics to individuals with pain below the mid-thoracic level. The higher the level of drug administration (dependent on dose, injection site, drug used, and rate of injection), the greater the degree of rostral redistribution via the CSF and the greater the likelihood of central side effects. (Moulin, 1984).

Complications associated with the technique of spinal injection itself include spinal headache, epidural hematoma, epidural abscess and direct trauma to nerve roots or the spinal cord. If the dura is accidentally punctured with an epidural needle (larger needle of 17 or 18 gauge), there is a 50 - 70% incidence of headache. (Bochenek).

Headache is thought to be due to persistent CSF leak. Usually, conservative treatment such as fluid and analgesia is sufficient, and the headache resolves itself within 24 to 48 hours. If conservative treatment is not sufficient, epidural blood patch is the most effective and reliable treatment available. (Buckley and Brodsky, 1987).

Rare complications

A hematoma may form in the epidural space after administration of an epidural narcotic. This is a rare complication and is almost always seen in association with clotting deficiencies. The patient may complain of back pain and/or neurological deficit (i.e. leg weakness). Symptoms may appear within hours to several days after insertion. The symptoms are related to spinal cord compression. Surgical decompression of the cord must be performed as soon as possible otherwise, permanent loss of motor function is likely.

Epidural abscess is also a rare complication. Infection may be related to faulty technique or it may occur in association with general systemic infection. Signs and symptoms include marked back pain, leg weakness, paresthesia and fever. Treatment includes immediate drainage of the abscess and aggressive antibiotic therapy. (Bochenek).

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As mentioned previously, spinal narcotics should be used in patients with coagulation disorders or local and/or systemic infection. Other complications such as direct trauma to nerve roots or spinal cord are very rare. Nonetheless, neurological symptoms following epidural or subarachnoid injection warrant careful assessment and prompt intervention. (Buckley and Brodsky, 1987).

Nursing implications

Management of the patient who has received spinal narcotics lies with effective monitoring, especially ventilation. It should be noted that respiratory rate alone is poor measurement of ventilatory adequacy and apneic episodes may occur with very little warning. Apneic monitors, pulse oximetry and end tidal capnography can be used to assist the nurse. The most dangerous time for respiratory depression is between the 6th and 12th hour after intraspinal administration. This is often the time when visitors may have left and the patient is thought to be safe left on his own resources with occasional nursing visits.

Nurses must also understand the importance of not administering parental narcotics or other sedatives in conjunction with spinal narcotics. This is because most life-threatening respiratory complications that have occurred involved combinations of spinal and parental narcotics. Standing Orders can be written to assist nursing staff in dealing with problems related to inadequate analgesic, pruritis, nausea, vomiting, and respiratory depression. (Buckley and Brodsky, 1987).

Because of concerns related to delayed respiratory depression, the majority of patients receiving spinal narcotics are cared for in the I.C.U. setting (i.e. thoracotomy, total cystectomy, bowel resection, etc). However, this superior form of analgesia is being utilized with increasing frequency in other areas outside of I.C.U. such as medical wards for terminally ill patients, or obstetrics for caesarian-section patients who have also received epidural anesthesia. It is imperative that nurses be well informed about spinal narcotics. Appropriate assessment skills and interventions can then be implemented when caring for the patient who has received spinal narcotics. ■

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About the author

Carol Markowsky, R.N., B.S.N., is head nurse, Post Anaesthetic Recovery, and Director of Central Supply, Kelowna General Hospital, Kelowna, B.C. She received her R.N. and B.S.N. from the University of Victoria, Victoria, B.C.

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