LABOUR ANALGESIA – RECENT CONCEPTS

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The delivery of the infant into the arms of a conscious and pain free mother is one of the most exciting & rewarding moments in medicine – Moir DD

INTRODUCTION

James Young Simpson, the Professor of midwifery in Edinburgh, Scotland, was among the first to use ether for the relief of labour pain. On January 1847, he used ether to ameliorate the pain of labour in a young woman with rickets & severely deformed pelvis, who was at grave risk of dying. She survived the complicated delivery pain free. But his concept of etherization of labour was strongly condemned by the clergy. Queen Victoria was given relief of pain during labour by John Snow using chloroform on a folded handkerchief. The Queen abruptly terminated the religious debate over the appropriateness of analgesia for labour. Since then labour analgesia has gained popularity and neuraxial analgesia has become the gold standard for the same.

Recent trends in providing pain relief during labour includes intravenous use of remifentany, inhalational sevoflurane, use of adjuvants like clonidine, neostigmine epidurally along with local anaesthetics, use of ropivacaine, continuous spinal analgesia, computer integrated patient controlled epidural analgesia, Programmed Intermittent or automated mandatory epidural boluses and Ultrasound guided neuraxial technique.

why labour analgesia is required?

It has long been known that painful labour produces several adverse changes in maternal physiology & biochemistry. Some changes have important implications for the baby also.

1. Maternal respiration increases by 75-150% during 1st stage of unmodified labour.

   This is associated with a number of maternal changes that may have adverse fetal effects
   a. Hypocarbia & respiratory alkalosis
   b. Increased O2 consumption
   c. Under-ventilation between contractions, resulting in episodes of haemoglobin desaturation which are more pronounced when systemic opioids are given.
   d. Compensatory metabolic acidosis which appears to be transferred readily to the foetus.
e. Vasoconstriction which affects the uterine arteries
f. A shift in the maternal oxyhaemoglobin dissociation curve counteracting the Double Bohr effect

2. Maternal hyperventilation lowers the umblical artery PCO2, but as labour progresses this change is overtaken by metabolic acidosis of increasing severity. Such that the longer the second stage of labour, the lower the cord pH at birth.

3. Maternal pain & stress have adverse fetal effects, maternal anxiety is associated with increased plasma catecholamines, cortisol, ACTH & lipoprotein Increased sympathoadrenal activity may lead to uncoordinated uterine activity & reduce uterine perfusion

4. Metabolic outcome is hyperglycemia with a poor insulin response, lipolysis with increased fatty acids, ketones & lactate. These acids cross the placenta and produce fetal acidosis & increase fetal O2 requirement.

**Characteristics of the ideal labour analgesic**

- Maternal & foetal safety
- Ease of administration
- Consistent, predictable, rapid onset
- Maternal composure & control during both the 1st & 2nd stages of labour
- Analgesia through all stages of labour
- Devoid of motor blockade, enabling ambulation & various birthing positions
- Preserve the stimulus for expulsive efforts during the 2nd stage of labour
- Retain maternal expulsive efforts
- Facilitate the delivery of supplemental analgesia without additional invasive procedures
- Facilitate the delivery of anaesthesia for surgery to avoid the need for general anaesthesia
- Motor assessment to determine ability to ambulate unassisted
- Assessment performed 15-20 min following intrathecal analgesia & 30 min following epidural analgesia.

**Classification of methods of analgesia** - Can be classified into non pharmacological methods & pharmacological methods.

1. Non pharmacological methods
a. Hypnosis  
b. Psychoprophylaxis  
c. Acupuncture  
d. TENS  
e. Sterile water blocks  
f. Hydrotherapy  
g. Maternal position  

2. **Pharmacological methods**:  
   Classified as systemic medications and regional analgesic techniques.  

**Systemic medication for labour and delivery**  
All systemic medications used can cross the placenta and can produce a depressant effect on the foetus. The amount of depression depends on the dose, route and time of administration before delivery and presence of maternal complications. Systemic medications can be used in places where the facilities for regional analgesia are not there, and in patients whom central neuraxial block is contraindicated.  
Systemic drugs can be classified as  
   1. Opioids  
   2. Tranquilizers  
   3. Dissociative or amnesic drugs  
   4. Antagonists  

**Opioids** are probably the most commonly used medications for labour analgesia. In many centres where epidural analgesia is unavailable or maternal condition contraindicates its use, opioids remain the analgesics of choice for labour pain.  
The common opioids used systemically are pethidine, fentanyl & Remifentanyl.  
**Fentanyl** – because of its rapid onset of action profound analgesic capabilities & lack of active metabolites, fentanyl is a popular IV or IM analgesic for labour. Fentanyl 100mcg is equianalgesic to morphine 10mg. The usual IM dose is 50 to 100 mcg and the IV dose is 25 to 50mcg. IV fentanyl produces analgesia almost instantaneously. The peak effect follows within 3 to 5 mins and the duration of action is 30 to 60 minutes.  
   After IM administration, analgesia begins in 7 to 8 minutes, peaks at about 30 minutes and lasts 1 to 2 hours. Fentanyl crosses the placenta rapidly & appears in the foetal blood within
1 minute and peaks at 5 minutes. In maternal blood 60-80% of fentanyl is bound to plasma albumin and only 1/3 is available for placental transfer.

Fentanyl also can be used as patient controlled IV analgesic. Compared to pethidine the side effects on the foetus and neonate are much less with fentanyl. Sufentanyl & Alfentanyl are the more lipid soluble opioids and have not gained popularity for labour analgesia as systemically administered drugs as they have little advantage over fentanyl.

**Remifentanil** – is an ultra short acting mu-1 opioid receptor agonist with a rapid onset of action and is hydrolysed by non-specific tissue and blood esterases to an inactive metabolite. Context sensitive half time is 3.5 mins and is independent of duration of infusion. The analgesic half life is 6 min, thus allowing effective analgesia for several consecutive painful uterine contractions. Remifentanil plasma concentration in pregnant women are approximately half those found in non-pregnant patients because of the greater volume of distribution & higher clearance.

Optimal dosing regimen – The efficiency of remifentanin may depend on both the dose and manner in which it is administered. It can be given as an intermittent patient administered bolus with a lockout interval and with or without background infusion. The timing of dose administration, the rate of bolus delivery and the lockout interval are important to analgesia outcome. Usual dose is 0.5mcg/kg with a 2 min lockout interval. It can also be given as a PCIA bolus dose of 0.25mcg/kg (2 min lockout) with a background infusion of 0.025 to 0.1mcg/kg/minute.

Maternal effects- Sedation, nausea & vomiting and maternal desaturation requiring O2 supplementation that is short lived.

Foetal & Neonatal effects – Because of the remifentanil’s rapid metabolism & redistribution in the neonate after placental transfer, the side effects are very few.

**Table 1. Suggested Guidelines for Patient controlled IV Analgesia(PCIA) with Remifentanil**

<table>
<thead>
<tr>
<th>Eligibility</th>
<th>Informed consent</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No opioid use in the previous 4 hrs</td>
</tr>
<tr>
<td></td>
<td>Dedicated IV cannula for remifentanil infusion</td>
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</table>

<table>
<thead>
<tr>
<th>PCIA protocol</th>
<th>PCIA bolus – 0.25 mcg/kg</th>
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<tbody>
<tr>
<td></td>
<td>Lockout interval : 2 min</td>
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</table>

<table>
<thead>
<tr>
<th>Continuous observations</th>
<th>SaO2 (pulse oximetry)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nursing supervision : one to one</td>
</tr>
<tr>
<td></td>
<td>Respiratory rate</td>
</tr>
</tbody>
</table>
30 min observations

<table>
<thead>
<tr>
<th>Sedation score</th>
</tr>
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<tbody>
<tr>
<td>Pain score</td>
</tr>
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</table>

**Indications for contacting the anaesthesia personnel**

<table>
<thead>
<tr>
<th>Excessive Sedation score (not arousable to voice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate &lt; 8 breaths/min</td>
</tr>
<tr>
<td>SaO2&lt;90% while breathing room air.</td>
</tr>
</tbody>
</table>

Optimal remifentanyl PCIA regimens may well require titration against individual patient response as well as a titration in dose requirements as labour progresses. Further developments may include synchronization of the remifentanyl PCIA bolus dose to the tocodynamometer recording so that the maximum analgesic effect of the drug can occur at the peak of the uterine contraction. Administration of the bolus during the period between contractions may also potential improve efficacy.

**Inhalation agents** Only inhalation agent still popular in some places is entonox- a 50% nitrous oxide in oxygen. Other agents like desflurane and sevoflurane have also been in use.

**Entonox**

Intermittent inhalation of nitrous oxide can provide analgesia for labor, but it does not completely eliminate the pain of contractions. Suitable equipment must be available to provide safe and satisfactory inhalation analgesia with nitrous oxide. An apparatus that limits the concentration of nitrous oxide (e.g., a nitrous oxide/oxygen blender or a premixed 1:1 cylinder) is required, and it must be checked periodically to prevent the unintentional administration of a high concentration of nitrous oxide and a hypoxic concentration of gas. Inhalation may occur through a mask or a mouthpiece with a one-way valve to limit pollution of the labor suite with unscavenged gases.

**Sevoflurane**

Sevoflurane is potentially an attractive inhalation agent for use as an analgesic during labour. Subanaesthetic concentrations offer advantages to mothers including a lack of irritation to the respiratory tract and a pleasant odour. In addition, sevoflurane has a low blood-gas partition coefficient of 0.65 that enables rapid uptake into the central nervous system together with fast washout which results in swift clinical effect and recovery. It has been found that sevoflurane at
a concentration of 0.8% provides optimum pain relief in labour. Disadvantage of inhalational anaesthetics – pollution of labour suit, mother may lose protective airway reflexes.

**Regional Analgesia for labour pain**
Regional techniques provide excellent analgesia with minimal depressant effects on mother & foetus. The regional techniques most commonly used in obstetric analgesia include central neuraxial blocks-(spinal, epidural, combined spinal/epidural(CSE)) paracervical, pudendal blocks & less frequently lumbar sympathetic blocks.

**Neuraxial analgesia** – is the only technique that can completely relieve the pain of labour. It is the gold standard for labour analgesia, although the technique is not without its own inherent complications.

**The indications** for neuraxial analgesia are
1. Maternal request
2. hypertensive disorders of pregnancy
3. preexisting medical disease
4. multiple pregnancy
5. previous caesarean section
6. prolonged labour
7. deterioration in foetal well being.

**Contraindications** for neuraxial analgesia
1. maternal refusal
2. coagulopathy & thrombocytopenia
3. local or systemic infection
4. Inadequate staffing or facilities

In modern obstetric anaesthetic practice the aim is to produce a selective sensory block from T10 to L1 while at the same time sparing the motor supply to the lower limbs, L2-L5, the “Mobile Epidurals or Walking Epidurals”. This sparing of motor fibres has been achieved by decreasing the concentration of local anaesthetics used by the addition of opioid, most commonly fentanyl. Bupivacaine ranging from 0.0625% to 0.1% with fentanyl 2mcg/ml is the most popular solution used till recently. For safety reasons Bupivacaine is gradually being replaced by L-bupivacaine and Ropivacaine.

**Techniques of neuraxial analgesia**
1. **Lumbar epidural analgesia** – Once labour is well established, epidural analgesia can be appropriate at virtually any time of labour when the parturient experiences painful contractions, providing there are no contraindications. In the past, epidural analgesia had been withheld until parturient was in the active phase of labour (4 to 6 cms dilated). Now with the introduction of low concentration of local anaesthetics with opioids one can start even in the latent phase.

**Drug regimen**

1. Epidural catheter is positioned & placement verified
2. Initial block –
   - Bupivacaine 0.125% (10 – 15 ml) with fentanyl 2 mcg/ml of Bupivacaine.
   - Ropivacaine – 0.125% to 0.2% with fentanyl (10 – 15 ml)
3. Maintainance of analgesia –
   a. Intermittent bolus technique
      - Bupivacaine 0.125% with fentanyl 2 mcg/ml, 10 ml injected once in 60 to 90 minutes
      - Ropivacaine 10 ml of 0.125% to 0.2% with fentanyl 2mcg/ml once in 60 - 90 minutes
   b. Continuous infusion technique
      - 0.0625% Bupivacaine 8-15ml/hr with fentanyl 2 mcg/ml
   c. Continuous infusion with intermittent bolus technique
      - 0.0625% Bupivacaine 8-15 ml/hr with fentanyl 2 mcg/ml + intermittent bolus dose of 5 to 10 ml of 0.125% bupivacaine with fentanyl 2mcg/ml whenever there is breakthrough pain.
   d. Patient Controlled Epidural Analgesia (PCEA)
      - Initial bolus dose as above
      - Basal infusion – 6 ml/hr of Bupivacaine 0.0625% with fentanyl 2 mcg/ml
      - Demand bolus dose – 3 to 5 ml – Bupivacaine 0.0625% to 0.125% with fentanyl 2 mcg/ml
      - Lock out interval – 10 minutes
      - Ropivacaine 0.125% with fentanyl 2 mcg/ml can also be used instead of Bupivacaine in the same dose
**Intermittent bolus technique** – the disadvantage is the breakthrough pain. Advantage is the better spread of the local anaesthetic in the epidural space with better analgesia

**Continuous Infusion technique** – Advantages are

a. maintenance of a stable level of analgesia
b. a more stable maternal heart rate and blood pressure with decreased risk of hypotension.
c. A less frequent need to give bolus doses of local anaesthetic which may reduce the risk of systemic local anaesthetic toxicity
d. Satisfactory perineal analgesia

**Patient Controlled Epidural Analgesia (PCEA)**

Advantages

e. Effective labour analgesia
f. Excellent patient satisfaction
g. Decreases the total amount of LA used
h. Lessens unwanted effects like hypotension & motor block
i. Reduces the demands on staff
j. Gives many parturients with a feeling of empowerment

**Computer integrated PCEA (CI-PCEA)**

Is a novel epidural drug delivery system that automatically adjusts the background infusion rate based on the number of PCEA demands. A laptop computer with a programmed algorithm is connected to a standard epidural pump. The computer program automatically adjusts the background infusion rate based on the number of patient’s PCEA demands in the previous hour (table 2). It has been found that women on CI-PCEA technique had similar LA consumption compared with demand only PCEA. But it was found that CI-PCEA was associated with increased maternal satisfaction
Table 2. Computer integrated PCEA (CI-PCEA)

<table>
<thead>
<tr>
<th>CSE: Intrathecal fentanyl 15μg + ropivacaine 2 mg + EP 1.5% lidocaine 2 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓ No infusion</td>
</tr>
<tr>
<td>↓ Demand dose: 5ml*, lockout 10 minutes</td>
</tr>
<tr>
<td>↓ Change infusion to 5 ml/hr</td>
</tr>
<tr>
<td>↓ 2nd Demand within 1 hr</td>
</tr>
<tr>
<td>↓ Change infusion to 10 ml/hr</td>
</tr>
<tr>
<td>↓ 3rd Demand within 1 hr</td>
</tr>
<tr>
<td>↓ Change infusion to 15 ml/hr</td>
</tr>
<tr>
<td>↓ 4th Demand within 1 hr → Stop infusion and activate alarm</td>
</tr>
</tbody>
</table>

* 0.1% ropivacaine + fentanyl 2 μg/ml

**Programmed Intermittent or automated mandatory epidural boluses (PIEB)**

With programmed intermittent epidural boluses (PIEB), the hourly total amount of local anaesthetic solution normally used in a continuous epidural infusion is administered as
intermittent boluses (e.g.: two 5 ml boluses every 30 minutes as opposed to a continuous epidural infusion of 10 ml/hr). Studies have shown that PIEB resulted in similar analgesia, higher maternal satisfaction, less need for unscheduled rescue boluses and a reduced consumption of Bupivacaine when compared to a continuous epidural infusion. This reduced dose of Bupivacaine is probably related to the better & more uniform spreads of larger volumes of local anaesthetic solution, compared to the slow spread achieved with a continuous infusion.

**Ultrasound guided neuraxial technique**

Ultrasound imaging is becoming an increasingly popular aid for performing neuraxial blockade. It may help to identify the midline, localize the epidural space, measure the skin-to-epidural space distance & estimate the angle of needle insertion. Prepuncture lumbar ultrasound assessment provides useful information which may facilitate the placement of epidural needles not only in healthy parturients but also in obese pregnant women and patients with scoliosis. It also has been shown that Ultrasonography used as a teaching tool, improves the epidural placement learning curve by increasing epidural success rate & reducing the number of epidural attempts & catheter replacement for failed labour analgesia. Ultrasound technology can help in better understanding of the physiology & pharmacology of neuraxial blockade and the development of a “difficult spine score”.

**Combined Spinal Epidural Analgesia (CSE)**

The CSE technique is widely used in obstetric practice. It offers effective, rapid-onset analgesia with minimal risk of toxicity or impaired motor block. It also provides the ability to prolong the duration of analgesia as required through the use of an epidural catheter. If operative delivery is required the same catheter can be used for providing anaesthesia.

Many methods may be used to perform a CSE block

a. Epidural catheter insertion followed by spinal needle placement at a lower interspace
b. An epidural needle beside the spinal needle at the same interspace with specially designed needles.
c. The most commonly used “needle-through-needle technique, which involves identification of epidural space & insertion of a long fine-bore pencil point spinal needle through the epidural needle until the tip of spinal needle pierces the dura. Free flow of CSF confirms correct placement & the opioid alone (25mcg of
fentanyl) or in combination with LA (Bupivacaine 0.5% 0.5 ml + fentanyl 25 mcg) is injected. After spinal injection, the spinal needle is withdrawn & the epidural catheter is placed 3 to 5 cms into the epidural space via the epidural needle.

An increased frequency of non reassuring FHR tracings & foetal bradycardia occurs with CSE. The aetiology of foetal bradycardia may be related to an acute reduction in circulating maternal catecholamine levels after to quick onset of analgesia. The typical foetal bradycardia resolves within 5 to 8 minutes.

**Walking Epidurals**

The ability of labouring women to ambulate is provided by the intrathecal component of the CSE technique & has resulted in many anaesthesiologists renaming this technique as “Walking Epidural”. Before making the woman ambulate she should be assessed for motor blockade, sensory blockade, postural hypotension and must be accompanied by the attendant or the nurse.

**Table 2. Motor assessment to determine ability to ambulate unassisted**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg strength</td>
<td>Straight leg raise (both legs)</td>
</tr>
<tr>
<td>Postural hypotension</td>
<td>sit at bedside</td>
</tr>
<tr>
<td>Leg strength &amp; postural hypotension</td>
<td>stand at bedside</td>
</tr>
<tr>
<td>Leg strength</td>
<td>partial deep knee bend</td>
</tr>
<tr>
<td>Ambulation</td>
<td>six unassisted steps</td>
</tr>
</tbody>
</table>

The clinical benefits of ambulation on the progress of labour & labour outcome, other than improved patient satisfaction, remains controversial.

**Test dose for epidural catheter position**

Epidural catheter placement may be complicated by blood vessel or dural puncture. The usual test dose given is Inj. Lidocaine 1.5% 3 ml with 1:200000 adrenaline. If intravascular increase in the heart rate of more than 10 beats/min will occur within 60 seconds. If intrathecal then motor block of the lower limbs will occur in 3 – 4 minutes. The test dose should be given at the end of a contraction as the pain of contraction can increase the heart rate. Use of hypobaric lidocaine can produce a very high block when given with the patient in sitting posture. Use of adrenaline also raises a few controversies as adrenaline can produce vasoconstriction of the uterine vessels and can decrease the uteroplacental circulation if the catheter tip is inside a vessel. The second
thing is that adrenaline can relax the uterus and can decrease the contractions. Since the concentration of local anaesthetic used for labour analgesia is very low, there is an argument saying that test dosing is not necessary. Test dose is necessary for epidural injection for operative delivery, where higher concentration and larger volumes of local anaesthetics are used. An alternate means of testing the catheter for intravascular placement is injection of 1-2 ml of air into the epidural catheter while listening over the precordium with the maternal external Doppler monitor for evidence of air.

Regardless of the technique used, the safe practice of epidural labour analgesia dictates –

1. Observing for the passive return of blood or CSF through the catheter.
2. Aspirating before each injection
3. Giving the test dose after a uterine contraction
4. Maintaining verbal contact with the patient, & looking for the subjective symptoms & objective signs of intravenous or subarachnoid injection of the local anaesthetic.
5. Not injecting more than 5 ml of local anaesthetic as a single bolus.
6. Having a low threshold for replacing the epidural catheter if uncertainty exists regarding the catheter location

**Adjuvants along with local anaesthetics other than opioids**

Lipophilic opioids such as fentanyl & sufentanyl have proven their efficacy & safety profile in millions of pregnant women. However undesirable side effects such as nausea, vomiting, pruritis, sedation required to search for alternative adjuvants, that might provide a local anaesthetic sparing effect without producing unwanted side-effects. Epidurally administered clonidine (an α2 receptor agonist that modulates pain perception at spinal level) and neostigmine (an acetylcholinesterase inhibitor, that indirectly stimulates both muscarinic & nicotinic receptors in the spinal cord) are promising agents for labour analgesia. Studies have confirmed that a combination of clonidine 75μg & neostigmine 500μg administered epidurally as a part of CSE technique with Ropivacaine & Sufentanyl prolonged the initial analgesic effect of the spinal component of the CSE, provided a subsequent local anaesthetic sparing effect and did not result in any maternal adverse effects such as hypotension, nausea or sedation, or in any neonatal adverse outcome. But clonidine alone when administered without neostigmine produced significant maternal hypotension.

**Continuous Spinal Analgesia technique**
Continuous spinal analgesia can provide excellent labour analgesia & surgical anaesthesia if required & is a very reliable, flexible technique. Fear of PDPH is the primary reason it is infrequently used; however the relative risk of this treatable side effect should be weighed against the many advantages of the technique in specific challenging populations. Although standard epidural catheters (20G) may be used for continuous spinal analgesia, paediatric epidural catheters (24G) that can be placed via 20G needles are available and can be used. Microcatheters of size smaller than 24G may produce higher incidence of neurological problems due to laminar flow of local anaesthetics & improper distribution in the CSF. Advantage of using a larger sized catheter is that the CSF can be easily aspirated and the intrathecal position can be confirmed.

Care must always be taken to clearly identify the spinal catheter as such, to avoid the possibility that it may be mistaken for an epidural catheter. When possible, different infusion pumps and tubing should be used for management of the spinal catheter, ideally pumps and tubing should be reserved solely for this purpose. When connecting, disconnecting, or injecting the catheter, strict adherence to “clean” technique should be used to decrease the risk of contamination. The timing of removal of the intrathecal catheter is a matter of some controversy. It was observed that a much lower incidence of PDPH after intrathecal catheter placement (20-g catheter placed via an 18-g Tuohy needle) if the catheter was left in place for 24 hours after delivery rather than immediately after delivery. Until further evidence is available, it is difficult to recommend a single practice regarding the timing of removal. The catheter should be left in place only if maintenance of sterility can be assured.

**Indications –**

1. Previous spinal surgery – identification of epidural space and spread of the drug in the epidural space if identified are the problems in such patients. Use of CSA can overcome this problem.

2. Significant cardiac disease – CSA for labour can be managed with intrathecal opioids alone which usually have negligible haemodynamic effects.

3. Morbid obesity – In this group the rate of failed induction, caesarean delivery & the rate of epidural failure is higher. CSA provides a highly reliable route to induce analgesia & anesthesia if required. The incidence of PDPH has been found to be lower in this population.
4. Difficult epidural catheter placement – covers situations in which an unintended dural puncture occur or when the palpable landmarks for epidural placement are so poor that it becomes essentially a “blind”, best guess needle placement.

5. Difficult airway – Though somewhat controversial, placement of a spinal catheter in a parturient with a difficult airway provides a reliable route to safely induce surgical anaesthesia, very rapidly if necessary, without worry about loss of the airway.

Table 3. Suggested Solutions for maintenance of Continuous Spinal catheter analgesia

<table>
<thead>
<tr>
<th>Technique</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour analgesia</td>
<td>Intermittent bolus: Plain bupivacaine 1.75 -2.5 mg + Fentanyl 15-20µg as needed(roughly each 1-2 hrs)</td>
</tr>
<tr>
<td></td>
<td>Continuous infusion: 0.05% - 0.125% bupivacaine + Fentanyl 2-5µg/ml at 0.5 to 3 ml/hr.</td>
</tr>
<tr>
<td>Surgical anaesthesia</td>
<td>Preservative free 0.5% bupivacaine 5mg(1ml) + fentanyl 15µg for the initial dose followed by 0.5 ml boluses of 0.5% bupivacaine until the desired height is obtained.</td>
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</tbody>
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Side effects & complications of Regional techniques

While neuraxial analgesia is usually safe, complications can occur. Some may be directly attributable to drugs or techniques.

Table 4. Complications of neuraxial analgesia

<table>
<thead>
<tr>
<th>Complications</th>
<th>Epidural</th>
<th>Combined Spinal-Epidural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure rate</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>PDPH</td>
<td>0.21% to 1.6%</td>
<td>0.2% to 1.7%</td>
</tr>
<tr>
<td>Nerve damage caused by needle trauma</td>
<td>0.6/100000</td>
<td>3.9/100000</td>
</tr>
<tr>
<td>Epidural abscess</td>
<td>0.2 – 3.7/100000</td>
<td>3/100000</td>
</tr>
<tr>
<td>Meningitis</td>
<td>0 -3.5/100000</td>
<td>0 -3.5/100000</td>
</tr>
<tr>
<td>Epidural Haematoma</td>
<td>1 in 168000</td>
<td></td>
</tr>
<tr>
<td>Foetal heart rate abnormalities</td>
<td>5.5%</td>
<td>31.7%</td>
</tr>
<tr>
<td>Foetal bradycardia</td>
<td>4.7%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Pruritis</td>
<td>29.5%</td>
<td>57.8%</td>
</tr>
</tbody>
</table>

Inadequate analgesia – Neuraxial analgesia failure is defined as epidural or CSE procedures resulting in inadequate analgesia or no sensory block after adequate dosing at any time after
initial placement, inadvertent dural puncture, intravascular placement or any technique requiring replacement or alternative management. Analgesia may be absent, asymmetrical or unilateral. To solve the problem it may be appropriate to administer a low-dose large volume bolus or to pull the epidural catheter back one or more centimeters. However if adequate analgesia has not been established within an hour, consideration should be given to repeating with the woman’s consent, the procedure.

**Failed epidural blocks** – is related to several factors – technique factors, catheter related factors & patient factors.

**Technique factors**-

1. Specialists versus trainees performing the block – more failures with the trainees.
2. Length of the catheter inserted inside the epidural space. Catheter should be inserted only for 3-4 cms. Increased failure rates occur when introduced for more than 5 cms. The engorged veins in the epidural space direct the catheter to move out through the intervertebral foramen.
3. The loss of resistance technique used - more failures when air was used compared to saline. It is said that epidural air bubbles may cause incomplete block by preventing spread of local anaesthetics and also more likely to cause headache as a result of pneumocephalus.
4. CSE versus epidurals – less failure rates when CSE is used compared with only epidurals.

**Catheter related factors** – multiorifice catheters may be less safe because they can be sited partially subdurally and allow multicompartmental spreads of local anaesthetic, but they are less likely to get occluded & requiring re-sitting. Bloody taps are more common with multi-orificial catheters and missed segments are more common when single orifice catheters are used.

**Patient factors** –

1. Spinal deformity, disease or previous spinal surgery –are associated with patchy or unilateral blocks.
2. The midline barrier – dorsal connective tissue band in the midline called as plica mediana dorsalis in the epidural space can produce partial block. The band in most of the patients is incomplete. Failed blocks can be managed by partial withdrawal of the catheter,
additional fractional doses of local anaesthetics with opioid to cross the barrier & change of posture.

**Accidental dural puncture & PDPH**

Classically the headache which can be severe occurs 24-72hrs after the dural puncture & is postdural in nature. The definitive treatment is epidural blood patch, which should be performed without delay once the headache is diagnosed.

**Nerve damage**  
Epidural catheters may injure nerve roots either because they are inappropriately rigid or because they are threaded too deeply & may compress a root, although a flexible catheter is unlikely to do lasting damage to a nerve root in the epidural space.

**Infection**  
epidural abscess & meningitis are infrequent complications of neuraxial techniques.

**Epidural haematoma**  
Inspite of the engorgement of epidural veins during pregnancy, epidural haematoma causing neurologic deficits is very rare in the obstetric population & perhaps the hypercoagulable state of pregnancy acts as a protective factor.

**Backache**  
Many studies have shown that epidural analgesia in labour does not result in postpartum backache. Short term (5-7 days) local tenderness at the site of the needle puncture occurs in about 50% of mothers.

**Maternal fever**  
In recent years there has been much discussion on the association of epidural analgesia during labour & maternal fever. Nulliparity, dysfunctional labour are significant co-factors in the fever attributed to epidural analgesia. It has been found that labour epidural analgesia was associated with maternal intrapartum fever which increased neonatal sepsis evaluation (NSE) rates, necessitating neonatal antibiotic treatment. Fever which is rarely $>38^\circ$C, related to epidural analgesia should not be the impetus to carry out sepsis screening in neonate.

**Bladder dysfunction**  
In some mothers epidural analgesia can result in difficulty in passing urine. Bladder distension must not be allowed to occur during labour & the insertion of a urinary catheter should be considered for mothers who are having difficulty passing urine or whose epidural analgesia has been in progress for greater than 6 hrs.

**Effect of epidural analgesia on the progress and outcome of labour**

NICE guidelines on Intrapartum care which are based on best available evidence, indicate that epidural analgesia

- is not associated with a longer first stage of labour or an increased risk of a caesarean birth.
-is associated with a longer second stage of labour and an instrumental birth.

The most important factors determining labour outcome however are anaesthetic & obstetric management. Therefore
- Low concentrations of local anaesthetic should be used to minimize motor block.
- Oxytocin should be used to augment labour when required.
- Maternal pushing in the second stage of labour should, if possible be delayed until the presenting part is visible or until 1 hr after reaching full cervical dilatation.

**Breast feeding** - The benefits of breastfeeding on neonate & infants wellbeing are well established. Breast milk provides adequate nutrients to the newborn while protecting the baby against infectious disease improving neonatal cognitive development & enhancing maternal-infant bonding. Whether or not neuraxial analgesia may impact breast feeding initiation & duration is controversial. Studies have found that neither epidural analgesia alone or epidural analgesia with fentanyl had any adverse effect on the initiation or duration of breast feeding. Low dose local anaesthetic/fentanyl regimens do not clinically affect breast feeding.

**Pharmacogenetics**

Clinicians are consistently confronted with variability in patients’ sensitivity to pain stimuli & their response to analgesic drugs. The relevance of pharmacogenetics in labour analgesia has been explored, by examining the effect of single nucleotide polymorphism(SNP) 304A>G located in the opioid mu-receptor(OPRM1) gene, on the response to intrathecal fentanyl in parturients in labour. Women with this mutant gene required less fentanyl and also requested supplemental analgesia at a greater cervical dilatation. 304A>G mutation in OPRM1 gene not only affected the potency of intrathecal fentanyl for labour analgesia, but also modulated pain tolerance. A thorough knowledge & understanding of pharmacogenetics is likely to help in the future to tailor analgesic therapy to suit patients’ needs.

**Conclusion:** Modern epidural techniques & medications have resulted in more consistent, predictable & effective analgesia during labour. Recent innovations in drug combinations and delivery systems have resulted in a flexible technique that meets the needs of most parturients in a safe and effective manner. The use of low concentrations of local anesthetics, combined with lipid-soluble opioids does not impede the progress of labor or depress the newborn. The addition of patient-controlled epidural analgesia and innovations using new technologies enhance patient satisfaction.
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