ISSN 2466-488X (Online) doi: 10.5937/sjait2408147G

Review article

EPIDURAL LABOUR ANALGESIA – A REVIEW
(LABOUR EPIDURAL)

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Summary

Labour pain is one of the most severe pains with significant physiological and psychological consequences. Timely labour analgesia has considerable foeto-maternal benefits. There are many pharmacological and non-pharmacological techniques for ensuring labour analgesia. In the group of pharmacological methods for pain relief, neuraxial techniques have become more popular than non-neuraxial. Among the different regional techniques for labour analgesia, continuous labour epidural remains the "gold standard". Combination of ultra-low concentration local anaesthetic and low dose of lipophilic opioid has emerged as the "ideal" prescription for neuraxial labour analgesia. Continuous epidural infusion technique with a background programmed intermittent epidural bolus in addition to patient controlled epidural analgesia to manage breakthrough pain ensures effective labour analgesia with minimal side effects to mother and foetus. Even though refinements of the technique and newer advances have resulted in better outcomes, there are many persisting myths and controversies surrounding labour epidural technique.

Keywords: *painless labour; neuraxial analgesia; epidural analgesia; continuous epidural; local anaesthetic; opioid*

Introduction

Labour pain is probably the most severe pain a woman would experience during the lifetime. On pain rating index scores, labour pain is more severe than pain from a fracture or even some of the cancer pains.[1] Primiparas experience greater pain than multiparas. When different ethnic groups were compared, Asian women experienced less pain in labour.[2] American Society of Anaesthesiologists (ASA) and American College of Obstetricians and Gynaecologists (ACOG) have issued advisory on pain relief, which reads, "In the absence of medical contraindication, maternal request is a sufficient indication for pain relief during labour. Pain management should be provided whenever medically indicated".[3] This should be guided by patient preference and advice of an obstetrician. Although there are various non-pharmacological and pharmacological options available for labour analgesia, epidural labour analgesia ranks the highest. This review article focuses on different aspects of epidural labour analgesia.

Methods

A literature search without any language restriction was done (Medline, Embase, Cochrane Central Register of Controlled Trials). Search terms were "labour pain", "labour analgesia", "obstetrical analgesia", "neuraxial analgesia", "epidural", and "combined spinal-epidural". Randomised Controlled Trials (RCTs), meta-analysis and reviews were included, and relevant articles were obtained and reviewed to obtain additional information.

1. Stages of labour and pain transmission

First stage of labour is divided into two phases, latent phase and active phase and intense pain is often experienced during the active phase. The onset of active phase has been shown to correspond to six centimetres cervical dilation for both

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multiparous and nulliparous women.[4] First stage pain results from stretch of lower uterine segment and cervix, and the pain pathways enter the spinal cord through T10 to L1 spinal segments.

Second stage pain results from a distension of pelvic structures, vagina and perineum. It is carried through pudendal nerve, sacral segments S2 to S4 segments and via T12 to L1 segments. There is a significant overlap between the two stages with regards to pain. Visceral pain predominates during early part of first stage, while somatic pain is felt mainly during the late first stage. Both, visceral and somatic pain occurs during the second stage. While visceral pain, poorly localised and dull in character, is transmitted by small unmyelinated C fibres, somatic pain, sharp and localised in nature, is transmitted by myelinated A delta fibres.

2. Effect of labour pain on mother and foetus

Labour pain is disconcerting to the mother and activates the sympathetic system, causing catecholamine release and uterine artery vasoconstriction. Maternal hyperventilation, a response to pain, and consequent hypocapnia does the same. Hypocapnia, in addition, shifts the maternal oxygen dissociation curve to the left, thereby causing compromised foetal oxygenation, leading to foetal hypoxemia and foetal acidosis.

Labour pain can lead to persistent postpartum pain (pelvis, perineum and abdomen) based on the mode of delivery. A retrospective study showed that 6.1% of women who had gone through the labour had significant persistent pain, at 2.3 years postpartum.[5] Caesarean delivery was less frequently associated with persistent pain in comparison with spontaneous vaginal delivery. On the contrary a prospective cohort study on persistent pain after delivery by Kainu et al showed that incidence of persistent postpartum pain one year later, was ~~is~~ greater following caesarean delivery in comparison with vaginal delivery and that pain experienced shortly after caesarean or vaginal delivery correlated with persistent pain.[6] Improving peripartum analgesia could potentially reduce the incidence of persistent postpartum pain.[7] By attenuating acute pain and the sympathetic response to pain, labour analgesia offer benefits for both the mother and the foetus. Persistent postpartum pain may be associated with depressive symptoms. Neuraxial labour analgesia has been shown to reduce the risk of maternal depression postpartum at two years after childbirth.[8]

3. History of labour analgesia

Modern era of analgesia for childbirth began in early 1847, when Dr J Y Simpson, a Scottish obstetrician administered ether to a woman in labour and later in the same year, administered chloroform for labour analgesia in another woman. Pain relief for childbirth was considered to be against religious belief and had strong opponents in the western world. Dr John Snow administered chloroform to Queen Victoria for the birth of her eighth child, Prince Leopold in 1853 and later for the birth of her daughter, Princess Beatrice. This important milestone popularised labour analgesia. A German obstetrician Stoeckel, used caudal epidural for labour with almost 50% success rate in 1909.[9] Thirty-three years later, Hingson and Edwards, started using continuous caudal epidural analgesia technique. Flowers in 1949 popularised continuous lumbar epidural for labour pain. Gambling et al, in 1988, introduced patient controlled epidural analgesia for labour pain.[10] B M Morgan described combined spinal epidural technique for labour analgesia in 1993.

4. What represents ideal labour analgesia?

An ideal analgesic technique for labour pain should be optimal, both from the maternal and foetal perspective. It should provide adequate analgesia, reduce maternal anxiety and fatigue and preserve contractility. The onset and offset should match the uterine contractions. Maternal motor block must be absent. It should maintain uterine blood flow and drug crossing through the placental barrier should be as low as possible.-Moreover, surgical anaesthesia should be facilitated as and when required.

5. Analgesic options for labour analgesia (Table 1)

Currently, non-pharmacological and pharmacological options are available for labour analgesia (Table 1). Whatever the chosen analgesia modality is, it is important that an informed discussion take place between parturient and healthcare provider about the risks, benefits and the alternatives available and written informed consent obtained.[11] Analgesic benefit measured by pain intensity score

Table 1: *Analgesic options for labour analgesia*

Type of options	Details of options / drugs used
Nonpharmacological	Massage technique Bradley method Lamaze breathing technique Le Boyer technique Hydrotherapy Aromatherapy Transcutaneous Electrical Nerve Stimulation
Pharmacological	**Non Regional** Opioids- Pethidine, Morphine, Fentanyl, Remifentanil (PCA) Inhalational agents- Entonox, Sevox **Regional** Central neuraxial techniques – Continuous epidural, Combined Spinal Epidural

PCA- Patient Controlled Analgesia

is not the only outcome that matters in a complex event such as childbirth process. In addition to quality of pain relief, degree of maternal autonomy during labour and the emotional and psychological support rendered by healthcare staff are significant determinants of maternal satisfaction with birthing experience.[12] In settings with limited resources, where neuraxial analgesia or patient controlled analgesia (PCA) are not available options, labour analgesia might be provided using intermittent systemic opioids. Among the non-regional techniques, intravenous patient-controlled analgesia using Remifentanil and Sevox are relatively newer developments. Appropriate counselling regarding available options and honest discussion about what to expect are mandatory before administration of labour analgesia.

6. Newer non-regional labour analgesia techniques

a) Remifentanil iv patient controlled analgesia (PCA)- Remifentanil is an ultrashort acting highly potent opioid. It offers better analgesia compared to other opioids for labour pain and is fairly effective for pain relief during the first stage of labour, but not so during the second stage. Remifentanil offers better pain relief compared to other opioids but is less effective compared to neuraxial analgesia as shown in the meta-analysis by Weibel et al.[13] The conversion rate to epidural technique would be about ten percent. Maternal desaturation may occur in few cases, requiring supplemental oxygen by nasal prongs and continuous monitoring by pulse oximetry. Onset of action is about 1 minute and peak effect occurs in two minutes. No reports of neonatal depression have been made. Dose of Remifentanil patient-controlled analgesia is 40 μg bolus with a lockout interval of three minutes. If body weight less than 50 kg, bolus dose may be reduced to 20 μg. Remifentanil is not advisable if the gestational age is less than 36 weeks. A dedicated intravenous cannula for remifentanil is essential.

b) Sevoflurane (Sevox)® Patient controlled inhalational analgesia. It is a relatively new technique, a self-administration method using an optimal concentration of 0.8% sevoflurane in oxygen, which allows a margin of safety and balances risk of sedation with benefit of labour analgesia. Analgesic efficacy of Sevox was slightly better than Entonox in the first stage of labour.[14] Short onset and offset of action of Sevox makes it a useful choice in labour analgesia. Administration of Sevox requires a modified vaporiser such as DSI-2.[15] Main concerns include intense sedation, loss of maternal protective airway reflexes and environmental pollution.

7. Regional techniques

Regional techniques provide much better analgesia in labour in comparison to non-regional methods. Of the regional modes, central neuraxial techniques such as continuous epidural and combined spinal epidural techniques are more popular, but continuous epidural technique remains the "gold standard" for labour analgesia. This review

article will be focusing on continuous epidural labour analgesic technique and its details.

Epidural labour analgesia

Continuous lumbar epidural technique has become extremely popular over the last few decades. As evident in the data from large hospitals in US, almost 60% labouring mothers opted for this mode of pain relief.[16] Better drugs, newer techniques and advanced delivery systems have ensured safety and enhanced efficacy of labour epidurals. Epidural analgesia offers many foeto-maternal benefits. In cases of pre-eclampsia, it stabilises maternal blood pressure. It is of great importance to the labouring parturient with significant cardiorespiratory conditions (e.g. ischemic heart disease, congestive cardiac failure, pulmonary artery hypertension) and neurological comorbidities (e.g. myasthenia gravis).[17] Foetal benefits include improved uteroplacental flow, better Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores and less metabolic acidosis in neonates. In high-risk cases for general anaesthesia such as difficult airway and obese parturient, a working epidural sited well in advance is a safe option.

a) Procedure of establishing labour epidural analgesia

Informed consent should be obtained and availability of personnel, equipment and drugs must be ensured before commencement of the procedure. A good venous access is an essential prerequisite. Skin should be prepared using chlorhexidine 0.5% in 70% alcohol, which is the recommended disinfectant.[18] An alternative skin disinfectant is aqueous solution of 10% povidone iodine. Quicker onset, less skin reaction and better effect in the presence of organic matter such as blood or amniotic fluid, makes chlorhexidine a better choice in comparison with povidone iodine.[19] Ensure that no spillage of chlorhexidine in alcohol occurs into the epidural set.

Patient position

Epidural may be sited with patient in sitting or left lateral position. Sitting position may give better feel of midline but with a higher risk of vascular puncture due to venous distension. Left lateral position offers better patient comfort and probably, lesser chance of vasovagal syncope, but the distance between the skin and the epidural space may be longer.

Needle insertion

Insertion of Tuohy needle in paramedian position compared to median position, offers faster catheter insertion and easier and more reliable cephalad threading of catheter and less dependence on spine flexion. Median insertion of the needle is associated with more paraesthesia.[20] The level chosen is usually from L2/L3, L3/L4 or L4/L5.

Space identification

Epidural space identification is most often performed using the Dogliotti technique of loss of resistance to air or saline. Following reports of higher incidence of complications such as unintentional dural tap, pneumocephalus and headache using loss of resistance to air led to significantly frequent use of loss of resistance to saline in the 1980s and 1990s. A recent Cochrane review concluded that there was not much difference between the two techniques in terms of ease of insertion or reduction of complications.[21]

Siphon test- Prior to using epidural catheter in situ, when the catheter is held upright taut and gently raised, the falling fluid level or the *"meniscus sign"* in the epidural catheter may be a simple useful test to confirm the correct placement of the epidural catheter.[22] Absence of the falling meniscus sign does not rule out correct epidural placement though. Rising fluid column may suggest an intrathecal placement. If the test is negative for return of blood, intravascular placement of catheter tip may be ruled out.

Aspiration test- Aspiration of the catheter is mandatory prior to epidural activation. If blood is aspirated continuously, it is forbidden to continue the procedure with this catheter and it should be re-sited. Continuous aspiration of a clear fluid may be indicative of intrathecal placement of catheter tip. When loss of resistance to saline is employed, this may be a confounding factor. An observational study in obstetric patients in sitting position did not show improved diagnostic accuracy of aspiration for detecting intravascular placement of multi orifice epidural catheter.[23]

During epidural catheter insertion through Tuohy needle, if at any stage, the catheter must be pulled back through the needle, it is recommended to do so along with the needle, to avoid catheter breakage.

b) Test dose, to apply it or not?

Classically, a test dose is recommended in routine epidural anaesthesia to rule out inadvertent

intrathecal or intravascular placement of catheter tip.[24] Some novel recommendations suggest avoiding a test dose for epidural sited for labour analgesia as current practice entails use of combination of low concentration local anaesthetic and opioid. It may result in failed block at the worst, in comparison to the potentially fatal complication of test dose.[25]

A prospective randomised trial by Pratt et al using lignocaine 30 mg as test dose for labour epidural concluded that 30mg dose is quite effective at confirming inadvertent intrathecally placed epidural catheter.[26]

Among those anaesthesiologists who continue to administer test doses for labour epidural analgesia, varied practices and options exist. One option is to give 3 ml of 1.5% lignocaine as test dose. Another method is to administer a combination of 1.5 ml 2% lignocaine and fentanyl 25 μg. If the catheter tip is inadvertently placed intrathecally, this dose (30 mg) of lignocaine would cause weakness and inability to perform dorsiflexion and plantar flexion of both feet. If epidural catheter tip is inadvertently placed intravascularly, the 25 μg fentanyl would make the patient suddenly sleepy or slightly dizzy. Alternatively, an incremental bolus dose of 10 ml of 0.1% ropivacaine or 10 ml of 0.1% levobupivacaine along with fentanyl 2 μg/ml may be used as a test dose.[27]

The administration of the test dose using 2% lignocaine with adrenaline, which is strongly recommended for epidural anaesthesia for caesarean section, is ***not*** recommended for epidural labour analgesia.[28]

c) Drugs used for labour epidural

Low concentration of local anaesthetics in combination with the short acting lipophilic opioids, fentanyl or sufentanil is the most common drug regimen for epidural labour analgesia, as mentioned in table 2. Addition of opioid adjuvants facilitate use of low concentration of local anaesthetic, thereby ensuring adequate analgesia and preserving motor power in the lower limbs and patient mobility ("*walking epidurals*"). Use of a combination of ultralow concentration local anaesthetic and low dose lipophilic opioid is the "ideal" prescription for neuraxial labour analgesia.

Another technique is to administer bolus dose of a combination of local anaesthetic (0.1-0.125% bupivacaine or 0.2% ropivacaine) and fentanyl 2 mcg/ml, as 1.5 ml boluses at multiple levels at each centimetre mark, as epidural catheter is withdrawn, leaving about four to five centimetres of catheter in the epidural space at its final position, rather than giving the desired dose after achieving the final catheter position. This ensures early onset of analgesia. About four to five centimetres of catheter is usually left behind in the epidural space. In case of asymmetric block, the catheter may be pulled out by another 0.5 to one centimetre. This would still leave at least three to four centimetres of catheter in the epidural space.

Table 2: *Drugs commonly used in epidural analgesia and their doses*

Class of drug	Drug	Initial bolus dose	Maintenance dose
Local Anaesthetic	ropivacaine	0.2% ropivacaine 10- 12 ml	0.1% ropivacaine 8-10 ml/hour
	bupivacaine	0.1-0.125% bupivacaine 10-12 ml	0.0625- 0.1% bupivacaine 8-10 ml/hour
	levobupivacaine	0.1-0.125% levobupivacaine 10-12 ml	0.0625-0.1% levobupivacaine 8-10 ml/hour
Opioids	fentanyl	50 μg	2-3μg/ml of maintenance LA solution
	sufentanil	5 μg	0.2-0.3 μg/ml of maintenance LA solution

LA -local anaesthetic

Even with a good working labour epidural, parturients might experience pain and discomfort in the bearing down phase of second stage. An additional bolus dose of combination of local anaesthetic (0.2% ropivacaine or 0.1% bupivacaine) and fentanyl in the semi recumbent position might help to overcome this breakthrough pain.

To overcome breakthrough pain, lipophilic opioids or large bolus dose of local anaesthetics is often given. If repeated bolus doses are required, epidural needs to be reviewed and re sited if necessary. When severe breakthrough pain occurs on a recurrent basis, sinister pathologies like uterine rupture must be considered as a differential diagnosis. This is described as "epidural sieve" by Crawford.[29-31]

d) After care

Proper documentation, including complications if any, is important. Bladder catheterisation, if not done earlier, may be required at this stage in some cases. Monitoring of both maternal and foetal wellbeing is mandatory. Essential monitoring would include that of maternal haemodynamics, block characteristics, uterine contractions and foetal monitoring in the form of cardiotocograph. Left uterine tilt using a wedge below right hip is given to prevent aortocaval compression. Routine administration of supplemental oxygen is not required.

After the third stage of labour, epidural catheter is removed. Prior to catheter removal, ensure complete removal of placenta and suturing of perineal tears, if any, has been completed. The catheter needs to be pulled out slowly by gentle traction and completely withdrawn till the distal blue tip of the catheter is visualised. Visualising the blue tip ensures that the catheter is removed intact. Sterile dressing may be placed over the injection site. In accordance with the American Society of Regional Anaesthesia and Pain Medicine guidelines, Low Molecular Weight Heparin, if prescribed should be administered after an interval of at least 4 hours following epidural catheter removal.[32]

e) Contraindications

Patient refusal, pre-existing or new onset coagulopathy or infection at lower back, raised intracranial pressure, uncorrected hypovolemic shock, inadequate resources including manpower, monitoring or equipment and lack of expertise would be deterrents to performing labour epidural. Relative contraindications would include systemic infections, pre-existing neurological diseases e.g. multiple sclerosis, preload dependent cardiac conditions e.g. severe aortic stenosis. Chorioamnionitis without sepsis is not a contraindication.

f) Concerns

Primary concern is that of a moving target (mother in distress from labour pain). The increased vascularity of epidural space in labour can predispose to bloody tap on catheter insertion. Following a dural tap, increased incidence of post dural puncture headache is seen in obstetric population compared to the non-obstetric population.

g) Complications

The list of complications associated with labour epidural is quite big, but fortunately, these are not very common. Patchy/incomplete analgesia and asymmetry of block result from transforaminal migration of catheter tip, primary or secondary migration and asymmetric epidural spread of the drug. Incidence of total failure of the block, hypotension, urinary retention, bloody tap and post dural puncture headache occurrence is about 1%. Break through pain requiring epidural top ups may occur in 6-25% cases.[16] This may reduce patient satisfaction and even result in repeat procedure and catheter replacement. Frequent requirement of epidural top ups should alert the differential diagnosis of placental abruption and uterine rupture, wherein a working epidural may still prevent physiological pain, but transmit pathological pain (epidural sieve).[31] Rare complications would include accidental subdural placement, or subarachnoid placement leading to total/high spinal block, neurological injury (1 in 25,000), epidural abscess (1 in 100,000) and epidural haematoma (1 in 150,000). Epidural catheter breakage is an uncommon complication reported in literature, which can happen during insertion or removal.[33.34]

8) Techniques of epidural labour analgesia

a) Continuous epidural infusion at variable rates as prescribed by the physician, administered via infusion pump is the most basic technique. This can be additionally topped up with physician administered boluses as required.

b) Continuous epidural infusion followed by patient controlled top ups - This ensures patient empowerment to a certain extent and a lower incidence of breakthrough pain.

c) Patient controlled epidural analgesia (PCEA) - This technique enables maternal empowerment, so that the patient feels more in control of her pain. Standard regime includes, 5 ml bolus, with 10 minutes lockout interval, with a maximum hourly volume limit of 25 ml. In fact, studies have shown lesser requirement of local anaesthetics compared to continuous epidural infusion.[10]

d) Combined spinal epidural (CSE) technique- Onset of analgesia was most rapid with Combined Spinal Epidural technique. This is the main advantage especially, when analgesia is requested in advanced or late stage of labour. This improves quality of epidural labour analgesia.[35] Combined Spinal Epidural technique was associated with a higher risk of non-reassuring foetal heart rate tracings than epidural alone.[36] Higher incidence of maternal pruritus and foetal bradycardia has been reported with intrathecal fentanyl when given for labour analgesia. Sudden decrease in maternal pain and consequential fall in sympathetic tone and fall in circulating adrenaline levels, may lead to uterine hypertonus and foetal bradycardia.

e) Dural puncture epidural (DPE) technique- Intentional dural puncture is performed and afterwards, the standard epidural analgesia regime is followed. It provides better quality of analgesia and faster onset compared to epidural analgesia, possibly related to drug spread into subarachnoid space. The dural puncture technique has improved block quality over epidural technique with fewer maternal and foetal side effects than the combined spinal epidural technique for parturient requesting early labour analgesia.[37]

f) Double catheter technique – In this technique, one epidural catheter is threaded cephalad and another catheter threaded caudally. This is usually done at two different levels. The cranially directed catheter would be activated in the 1st stage of labour and the caudally directed one would be activated for analgesia when 2nd stage pain begins. Study by Li et al, concluded that double catheter epidural block provides better labour analgesia than single catheter technique without any adverse effects on delivery outcomes.[38]

g) Use of additives- Addition of lipophilic opioids such as fentanyl and sufentanil to epidural solution facilitates the use of more dilute local anaesthetic concentration and thereby use of larger volumes. This enhances the spread of drug in the epidural space and ensures better analgesia. Fentanyl in a dose of two to three μg/mL and sufentanil in a dose of 0.2-0.3μg/mL are recommended for epidural solutions. A recent meta-analysis suggested Dexmedetomidine as a useful adjunct to local anaesthetic for epidural labour analgesia, although this is not yet approved by FDA for epidural use.[39]

9. Recent advances in epidural techniques

a) Programmed intermittent epidural boluses (PIEB) - This is the recommended technique nowadays if it is available. There is evidence that programmed intermittent epidural bolus technique as a maintenance mode compared to continuous infusion results in better analgesia following better epidural spread of the drug. Programmed intermittent epidural bolus technique seems to be more effective maintenance mode than continuous epidural infusion for labour analgesia.[40] This may be due to better spread of local anaesthetic, lower anaesthetic drug requirements, less breakthrough pain and less motor block, and subsequently less instrumental delivery compared to the continuous epidural infusion method. Better spread in the neuraxial space has been demonstrated in porcine models with boluses compared to infusions.[41] A recent randomised controlled trial showed that dural puncture epidural (DPE) technique with programmed intermittent epidural bolus (PIEB) mode achieved the greatest drug sparing effect without increasing maternal or neonatal side effects.[42]

b) CI- PCEA (Computer integrated- patient controlled epidural analgesia) – This is a novel epidural drug delivery system, which incorporates more sophisticated computer software. In this, computer controls the background infusion rates, based on the previous hour's demand boluses. In a randomised trial by Lim et al, parturient using computer integrated patient controlled epidural analgesia (CI-PCEA) had higher maternal

satisfaction scores and lower local anaesthetic requirements, when compared to parturient using demand only patient controlled epidural analgesia (PCEA) for labour pain relief.[43]

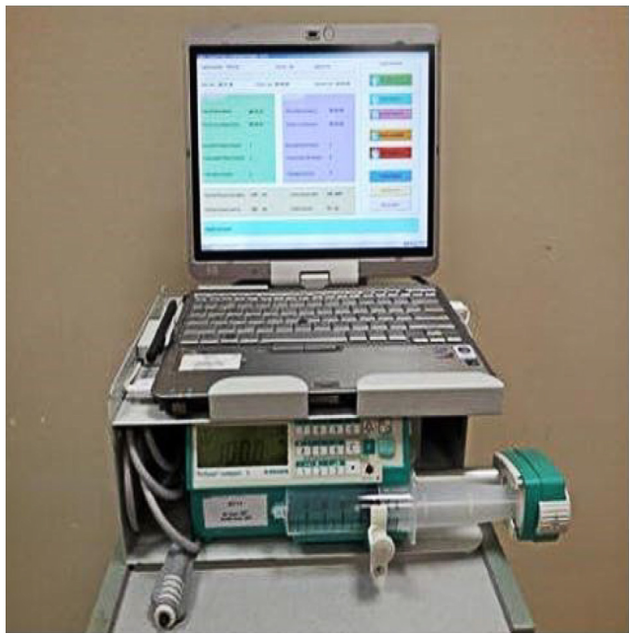

Figure 1: CI-PCEA system using a HP Compaq Tablet PC connected to a modified B Braun Perfusor R Compact S infusion pump

10. Innovations in equipment design and procedure

a) Episure AutoDetect syringe and Epidrum- These are novel loss of resistance techniques and may prove useful for epidural space identification, especially from a trainee perspective.[44,45]

b) Compuflow® epidural trainer- Compuflow trainer (Milestone Scientific, Inc. Livingston, New Jersey, USA) using the Dynamic Pressure Sensing® technology allows the trainee to accurately identify the needle location and tissue changes that are imperceptible by tactile sensation. This helps trainee to identify between true and false loss of resistance, thereby reducing the learning curve. A prospective single blinded study showed that compared to conventional training, the Compuflow trainer reduced the number of attempts by trainees to correctly identify the ligamentum flavum.[46]

Figure 2- Episure AutoDetect syringes^{TM} (Indigo Orb Inc, Santa Clara, CA, USA)

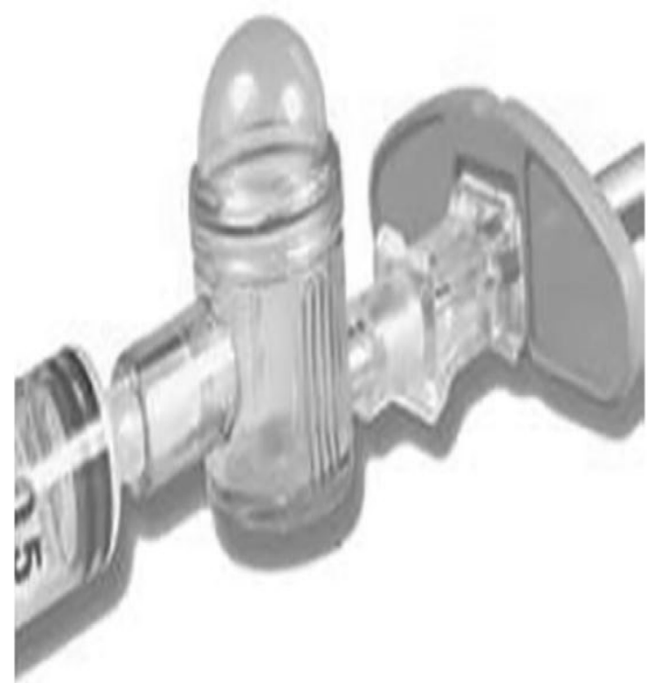

Figure 3- Epidrum^{TM} (Exmoor Innovations Ltd UK)

c) Ultrasound guided epidural technique- Pre procedure ultrasound can help with epidural placement, especially in those with abnormal lumbosacral anatomy (scoliosis) and difficult landmarks (obese parturient). Ultrasound scan helps in

identification of midline, and estimation of depth of epidural space. It also helps visualisation of local anaesthetic spread in the epidural space. Use of pre procedural ultrasound assessment helps in increasing the success rate of epidural and reducing complications of the blind or landmark approach including multiple failed attempts.[47]

11. Myths and controversies

Although the reported incidence of breakthrough pain after epidural analgesia is as high as 6-25%, patient controlled epidural boluses and programmed intermittent epidural bolus techniques have been able to reduce breakthrough pain. A protocolised algorithmic approach may also help to deal with this problem.[48]

Slight prolongation of second stage of labour with epidural technique, without much difference in the duration of first stage of labour has been reported in literature.[49,50] In a patient receiving epidural analgesia, American College of Obstetricians and Gynaecologists (ACOG) has defined an abnormally prolonged second stage of labour as longer than three hours in nulliparous women and as longer than two hours in multiparous women.

Epidural analgesia in labour does not increase the rate of operative delivery but increases the rates of instrumental delivery. Over the years, there has been a paradigm shift towards the use of lower concentrations of local anaesthetics for epidural labour analgesia. A recent systematic review and meta-analysis of randomised controlled trials concluded that epidural analgesia with low concentration local anaesthetics when compared with non-epidural analgesia was not associated with a prolonged duration of second stage of labour or an increased instrumental birth rate.[51]

A large systematic review on timing of epidural initiation, found no difference in the risk of operative or instrumental delivery between early versus late initiation of epidural analgesia for labour pain relief.[52] Therefore, initiation of epidural analgesia should be based on maternal request. Withholding epidural late in labour does not offer any maternal advantages in terms of reducing the risk of instrumental delivery.

Contrary to the common perception, there was no increased incidence of chronic back pain attributable to epidural analgesia.[53]

Does the maternal position in labour matter following epidural analgesia? Birthing in upright maternal position versus lying down position in women with low dose epidural in second stage of labour (BUMPES) trial from UK showed that lying down in the second stage of labour compared to upright position results in more spontaneous vaginal births in nulliparous women with low dose epidural analgesia.[54]

There is a definite association between epidural analgesia and intrapartum maternal fever, but whether it translates to any neurological injury in neonates is yet unknown.[55]

12. Future

A novel epidural drug delivery regime considers variable volume and variable frequency automated mandatory boluses for patient controlled epidural analgesia during labour. Currently, phase III trials are ongoing to confirm their efficacy.[56]

Liposomal bupivacaine has not yet been approved for epidural use by U.S Food and Drug Administration (FDA). Its role in labour analgesia has not been extensively studied yet.

Another area which needs further research and insight is long term outcomes in mother and child following the childbirth pain management.

Conclusion

Labour analgesia has numerous foeto-maternal benefits. Among the various labour analgesia options available, continuous labour epidural remains the "gold standard". Combination of ultra-low concentration local anaesthetic and low dose lipophilic opioid seems to be the optimal recipe for neuraxial labour analgesia. Continuous epidural technique with a background programmed intermittent epidural bolus and patient controlled epidural analgesia to manage breakthrough pain ensures effective labour analgesia with minimal side effects.

Main points

1. Labour analgesia offers numerous benefits both to the labouring mother and the foetus
2. Continuous epidural technique remains the gold standard for labour analgesia

3. Combination of ultralow concentration of local anaesthetic and low dose lipophilic opioid, when used as the epidural drug, gives the best results

4. With the modern technology available, a combination of continuous epidural technique with a background programmed intermittent epidural bolus and patient controlled epidural analgesia, gives the best results for labour analgesia with the least side effect

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Datum prijema rada: 01.02.2024. Prva ispravka rukopisa: 03.11.2024. Datum prihvatanja rada: 13.11.2024.