CSE for Labour Analgesia

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Overview:

- History
- Practical issues: technique / failure rates
- Safety issues: balance function during ambulatory CSEs / epidurals

History:

A combined spinal epidural (CSE) technique is a combination of both a spinal and an epidural block. A CSE allows the anaesthetist the flexibility of using the advantages of both techniques with very few associated problems. Although there are several methods to perform a CSE, by far the most popular way to perform a CSE is to use a single interspace, needle through needle technique (1). Usually a definite dural "click" is felt when the spinal needle enters the subarachnoid space. Entry is confirmed by seeing CSF at the hub of the spinal needle when its stillette is removed. After intrathecal drug injection, the spinal needle is removed and the epidural catheter placed.

CSEs have enjoyed the most success in obstetrics not only to provide anaesthesia for Caesarean section (2), but also to provide rapid analgesia for labour (3-6). Probably the first use of CSE for labour analgesia was by Barbara Leighton's group from Philadelphia, USA in 1988 (7). The rapid onset of analgesia using either opioids alone or a local anaesthetic / opioid mixture, followed by the ability to continue labour analgesia with the epidural catheter led to a surge in popularity for CSE for labour especially in the USA. In the UK the CSE technique was introduced for labour analgesia by Barbara Morgan and her colleagues in the early 1990s at Queen Charlotte's Hospital in London (8).

Technical failure / Locking CSE needles

One of the main problems, especially for novices, of the needle through needle CSE technique, is difficulty immobilising the spinal needle at the time of intrathecal injection. At this stage the long spinal needle is held in place only by the dura mater. At this point there is a risk of needle displacement during syringe connection or intrathecal injection. Failure rates with the spinal injection can in fact be as high as 10% when the technique is first introduced into a unit (9), but usually falls to very low levels with experience. To reduce the chance of spinal needle movement during injection, various locking spinal needles have been developed (10), which can be locked to the epidural needle at the hub including the recent CSE cure locking device (11).

Needle through needle CSE sets. Any long spinal needle can be used with an epidural needle but due to different hub designs and shaft lengths success is variable. Joshi et al suggested that the length of the spinal needle protrusion should be greater than 13 mm (12), as a 10-mm protrusion distance caused technical failures in 15% of patients. The SIMS Portex CSEcure® (11) and the B-D Adjustable Durasafe® CSE (10) system both have 15 mm maximum protrusion distances. The spinal needle should however be inserted only until the dura is punctured and CSF seen.

Further advancement may risk nerve damage or cause the needle to pass through the front of the dural sac and hit the posterior wall of the vertebral column.

Drug regimes:

CSEs have become increasingly popular to provide pain relief during labour, mainly due to the rapidity of onset compared to standard epidural analgesia (8,9,13,14). These regimes also allow most mothers the ability to walk during their labour due to the low incidence of motor block. It is important to remember that these "ambulatory epidurals" can be provided using low dose epidural and CSE regimes both which have a low incidence of lower limb motor block. Some typical CSE regimes are given below:

- Spinal dose = 2.5 mg bupivacaine + 25 µg fentanyl; epidural dose = 0.1% bupivacaine + 2 µg/ml fentanyl (15 ml intermittent bolus or 8-15 ml/h infusion) / Queen Charlotte's Hospital Regime
- Spinal dose = 2.5 ml of epidural mixture (0.1% bupivacaine + 2 µg/ml fentanyl) = 2.5 mg bupivacaine + 5 µg fentanyl; epidural dose = as above / Royal Free Hospital Regime
- Spinal dose = 2.5 mg bupivacaine + 5 µg sufentanil; epidural infusion of 0.0625% bupivacaine + 0.25 µg/ml sufentanil at 10-12 ml/h

At our institution all our low dose epidural mixtures (LDM) are pre-mixed in syringes by the hospital pharmacy. During the previous 4 years, for convenience 2.5 ml of the epidural LDM (equivalent to 2.5 mg bupivacaine + 5 µg fentanyl) is used for the initial spinal injection and appears to provide equally good labour analgesia in the majority of patients. The use of the same epidural mixture for the intrathecal injection has also been reported by Vercauteren et al (15).

Balance function

- Many anaesthetists are concerned about mothers falling during ambulation following CSE / epidural analgesia (16). Certainly motor block must be absent to allow the mother to walk. If a mother can sustain a straight leg raise against a downward force (9), then it is probably safe to get her out of bed. If she has minor degrees of motor block she should not walk, but can be encouraged to stand by the bed or sit in a chair. Since motor block will increase with time regardless or whether an intermittent bolus (13) or infusion method (17) is used, it is important to assess lower limb motor power each time prior to ambulation.
- Somatosensory inputs such, as proprioception from joint receptors, via the dorsal columns of the spinal cord are needed to maintain accurate balance (18). 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 (SEPs) have also been used after low dose epidurals (19).
- Normal balance and walking depend not only on somatosensory input to the brain but also information from visual and vestibular receptors (20,21).

Buggy et al found a 66% incidence of DCF following 15 ml of 0.1% bupivacaine with 2 µg/ml fentanyl epidurally in labouring women (18). Since a 15 mg bupivacaine (3 ml of 0.5% bupivacaine) test dose was used prior to the main epidural dose, the high incidence of abnormal signs should be related to a total dose of 30 mg bupivacaine. Parry et al from our unit comparing low dose labour CSE and low dose epidural, without a test dose, with patients receiving 10 mg intrathecal bupivacaine for elective Caesarean section, 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 (22). Platt et al reported no DCF abnormality in patients receiving low dose CSE and further suggested that the mothers' own judgement regarding her ability to walk should also be taken into consideration (23). Bell et al from our unit recording SEPs after posterior tibial nerve stimulation found no difference in dorsal column transmission between patients with CSEs and pregnant controls awaiting elective caesarean section or induction of labour (19).

More recently we have used computerised dynamic posturography (CDP) to accurately evaluate balance function after ambulatory CSE (24).

CDP is a sophisticated method of individually assessing the relative contributions of somatosensory, visual and vestibular inputs to maintain accurate balance. Essentially the subject stands in front of a 3-sided visual surround on a pressure sensitive forceplate, 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 forceplate 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 (25), in the elderly (26), and also following day case anaesthesia (27). Of particular interest has been the use of posturography to assess balance function in a group of volunteers receiving epidural infusions of ropivacaine and bupivacaine (28). In this study posturography proved to be a sensitive index of balance function between the different infusion regimes. Within our unit, 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, which is a quantified Romberg's test. This merely 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 5 foot pressure sensitive platform (29). This has led to a more dynamic assessment of balance during ambulation. McLeod et al from our unit, utilising the Balance Master 6.1, studied patients after ambulatory labour CSE as well as both pregnant and non-pregnant controls and found only differences between the pregnant and non-pregnant control groups. Pregnant patients walked with a wider based gait and swayed more on turning 180 degrees. There were no differences between pregnant patients after CSE compared to pregnant controls, suggesting that providing lower limb motor power is satisfactory, it may be as safe for patients to mobilise after low dose epidurals as any pregnant woman.

Conclusion:

Over the past 10 years or more labour regional analgesic techniques have become inherently safer primarily due to the increasing use of low dose local anaesthetic / opioid combinations which have the added advantage of permitting ambulation for short periods. The introduction of low dose CSE for labour analgesia with its distinct advantage of providing rapid pain relief has added a useful technique to the anaesthetists' armamentarium.

References:

1. Rawal N, Van Zundert A, Holmstrom B, Crowhurst JA. Combined spinal-epidural technique. Reg Anesth 1997;22:406-23
2. Carrie LE. Epidural versus combined spinal epidural block for caesarean section. Acta Anaesthesiol Scand 1988;32:595-6
3. Honet JE, Arkoosh VA, Norris MC, ym. Comparison among intrathecal fentanyl, meperidine, and sufentanil for labor analgesia. Anesth Analg 1992;75:734-9
4. Campbell DC, Camann WR, Datta S. The addition of bupivacaine to intrathecal sufentanil for labor analgesia. Anesth Analg 1995;81:305-9
5. Campbell DC, Banner R, Crone LA, ym. Addition of epinephrine to intrathecal bupivacaine and sufentanil for ambulatory labor analgesia. Anesthesiology 1997;86:525-31
6. Burnstein R, Buckland R, Pickett JA. A survey of epidural analgesia for labour in the United Kingdom. Anaesthesia 1999;54:634-40
7. Leighton BL, DeSimone CA, Norris MC, Ben-David B. Intrathecal narcotics for labor revisited: the combination of fentanyl and morphine intrathecally provides rapid onset of profound, prolonged analgesia. Anesth Analg 1989;69:122-5
8. Collis RE, Baxandall ML, Srikantharajah ID, ym. Combined spinal epidural analgesia with ability to walk throughout labour. Lancet 1993;341:767-8
9. Collis RE, Baxandall ML, Srikantharajah ID, ym. Combined spinal epidural (CSE) analgesia: Technique, management, and outcome of 300 mothers. Int J Obstet Anesth 1994;3:75-81
10. Hoffmann VL, Vercauteren MP, Buczkowski PW, Vanspringel GL. A new combined spinal-epidural apparatus: measurement of the distance to the epidural and subarachnoid spaces. Anaesthesia 1997;52:350-5
11. Stocks GM, Hallworth SH, Fernando R. Evaluation of a spinal needle locking device for use with the combined spinal epidural technique. Anaesthesia 2000:In Press
12. Joshi GP, McCarroll SM. Evaluation of combined spinal-epidural anesthesia using two different techniques. Reg Anesth 1994;19:169-74
13. Collis RE, Davies DW, Aveling W. Randomised comparison of combined spinal-epidural and standard epidural analgesia in labour. Lancet 1995;345:1413-6
14. Morgan BM, Kadim MY. Mobile regional analgesia in labour. Br J Obstet Gynaecol 1994;101:839-41
15. Vercauteren M, Bettens K, Van Springel G, ym. Intrathecal labor analgesia: Can we use the same mixture as is used epidurally? Int J Obstet Anesth

1997;6:242-246

16. Breen TW, Shapiro T, Glass B, ym. Epidural anesthesia for labor in an ambulatory patient. Anesth Analg 1993;77:919-24
17. Russell R, Reynolds F. Epidural infusion of low-dose bupivacaine and opioid in labour. Does reducing motor block increase the spontaneous delivery rate? Anaesthesia 1996;51:266-73
18. Buggy D, Hughes N, Gardiner J. Posterior column sensory impairment during ambulatory extradural analgesia in labour. Br J Anaesth 1994;73:540-2
19. Bell R, Parry MG, Fernando R, ym. Assessment of dorsal column function using somatosensory evoked potentials after ambulatory combined spinal epidural analgesia for labour. Int J Obstet Anesth 1997;6:199-200
20. Nashner LM. Practical biomechanics and physiology of balance. Kirjassa: Handbook of Balance Function Testing s. 261-79 Toim. Jacobson GP, Newman CW, Kartush JM. Mosby-Year Book, Chicago 1993.
21. Diener HC, Dichgans J. On the role of vestibular, visual and somatosensory information for dynamic postural control in humans. Kirjassa: Progress in Brain Research s. 253-62. Toim. Pompeiano O, Allum JHJ. Elsevier, New York 1988.
22. Parry MG, Fernando R, Bawa GPS, Poulton BB. Dorsal column function after epidural and spinal blockade: Implications for the safety of walking following low-dose regional analgesia for labour. Anaesthesia 1998;53:382-387
23. Plaat F, Singh R, Alsoad SM, Crowhurst JC. Selective sensory blockade with low dose combined spinal / epidural allows safe ambulation in labour: a pilot study. Int J Obstet Anesth 1996;5:220
24. Pickering AE, Parry MG, Ousta B, Fernando R. Effect of combined spinal-epidural ambulatory labor analgesia on balance. Anesthesiology 1999;91:436-41
25. Paloski WH, Black FO, Reschke MF, ym. Vestibular ataxia following shuttle flights: effects of microgravity on otolith-mediated sensorimotor control of posture. Am J Otol 1993;14:9-17
26. Cohen H, Heaton LG, Congdon SL, Jenkins HA. Changes in sensory organization test scores with age. Age & Ageing 1996;25:39-44
27. Gupta A, Ledin T, Larsen LE, ym. Computerized dynamic posturography: a new method for the evaluation of postural stability following anaesthesia. Br J Anaesth 1991;66:667-72
28. Zaric D, Nydahl PA, Adel SO, ym. The effect of continuous epidural infusion of ropivacaine (0.1%, 0.2% and 0.3%) on nerve conduction velocity and postural control in volunteers. Acta Anaesthesiol Scand 1996;40:342-9
29. McLeod A, Fernando R, Page F, ym. An assessment of maternal balance and gait using computerized posturography. Anesthesiology 1999;90:A6

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