

Local Anesthesia for Cesarean Section

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Local infiltration anesthesia as a primary technique for cesarean section is very rarely used and is not even briefly mentioned in some modern textbooks. Most of our references come from the third world countries where there may be a single operator and a lack of anesthetic personnel, equipment, and supplies. It has been used as recently as 1996 in the United Kingdom (Leeds) and 1999 in India. Admittedly, there are but few indications for this technique in modern anesthetic practice. The indications, 3 techniques, and complications of this method of analgesia have been described. All anesthetic techniques used for cesarean section carry their own special hazards. This particular technique may be useful when general or regional anesthesia is contraindicated. Although there are limitations on the surgical technique — no packs, no retractors, gentleness on the part of the operator, and avoidance of sudden movement — the surgery has been performed successfully on several occasions.
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Spinal analgesia in obstetrics was first used by Kreiss, a German, in 1901. It was popularized in the United States by Pitkin in 1928. Gellhorn was the first to try local anesthetics for infiltration of the perineum in 1927. Hingson and Edwards were the first to use continuous caudal analgesia during labor in 1942.

Obstetric anesthesia has developed very rapidly, and the current high standards, with an increasing trend to cesarean section being performed under regional anesthesia, preclude this procedure being performed under local infiltration in developed countries. Local infiltration is often used to provide supplemental anesthesia in patients with inadequate epidural anesthesia,¹ but it rarely is used as a primary anesthetic technique. However, in high-risk patients, infiltration block may have a substantial role in anesthesia for cesarean section, especially in the third world countries where round-the-clock anesthesia personnel are not available.

Indications

The obstetrician may use this technique when skilled anesthesia care is not available immediately, especially when there is severe fetal distress. It may be the appropriate technique for the rare patient who is in extremis. It may also be used as the sole technique in patients with severe coagulopathy and a known

difficult airway. It has been used as a primary technique in severe respiratory compromise² and in morbid obesity.³ The postoperative morbidity is low in these cases when compared with general or regional anesthesia. In a compromised fetus, the pH levels were found to be more stable with local anesthesia than general anesthesia.⁴

Advantages

The main advantage is the loss of pain sensation in selected areas only, with minimal disturbances of all other systems of the body. There is no fetal or maternal depression (no danger of aspiration in the mother). There is no alteration of uterine contractility.

Disadvantages

Large amounts of local anesthetic agents need to be used (up to 100 mL in some cases). Because of the large volumes, the risk of local anesthetic toxicity is high. Success cannot be assured and is very operator dependent. Maternal discomfort and lack of cooperation may lead to difficulties. It is a time-consuming technique, especially if the surgeon is not well-versed with the local infiltration technique. An experienced surgeon who can perform gentle surgery without exteriorizing the uterus is required.⁵

Anatomy

The sensory innervation of the birth canal is now well known and is illustrated in Fig 1.⁶ The A delta and C afferent fibers from the body and cervix of the uterus pass through the paracervical tissues and travel upwards through the inferior, middle, and superior hypogastric plexuses to enter the lumbar and lower thoracic portions of the chain of sympathetic ganglia. Central connection to the spinal cord is by the white rami communicantes of T11, T12, and L1 nerves. The pain of uterine contractions is referred to the areas of skin supplied by these nerves in the lower abdomen, loins, and lumbosacral region. The vagina and perineum have an entirely separate sensory nerve supply, principally from the pudendal nerves (S2, 3, and 4), with a minor contribution from the ilioinguinal, genitofemoral, and posterior femoral cutaneous nerves and the cutaneous branches of S2, 3, and 4 nerves.

Technique

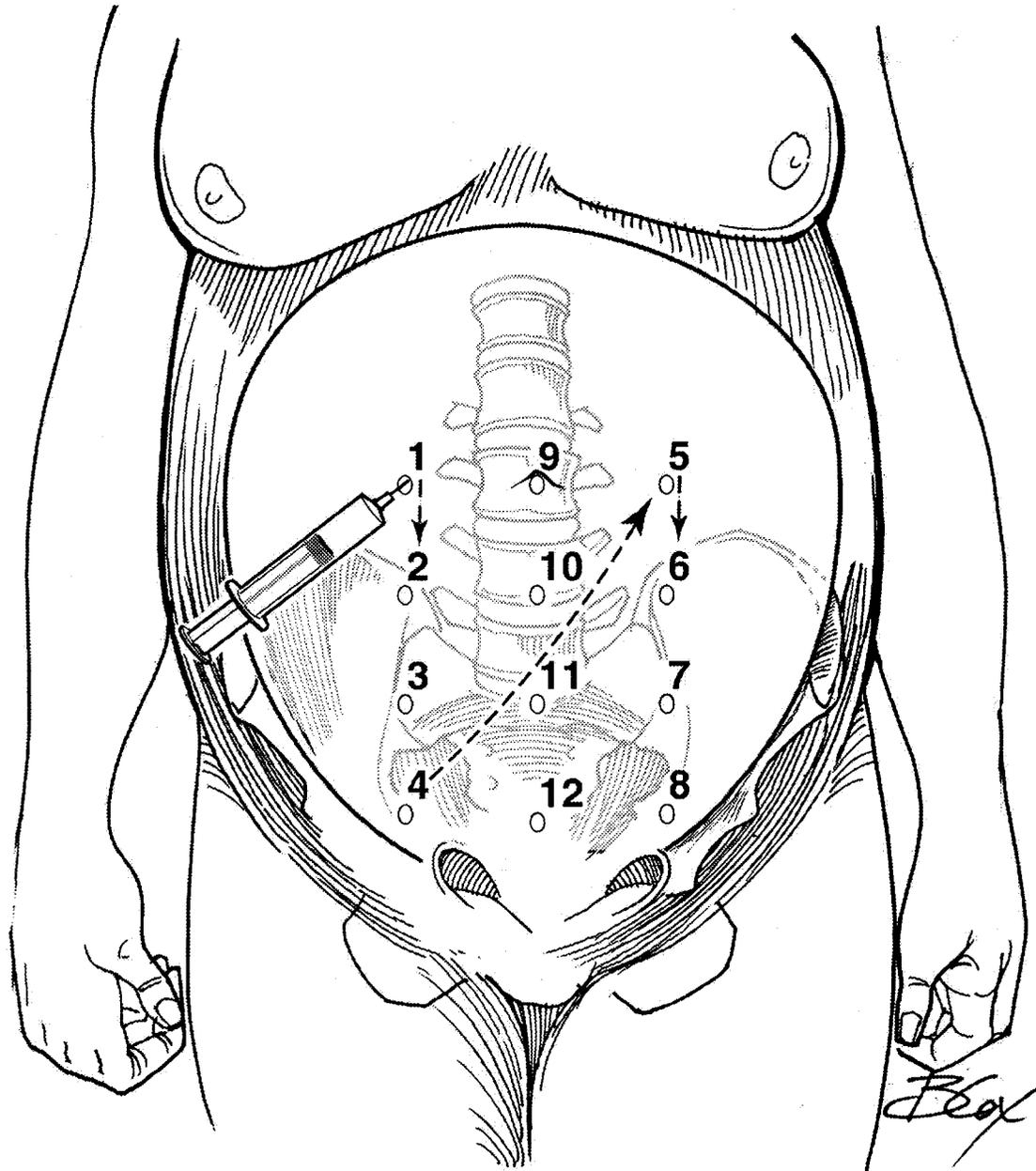
It is possible to perform the entire procedure with local infiltration, provided the obstetrician makes a midline abdominal incision, makes minimal use of retractors, and does not exteriorize the uterus. Alternatively, the obstetrician might begin surgery and deliver the infant with the aid of local infiltration.

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Fig 2. Injection technique for the abdominal wall with a local field block as described by Ranney and Stanage.⁷



Temporary hemostasis may be achieved until the anesthesiologist arrives, and surgery may then be completed after the induction of general anesthesia.

Preparation for Local Anesthetic

General rules to be followed before any local infiltration technique are as follows:

1. Avoid the supine position. Left lateral tilt must be arranged.⁶
2. Oxygen via face mask must be given.
3. Large bore intravenous catheter must be inserted.
4. Prophylaxis for acid reflux must be taken by giving ranitidine 1 hour and sodium citrate 15 minutes before surgery.
5. One person at the head end (either a nurse or anesthesiologist) explains the procedure and reassures the patient.
6. Pediatric personnel must be available to care for the newborn, especially if it is a compromised fetus.
7. Resuscitative drugs and equipment must be available for both the mother and the newborn baby.

There are several ways of performing analgesia for cesar-

ean section with the local anesthetic agent. Local field block of the lower abdominal wall was popularized by Ranney and Stanage⁷ in the 1970s. Another method, the Arrowhead field block, was used by Trent Busby⁸ in the 1960s. In this technique, the T10 to T12 dermatome are blocked bilaterally in the midaxillary line with blocks of the ilioinguinal and genitofemoral nerves as they emerge from the inguinal ring. Lidocaine at 0.5% with 1:200,000 epinephrine would be the sensible choice with a maximum limit of 100 mL. We must remember that these nerve blocks are notoriously difficult to perform in pregnant women, and there is also the increased risk of peritoneal puncture and injury to viscera. It is safer to inject layer by layer. The method described by Bonica,⁵ and detailed in the following section, seems to be a safer technique from this point of view.

Abdominal Field Block

Twenty-five-gauge, 1.5-inch needles attached to 10-mL syringes are used. By intracutaneous injection, a small skin wheal is raised at a point 4 cm lateral to the umbilicus (Fig 2). The infiltration continues as shown in the diagram from above

Fig 1. Sensory innervation of the birth canal.

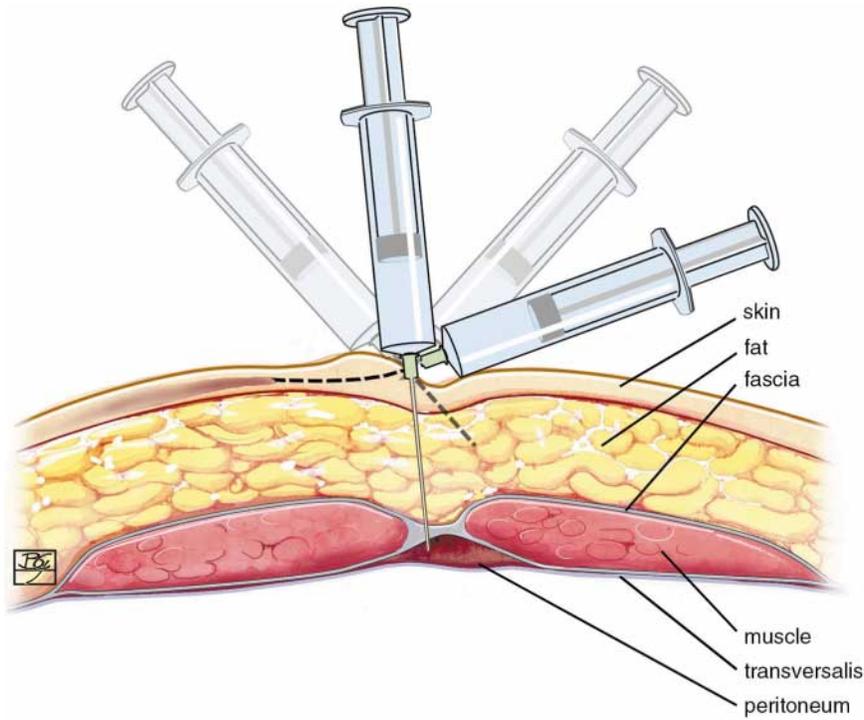
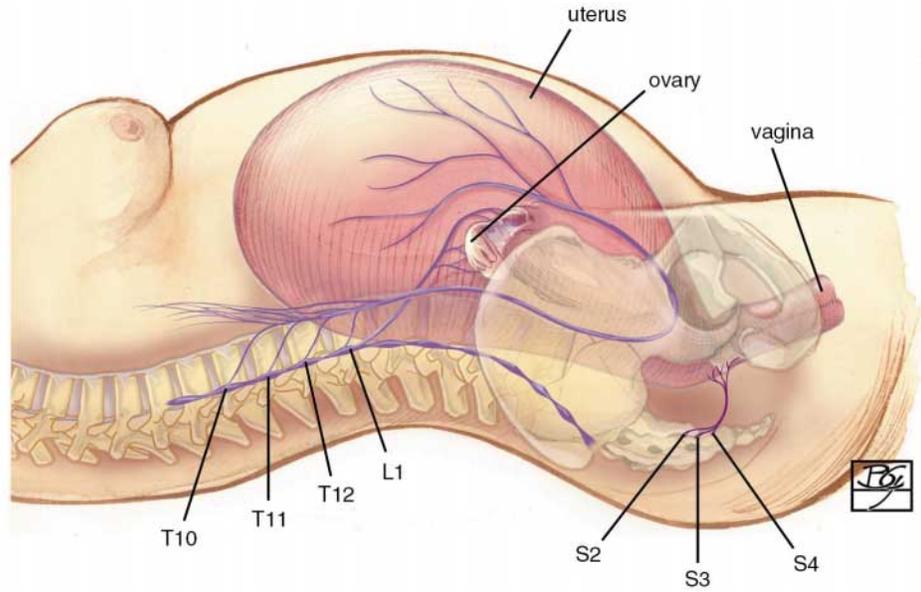
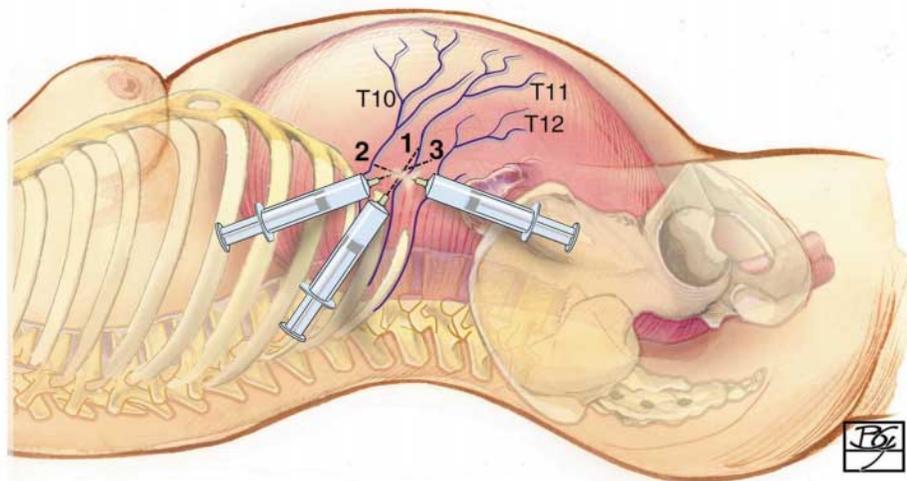


Fig 3. Layers of infiltration of the skin. Local anesthetic is infiltrated into all layers excluding fat. Data from Ranney and Stanga.⁷

Fig 4. Busby's arrow-head field block showing blockade of the 10th, 11th, and 12th intercostal nerves.



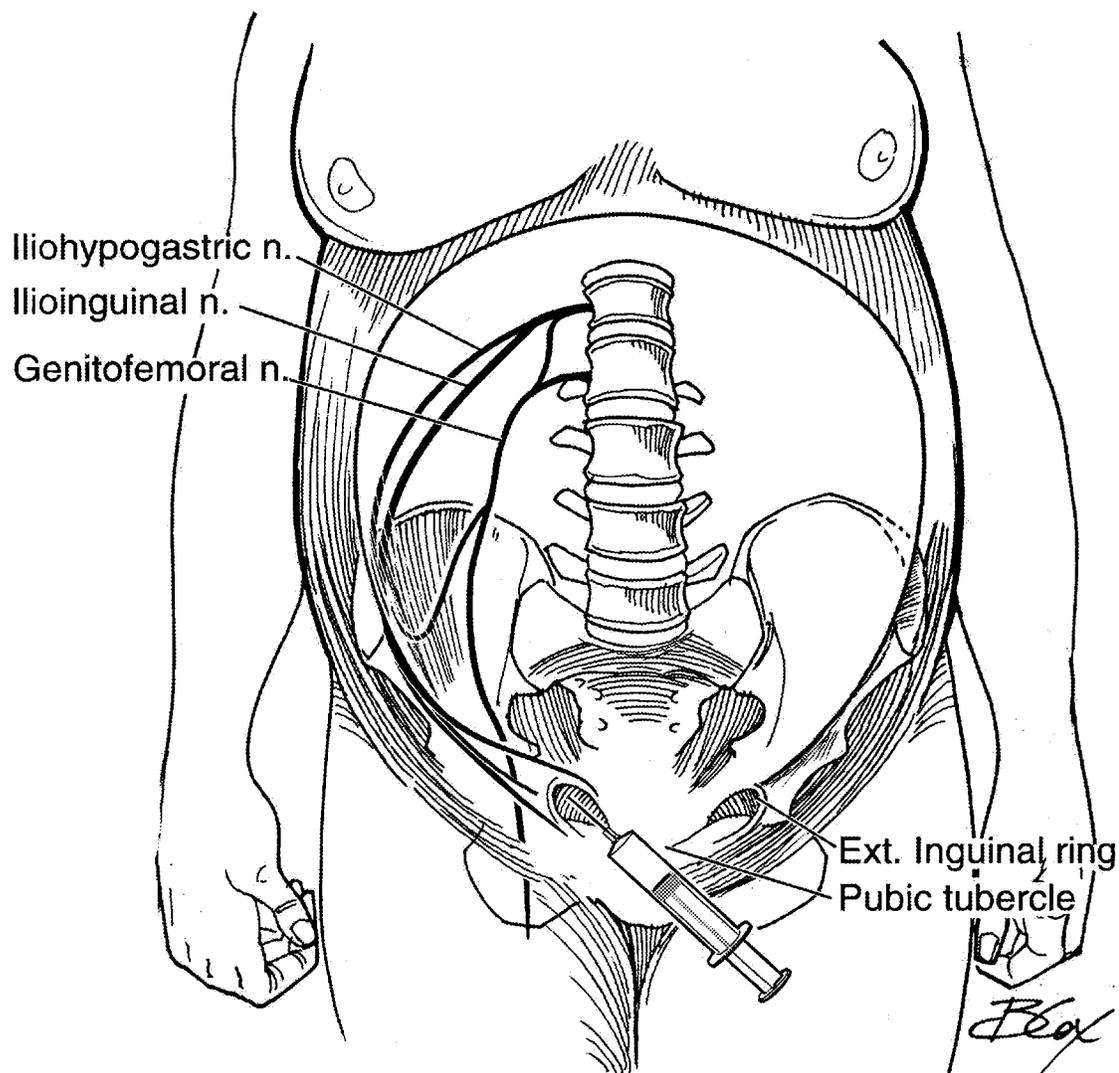


Fig 5. Inguinal block showing the anatomy and relevant nerves blocked by this technique. Data from Busby.⁸

downwards to the pubic area, infiltrating 12 different spots. Wherever possible, a fan-shaped infiltration is performed. The fatty layer is avoided, and local infiltration is carried out deep to the fascia (Fig 3). The mons pubis is richly supplied with nerves and requires special care. Then the rectus fascia, the transversalis, and peritoneum are infiltrated. After the peritoneal incision, local anesthetic is infiltrated under the peritoneum. The operator must constantly plan ahead and be gentle with tissue separation. One percent procaine was used by Ranney and Stanage, but 0.5% lidocaine with 1:200,000 epinephrine would be the appropriate choice now.

Arrowhead Field Block

Once the abdomen is cleaned and draped, the arrowhead field block is made as shown in Fig 4. First a point midway between the costal margin and the iliac crest in the midaxillary line is identified. A 22- or 25-gauge, 2-inch needle is thrust through the skin at this point, first at a right angle to the body axis, and then horizontally. As the needle is inserted, the resistance of the fascia of the oblique abdominal muscles and the transversus abdominis are met in turn, and the injection is carried down to the transversalis fascia. Approximately 5 to 8 mL of solution is injected in this area. This anesthetizes the 11th intercostal nerve. The needle is

then withdrawn almost to the skin and directed cephalad at a 45° angle and, with the same continuous injection, as the needle is inserted, the various layers down to the transversalis fascia are infiltrated. This anesthetizes the 10th intercostal nerve. The third injection is made by directing the needle 45° caudad and injecting as mentioned previously. This anesthetizes the 12th intercostal nerve. The area over the mons pubis is very sensitive because of its multiple innervation. However, this area can be effectively anesthetized by infiltrating the ilioinguinal and genitofemoral nerves as they emerge from the inguinal ring. Palpate the pubic tubercle and inject at a 45° angle laterally, for about 2 to 3 cm, and from this point down to the external oblique fascia (Fig 5). The opposite side is likewise injected. At this point additional drapes are applied, leaving only the line of incision exposed. Then a "pigskin" wheal is raised along the line of the proposed incision. One of the most common errors made by the novice in local anesthesia is to inject large volumes of solution into the fatty layers. This area is relatively devoid of nerve supply, and it is best to ignore the fat layer in making the local infiltration.

The patient is now ready for surgery. The addition of epinephrine to the anesthetic mixture results in local vasoconstriction and decreases bleeding, tissue trauma, and the duration of

surgery. Operations under local anesthesia require a gentle, precise operative technique, but, after all, this is a criterion for good surgical technique under any anesthetic.

Once the peritoneum has been entered, about 10 mL of the anesthetic solution is poured into the peritoneal cavity. The patient may experience some discomfort just as the baby is delivered, but this is of very short duration and is usually not severe. In some cases, after the baby is delivered, an intravenous sedative or hypnotic is given.

Bonica's Method

Local infiltration is performed in sequential steps as the operation progresses (Table 1). Time must be allowed for the local anesthetic to penetrate and exert its effect before proceeding to the next step. The administration of 0.5% lidocaine with 1:200,000 epinephrine is recommended (Table 2). The use of a more concentrated solution is likely to result in systemic toxicity.

Bonica⁵ described the following 6 steps for local infiltration: (1) intracutaneous, (2) subcutaneous, (3) intrarectus, (4) parietal peritoneal, (5) visceral peritoneal, and (6) paracervical. A 25-gauge spinal needle is used to make the intracutaneous injection; the needle is inserted just below the umbilicus and is directed in the midline toward the symphysis pubis.⁹⁻¹¹ Approximately 10 mL of local anesthetic is required to create a skin wheal that extends from the symphysis pubis to the umbilicus. The subcutaneous injection also is performed for the full length of the planned incision. Approximately 10 to 20 mL of local anesthetic is injected subcutaneously. Ideally, the obstetrician should then wait approximately 3 to 4 minutes before making the skin incision. Then steps 5 through 11 are followed from Table 1.

It also is necessary to infiltrate generously in the suprapubic area to ensure blockade of the branches of the iliohypogastric nerve. The disadvantages⁵ of this method of rectus block include the following:

1. It requires a large volume (40 to 100 mL) of local anesthetic solution.
2. Patient discomfort.
3. Potential for systemic toxicity, given that approximately 100 mL of local anesthetic solution is required. This is problematic because a skilled anesthesia care provider may not be present to assist with resuscitation of the mother.
4. Time is required for maximal anesthesia to develop. This time may be sacrificed when fetal distress is the indication

TABLE 1. Local Infiltration Anesthesia for Cesarean Section: Eleven Steps as Described by Bonica

1. Professional support person with patient
2. Infiltration with lidocaine 0.5% (total dose should not exceed 500 mg)
3. Intracutaneous injection in the midline from the umbilicus to the symphysis pubis
4. Subcutaneous injection
5. Incision down to rectus fascia
6. Rectus fascia blockade
7. Parietal peritoneal infiltration and incision
8. Visceral peritoneal infiltration and incision
9. Paracervical injection
10. Uterine incision and delivery
11. Administration of general anesthesia for uterine repair and closure if needed

TABLE 2. Recommended Maximum Dosages for Local Anesthetic Agents

Agent Used	Epinephrine	Percentage	Maximum Dose*†
Prilocaine	Without	0.5	80 mL (400 mg)
Prilocaine	With	0.5	120 mL (600 mg)
Mepivacaine	Without	0.5	40 mL (200 mg)
Mepivacaine	With	0.5	80 mL (400 mg)
Lidocaine‡	Without	0.5	40 mL (200 mg)
Lidocaine	With	0.5	100 mL (500 mg)

*Doses should be halved when the 1% solution is used.

†Epinephrine must be used in a dilution of 1:200,000 or greater. Side effects may include pallor, sweating, tachycardia, hypertension, and ventricular arrhythmias including ventricular fibrillation. Advantages of using a vasoconstrictor include prolongation of local anesthetic effect, decreased speed of absorption, and decreased systemic absorption and toxicity.

‡Lidocaine is recommended because of its rapid onset (10 to 20 minutes) and least effect on neonatal neurobehavioral reflexes.

for cesarean section, but the mother likely will suffer greater discomfort if they proceed on too soon before the block is established.

5. Local infiltration does not provide satisfactory surgical conditions if the obstetrician encounters a complication of surgery (eg, uterine atony, uterine laceration, broad ligament hematoma).

Supplements

Several agents have been used as supplements. Among these are atropine, glycopyrrolate, metoclopramide, benzodiazepines (especially valium),¹² perphenazine, promazine, dimenhydrinate, papaveratrum, meperidine, fentanyl, entonox (50:50 of oxygen and nitrous oxide), and ketamine, to name a few. Droperidol and pethilorfan^{1,13} have been used in the neurolept anesthetic technique. General anesthesia after the delivery of the baby was also conducted, provided the anesthesiologist was available and there were no contraindications to a general anesthetic.

Conclusion

Although clinical situations in which local infiltration for cesarean section as a primary technique are rare in modern anesthetic practice, there may be the unusual occasion in which both general and regional anesthesia are contraindicated or undesirable. In these unfortunate situations, it is certainly useful to be aware of this alternative method of pain relief. The author has had the opportunity of getting involved in 2 such deliveries in the Middle East in which the surgeon had started surgery under local infiltration and delivered babies with Apgar scores of 9 in the first minute! General anesthesia was administered after the delivery of the babies.

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