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Pain Control After Cesarean Birth – What are the Options?

Nambiath Sujata*, and Vijay Mohan Hanjoora

Department of Anesthesia and Pain Management, Max Super Speciality Hospital, India

Corresponding author: Dr. Nambiath Sujata, Department of Anesthesia and Pain Management, Max Super Speciality Hospital, Saket, New Delhi 110017, India, Tel: 9999109402; E-mail: drnambiath@yahoo.com

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Abstract

Cesarean sections are being performed more frequently nowadays. In most cases, it is also the first visit to the operating room for the woman, with its associated anxieties and apprehensions. The young age and female gender, in addition, make them more vulnerable to pain. Also, new mothers cannot afford the luxury of prolonged convalescence. They are expected to actively take care of the new born. Because pregnancy is a risk factor for thromboembolic phenomena, early mobilization after delivery is recommended. Good pain relief is required for this. All of these have contributed to the search for newer and more effective methods of pain control after cesarean birth.

The conventional methods of analgesia have centered on the use of opioids given via diverse routes like systemic and neuraxial. Patient-controlled analgesia with elastomeric pumps has made this more acceptable and satisfying to the patients. However, opioids have some unwanted effects like pruritus and respiratory depression. In addition, secretion into breast milk is a unique concern in this population. Drugs like Non-Steroidal Anti Inflammatory Drugs (NSAID) and paracetamol can only supplement other modes of analgesia and are not sufficient on their own. Neuraxial methods, though effective and safe, need to be performed by an experienced person and require a higher level of monitoring. Regional field blocks like Transversus Abdominis Plane (TAP) block and iliohypogastric-ilioinguinal nerve blocks are gaining in popularity, especially after the advent of ultrasound in anesthesia. Wound infiltration catheters are also in vogue.

Introduction

The rate of cesarean deliveries is on the rise. Data from the United States show an increase in rate from 21% in 1996 to 32% in 2011 [1]. According to WHO reports, the rate has risen to 46% in China and 25% and above in many Asian, European and Latin American countries [2]. Many deliveries are carried out in units with fewer infrastructures. This makes it more challenging to provide good pain control for these patients.

There is a lot of inter-individual variation in pain threshold, and the way pain is experienced is a reflection of the individual's emotional, motivational, cognitive, social, and cultural circumstances. Inadequately controlled pain in the postoperative period can lead to the development of chronic pain. According to a survey by Nikolajsen et al. [3] six months after cesarean delivery, 12.3% of patients experience pain that is severe enough to affect infant care and the incidence of persistent daily pain one year after cesarean section was 6%. Chronic pain can lead to postpartum depression [4].

An ideal method of pain relief after cesarean section should be cost effective, safe for the mother, require minimal monitoring and use drugs that are not secreted into breast milk. Moreover, the mother should not be sedated or hampered by equipment that prevents her from moving freely and caring for the newborn. Minor side effects, acceptable in the general population, like nausea and vomiting, pruritus and shivering may interfere with care of the new born, leading to less maternal satisfaction. Drug availability, maternal health conditions, patient preferences and availability of medical expertise and trained support staff also play a role in choice of analgesic method.

Opioids

Opioids are the most popular class of drugs used for post-cesarean analgesia. They are most useful in treatment of somatic pain. Use of morphine, diamorphine, fentanyl, sufentanil, meperidine, nalbuphine and buprenorphine is well documented. The various opiods differ in their potency and severity of side effects. A discussion of the merits and de-merits of each is beyond the scope of this article. The common minor side effects include nausea, vomiting, pruritus, shivering and urinary retention. Respiratory depression, especially late-onset, is a more dreaded complication.

Routes of opiod administration

Central neuraxial – intrathecal / epidural

Intrathecal opiods exert analgesic action by acting on the μ-receptors of the spinal cord. The onset and duration of action are dependent on lipid solubility. Lipid soluble opiods like fentanyl and sufentanil diffuse more from the cerebrospinal fluid into the neural tissue. This translates to faster onset and shorter duration of action when compared to less lipid soluble opiods like morphine, diamorphine and buprenorphine. However, sufentanil has a longer duration of action than fentanyl due to its higher μ-receptors affinity. Very small amounts of opiods are required via the central neuraxial route as compared to the larger doses required systemically. Hence secretion into breast milk is not a cause for concern [5].

Intrathecal morphine is the gold standard for post-cesarean analgesia. Palmer et al. [6] found a ceiling analgesic effect with intrathecal doses of morphine above 75 μg. Higher doses increased the

severity of pruritus, while other common opioid-related side effects, such as nausea and vomiting, did not have any dose-dependent relationship. They suggest an intrathecal dose of 0.1 mg of morphine for post-cesarean analgesia. A meta-analysis of intrathecal opioid studies revealed that intrathecal morphine (0.1-0.2 mg) provided optimal analgesia with a median time to first request for supplemental analgesia of 27 hours (range 11-29 hours), in addition to reducing pain scores and the amount of supplemental analgesics needed for 24 hours postoperatively [7]. The low lipid solubility of morphine leads to more rostral spread in the cerebrospinal fluid and slow penetration in the brainstem. So these patients should always be monitored for late-onset respiratory depression [8].

Diamoprhine, a semi-synthetic prodrug of morphine, is more potent with a higher lipid solubility. Hence the drug has a faster onset of action. In the neural tissues it is converted to morphine, which increases its duration of action. The optimum dose of diamorphine is 250 and 375 μg. Itching and vomiting are the common side effects, especially at higher doses [9].

Due to its fast onset of action, intrathecal fentanyl (20 to 30 mcg) and sufentanil (2.5 to 5 mcg) provide excellent intraoperative analgesia, but doesn't provide analgesia for the post-operative period [10]. There is no risk of delayed respiratory depression because of lack of rostral spread. The combination of fentanyl and morphine given intrathecally combines the quick onset of the former with the longer duration of action of the latter, making it a good adjuvant for local anesthetics in women receiving spinal anesthesia for cesarean section.

Meperidine [11] has intermediate lipid solubility with significant local anesthetic properties. This can cause motor blockade in the postoperative period. At an intrathecal dose of 10 mg, the duration of effective analgesia in the postoperative period is only 4 hours. Also, the incidence of nausea and vomiting is more than with fentanyl and sufentanil. Hence this drug is not popular anymore.

Buprenorphine at an intrathecal dose of 50 to 150 μg provides inferior pain relief to morphine, and hence is not preferred.

The mechanism of action of epidural opioids is via both spinal and supraspinal (systemic delivery) sites of action. The epidural space contains an extensive venous plexus which is engorged in pregnancy. Therefore, the intravascular reabsorption of opioids following epidural administration is extensive. Though the epidural doses of opiods are higher than that given intrathecally, they are, nevertheless, safe in breastfeeding [12].

Data from a dose-response study by Palmer et al. [13] data indicate that the degree and duration of analgesia of epidural morphine increase in a dose-related manner from 0 to 3.75 mg. A single bolus dose provides good analgesia for the first 24 hours. An extended release formulation EREM (extended release epidural morphine) is also available.

Shorter acting opioids like fentanyl (2 mcg/ml) and sufentanil (0.8 mcg/ml) are used in nurse-controlled or Patient Controlled Epidural Analgesia (PCEA) techniques in combination with low-dose local anesthetic agents.

Systemic opioids

Systemic opiods are the mainstay of pain relief after a cesarean section done under general anesthesia. Patient-controlled intravenous opioids (IV- PCA) lead to low fluctuations in plasma opioid levels and higher maternal satisfaction. However, the quality of analgesia is inferior to the PCEA method. Morphine, fentanyl and remifentanil have been used through an IV-PCA in obstetrics [14]. Though remifentanil crosses the placenta, it has not been shown to cause adverse effects in the neonate [15].

Intramuscular and subcutaneous opioids are affordable, easy to administer and associated with less side effects. The disadvantages are the requirement for repeated and painful injections, variable systemic absorption, delayed onset of action and fluctuating plasma levels of the drug.

The advantages of the oral route are ease of administration, low cost, high maternal acceptance and fewer opioid-related adverse effects as compared with the intravenous or neuraxial route. Constipation is a unique side effect of this route, and can be of increased concern in the post-surgical patients. Oral oxycodone in doses ≤ 90 mg in a 24 h period poses minimal risks to the neonate [16]. Oral morphine provides satisfactory analgesia, but randomized trials are lacking.

Tramadol is a weak μ-opioid receptor agonist, induces a serotonin release, and inhibits the reuptake of norepinephrine. It is given intravenously, intramuscularly and orally. It can be used in combination in diclofenac or paracetamol for moderate pain relief in the post-operative period [17].

Non-opiod analgesics

Paracetamol, a cyclo-oxygenase inhibitor, has almost no side effects and hence is routinely used as part of a multimodal plan for post-operative analgesia. Typical doses are 1g every 6 hours. However, peripartum women have a faster clearance of paracetamol with a larger distribution volume. Hence higher doses may have to be given in this population.

NSAIDs like ketorolac [18] and diclofenac (intravenous and rectal) [19] improve the quality of analgesia provided by opioids and reduce its consumption. It is very effective in treating the visceral component of post-cesarean section pain, complementing the somatic wound pain relief from the opioid. NSAIDs are safe in breast-feeding too. Bleeding, platelet dysfunction and renal damage are the major side effects. They act by inhibiting the cyclooxygenase enzyme, and hence prevent prostaglandin synthesis too. This may lead to uterine atony [20]. The drug is contraindicated in postpartum bleeding, asthma, acid peptic disease renal insufficiency.

Selective COX2-inhibitors like celecoxib [21] and parecoxib [22] have similar analgesic efficacy as diclofenac with less side effects.

Administration of intravenous ketamine prior to general anesthesia has not been shown to reduce postoperative opioid consumption [23]. Gabapentin, though having sedative properties, has been shown to be useful [24]; but further studies are required to evaluate its safety in breastfeeding.

Techniques Using Local Anesthetics

Epidural Infusion

An epidural catheter with an infusion of local anesthetics is an effective method of pain relief in the postoperative period. Bupivacaine (both enantiomers) 0.1 to 0.125% and ropivacaine 0.1 to 0.2% are equally effective. Use of dilute solutions of local anesthetics cause minimal motor blockade. Sympathetic blockade leads to vasodilation and decreases the chance of deep vein thrombosis.

The analgesic effect can be further augmented by the addition of adjuncts, the most popular being fentanyl (2 mcg/ml) and clonidine (1 to 1.5 mcg/ml). Clonidine, a centrally-acting alpha agonist, reduces opioid consumption and decrease shivering. Its side effects are hypotension, sedation, bradycardia and prolonged motor blockade [25].

Patient Controlled Epidural Analgesia (PCEA), with or without a background infusion, is safer with less drug consumption and increased patient satisfaction. With the advent of elastomeric pumps, patient mobility is also not affected. However, these pumps are expensive and require professionals for its programming.

Abdominal field blocks

These blocks provide analgesia for the abdominal wall, but not for the visceral contents and are ideally used as part of a multimodal approach to analgesia. Good postoperative analgesia and a decrease in morphine requirements for up to 48 h after operation have been demonstrated. These techniques have the advantage of lower invasiveness as compared with neuraxial blocks, and are suitable for patients undergoing general anesthesia too.

Transversus abdominis plane (tap) block

The TAP block involves injection of local anaesthetic into the TAP, an anatomical space between the internal oblique and transversus abdominis muscles. The nerves supplying the skin, muscles and pariental peritoneum of the anterior abdominal wall are derived from the T6 to L1 roots and pass through this plane.

Ultrasound guided TAP block is a basic skill level block. The patient is placed supine, abdomen exposed between costal margin and illiac crest. A linear, high frequency (6 to 13 MHz) transducer is placed in a transverse plane, above the iliac crest, in the anterior axillary line. A 80-120 mm short bevelled (spinal/tuohy) needle is inserted in-plane with the transducer, in an antero-posterior direction. The local anesthetic is placed deep to the fascial layer between the IO and TA (facilitated by hydro-dissection). 20 -30 ml of local anesthetic (Bupi 0.25% or Ropi 0.2%) is injected into this plane (B/L). Over several hours, the LA spreads and anaesthetises multiple nerves. A single-shot TAP technique can produce effective analgesia for up to 2 days [26]. This prolonged duration of analgesia is due to the relatively poor vascularization of the tranverse abdominis plane.

Iliohypogastric ilioinguinal nerve block

The Pfannensteil incision lies within the L1 dermatome, which is supplied by the iliohypogastric and ilioinguinal nerves. These nerves run in the plane between the internal oblique and transversus abdominis close, to the anterior superior iliac spine. Blocking the nerves at this site has been shown to lower analgesic requirements [27]. The ultrasound probe is placed obliquely on a line joining the ASIS and the umbilicus. The nerves appear dark with a white horizon and white spots inside in fascia between the IO and TA. 10 – 15 ml of local anesthetic is injected in this plane.

Wound Infiltration Techniques

Local anesthetic injections into the surgical wound directly block the transmission of impulses from the wound site. Drug deposition under the fascia is reported to be more effective than surface instillation. Wound infiltration catheters placed under the fascia with either continuous or intermittent boluses of local anesthetic has been shown to provide effective postoperative analgesia [28].

Conclusion

Optimal pain control after a cesarean birth is essential for early mobilization and care of the new born. Providing good analgesia to this subset of the population is more challenging because of the altered physiology and possible transmission of the pharmacological agent into the breast milk. Although the choices of drugs and routes of administration are many, we have yet to reach the ideal standards of a VAS score of <3 in more than 90% of women, as set by the Royal College of Anesthetists.

Intrathecal morphine, supplemented by paracetamol and NSAIDs, remain the gold standard. Abdominal field blocks like the TAP block is a good alternative in patients receiving general anesthesia for cesarean section.

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