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Room F1

**OVERVIEW**

- What are ambulatory epidurals?
- What is meant by the term “ambulation”
- Ambulation after regional analgesia.
- Is it safe to ambulate after regional analgesia for labour?

**WHAT ARE AMBULATORY EPIDURALS ?**

Ambulatory epidurals are regional analgesic techniques which allow mothers requesting epidural analgesia to walk during labour. This is possible using low dose combinations of local anaesthetic and opioid which dramatically reduce the incidence of lower limb motor blockade, enabling mothers to walk, sit in a chair or stand upright. This was impossible with “traditional” epidurals using intermittent boluses of 0.25% bupivacaine which caused a high incidence of motor block in the legs.

An ambulatory or “mobile” epidural can be performed in two ways:

1. Combined spinal-epidural [CSE]. A CSE is commonly sited utilizing a single space needle-through-needle technique using a standard epidural needle such as a Portex 16G Tuohy needle through which a longer spinal needle, such as a Portex or B-D 119mm, 27G Whitacre spinal needle, is advanced into the subarachnoid space. The initial intrathecal injection results in rapid pain relief, usually within 5 minutes. Subsequent analgesia can be administered by intermittent bolus, continuous infusion or patient controlled epidural analgesia (PCEA) via the epidural catheter which is placed following the removal of the spinal needle. The initial intrathecal injection is often a low dose bupivacaine / opioid combination (e.g. Queen Charlotte’s Hospital regimen which consists of 2.5mg bupivacaine and 25µg fentanyl). Vercauteren et al first reported the use of the same low dose epidural mixture intrathecally with a CSE. In some UK institutions, 2.5–3 ml of a convenient pre-packaged low dose epidural mixture (0.1% bupivacaine and 2 µg/ml fentanyl), equivalent to 2.5–3 mg bupivacaine with 5–6 µg fentanyl, is used to provide the intrathecal injection. The optimum intrathecal bupivacaine/fentanyl combination providing rapid analgesia with minimal side effects is presently unknown. Intrathecal sufentanil 5-10µg with or without bupivacaine has also been used for labour analgesia. Following regression of intrathecal analgesia, epidural boluses (15 ml as required) or infusions (10-12 ml/hr) using similar low dose mixtures, can be administered.
2. An ambulatory epidural can also be initiated without the intrathecal component by administering 15ml of low dose epidural bupivacaine/fentanyl mixture without a traditional epidural test dose (e.g. 3 ml, 0.5% bupivacaine). The epidural technique will have a slower onset time than the CSE, but both should offer equivalent analgesia after 30 minutes.

**WHAT IS AMBULATION?**

Ambulation describes mothers who are able to walk and adopt other upright positions such as standing or sitting in a chair during the course of their labour.

**REDUCED MOTOR BLOCK AND AMBULATION**

The drive to improve labour analgesia has resulted in the reduction of lower limb motor block by reducing the dose of local anaesthetic. With CSE it has become easier to provide effective analgesia with a low dose of intrathecal local anaesthetic. CSE tends to produce less motor block than traditional (high concentration) epidurals. However, over the course of a normal labour, when the epidural catheter will be used for continuing analgesia after the intrathecal component has regressed, motor block is likely to be similar between CSE and epidural when modern low dose epidural solutions are used.

The lower incidence of lower limb weakness (compared to standard epidurals) led the CSE to be dubbed the “walking epidural”. In fact, parturients with low dose local anaesthetic and opioid combinations in their epidurals were walking in the 1980s. Approximately 90% of mothers can weight bear after standard intrathecal low dose opioid / local anaesthetic regimens [1], although the intensity of leg weakness and postural instability increases once maintenance epidural analgesia is started [2].

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The effect of ambulation on labour is controversial. In theory adopting the upright position may increase pelvic dimensions [4], reduce aortocaval compression and improve the force of uterine contractions [5]. However the potential benefits of ambulation on obstetric outcome have been disappointing. Nikodem, reviewing the upright versus recumbent position in both the first and second stage of labour, found minimal advantages in being upright [6, 7]. Equally importantly, adopting this position did not lead to any adverse maternal or foetal effects. Many earlier studies evaluating ambulation during labour are difficult to interpret since mothers often retired to their labour bed once contractions required analgesia. Those with epidurals would commonly receive high concentrations of local anaesthetic preventing further ambulation. The newer low dose techniques mean that ambulation is now possible even in the advanced stages of labour. Several studies have attempted to define the benefit / risk ratio of allowing women to walk during labour with regional analgesia. Nageotte et al, in a large study, randomized women to receive either CSE or a standard epidural regimen [8]. Among those allocated to receive a CSE, some were discouraged from walking while others were encouraged to walk. There were no significant differences in Caesarean section rate, incidence of dystocia, frequency of maternal or foetal complications or degree of overall satisfaction between the 2 groups. Interestingly most women who were encouraged to walk elected not to do so. Bloom et al's study, in which a third of women received epidurals, also showed that walking during labour did not affect obstetric outcome [9]. Collis et al randomized mothers receiving CSE to either stay in bed or to ambulate, and found no differences in labour parameters or obstetric outcome [10]. Vallejo et al used a low dose epidural ropivacaine regimen and found that walking or sitting did not shorten the time from epidural insertion to complete cervical dilatation [11]. Frenea et al criticized some of these earlier studies stating that the period of ambulation was either too short in comparison to the duration of labour or that the criteria for ambulation included sitting in a chair as well as walking [12]. His group went on to randomize mothers receiving low dose epidural analgesia to a period of prolonged ambulation (walking for more than 25% of the duration of the first stage of labour) or to be recumbent, but once again found no differences in obstetric outcome. A minor finding in this study was that the total amount of bupivacaine and oxytocin use was reduced in the ambulating group.

Recent studies from North America have focused on the effect on the epidural test dose on lower limb motor block and therefore ambulation. Cohen et al studied the ability to walk after a lidocaine / epinephrine test dose when mothers received low dose epidural analgesia and concluded, probably not surprisingly, that omitting the test dose improved the ability to ambulate [13]. A similar study by Calimaran et al looked at the effect of a lidocaine / epinephrine test dose after CSE and made the same conclusions about omitting the test dose [14].

#### **SAFETY ISSUES RELATING TO BALANCE WHILE AMBULATING**

In the current medico legal climate, many anaesthetists are concerned about mothers falling during ambulation following epidural analgesia. A fall in a pregnant patient whilst ambulating with an epidural is naturally of concern, even though only one such case has been reported in the literature [15]. Certainly motor block must be absent to allow the mother to walk. If minor degrees of motor block are present walking is probably inadvisable, although some units still allow the mother to stand by the bed or sit in a chair.

- Lower limb motor power should be assessed very carefully. Evaluating hip flexion using straight leg raising against resistance was originally used at Queen Charlotte's Hospital prior to ambulation. Other workers have used other methods including asking mothers to perform a modified knee bend [15]. Since motor block will increase with time regardless of whether an intermittent bolus or infusion method is used, it is important to assess lower limb motor power prior to each ambulation.
- Somatosensory inputs such as proprioception from joint receptors are needed to maintain accurate balance [16]. Apart from simple clinical tests (using distal joint displacement to measure proprioception and a tuning fork to evaluate vibration sense) to assess dorsal column function (DCF), more invasive methods such as somatosensory evoked potentials (SSEP) have also been used after low dose epidurals.
- Normal balance and walking depend not only on somatosensory input to the brain but also information from visual and vestibular receptors [17, 18]. A deficiency in one of these systems can be compensated by increased input from the other two systems. For example, patients with chronic vestibular disorders may compensate by becoming more dependent on visual information for balance control.

Buggy et al found a 66% incidence of DCF abnormalities following 15ml of 0.1% bupivacaine with 2µg/ml fentanyl epidurally in labouring women [16]. Since a 15mg bupivacaine (3ml of 0.5% bupivacaine) test dose was used prior to the main dose, the high incidence of abnormal signs could have been related to a total dose of 30mg bupivacaine. Parry et al compared patients getting labour analgesia with low dose CSE and low dose epidural (without a test dose), with patients receiving 10mg intrathecal bupivacaine for elective caesarean section. They found only a 7% incidence of dorsal column abnormalities in the low dose groups in contrast to a 97% incidence in the caesarean section group [19].

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More recently, computerised dynamic posturography (CDP) has been used to accurately evaluate balance function after ambulatory CSE [20]. CDP is a sophisticated method assessing the relative contributions of somatosensory, visual and vestibular inputs in maintaining balance. The subject stands in front of a 3-sided visual surround on a pressure sensitive force plate, which records the amount of patient sway during each of the test protocols. These protocols include independent movements of both the visual surround and the force plate in an anterior-posterior direction. This technique has been extensively validated in a range of subjects with both normal and abnormal balance function including patients with vestibular disorders, following weightlessness in astronauts, in the elderly, and also following day case anaesthesia. Balance function was assessed in a group of volunteers receiving epidural infusions of ropivacaine and bupivacaine [21]. Posturography proved to be a sensitive index of balance function between the different infusion regimes. Pickering et al found no significant differences in sensory or motor co-ordination scores between mothers receiving low dose CSE for labour analgesia in comparison to pregnant controls. Interestingly 3 patients in the CSE group with an abnormal clinical Romberg's test had a normal SOT2 score (a quantified Romberg's test). This serves to illustrate the subjective nature of this clinical sign. Further posturographic work using the Balance Master 6.1, the updated version of the original CDP Equitest machine used by Pickering et al, has assessed sway while pregnant patients are actually walking on a 1.5m pressure sensitive platform. Davies et al, using the Balance Master 6.1, studied 50 patients after ambulatory labour CSE as well as both 50 pregnant and 50 non-pregnant controls and only found differences between the pregnant and non-pregnant control groups [22]. Non-pregnant women scored significantly better results in 6 of the 13 measured balance function parameters compared to both the CSE and pregnant control groups. Compared with the non-pregnant subjects, the pregnant groups generated less force standing up from the sitting position ( $P < 0.0001$ ), walked more slowly ( $P = 0.0067$ ) and took shorter steps ( $P < 0.0001$ ). They also took longer to step up onto and over a 20 centimeter-high obstacle ( $P < 0.0001$ ) and they generated less force while stepping up. Initial intrathecal analgesia in labouring women did not significantly affect performance in comparison to the pregnant controls. 34% of women in the CSE group required supplemental epidural analgesia following the initial intrathecal injection ( $n=17$ ) before testing; they had significantly impaired balance function in four tests compared to those receiving an intrathecal injection only ( $n=33$ ). These studies suggest that being pregnant at term significantly affects balance function, although initial low dose CSE analgesia does not impair function further. Subsequent supplemental epidural analgesia (intermittent boluses or continuous infusions) may have a detrimental effect on balance, and properly designed studies are awaited. This study supports the practice of allowing labouring women with initial low-dose CSE analgesia to ambulate, but indicates that further studies need to be carried out on the effects of subsequent epidural supplementation.

Extrapolating the results from the posturography studies carried out with mothers receiving regional analgesia, one would expect lower limb motor block to increase over the course of a normal labour since local anaesthetic mixtures will continue to be administered either by intermittent bolus, continuous infusion or PCEA. This could lead to reduced balance function as labour progresses and a greater risk of falls. Therefore it is prudent to test lower limb power each time a mother wishes to ambulate with regional analgesia.

#### **MATERNAL HYPOTENSION**

Postural hypotension does not appear to be a significant problem when adopting the upright position or when walking after ambulatory epidurals [24]. Rapid onset of a profound sympathetic block may make the mother hypotensive, and this is clearly seen during spinal blockade for caesarean section. With low dose mixtures used for labour analgesia, the onset of sympathetic block is much slower, and the mother is able to compensate for a decrease in cardiac afterload by increasing stroke volume (assuming venous return is maintained by avoiding aortocaval compression). Two studies of mobile epidurals at Queen Charlotte's Hospital showed that maternal blood pressure was well maintained while ambulating [24], and that foetal heart decelerations were fewer while standing than while lying [25]. These favourable results could be attributed to the complete absence of aortocaval compression while erect, together with reflex maternal tachycardia.

#### **FOETAL MONITORING**

Intrapartum foetal monitoring during ambulation is another concern. Although telemetry is an option in this situation, it is expensive and rarely available in obstetric units. However, research and experience have shown that intermittent monitoring is adequate in all but high risk obstetric patients

In conclusion, if mothers wish to ambulate after low dose CSE or epidurals, they should not be discouraged, providing the following recommendations are followed:

1. The labour should be judged to be of low risk.
2. No lower limb motor block exists. Testing should occur every time a mother wishes to ambulate.
3. The mother feels confident enough to ambulate.
4. The mother is accompanied at all times while ambulating.

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