CONTINUOUS SPINAL ANALGESIA – INITIAL EXPERIENCES WITH DIFFERENTIAL SENSORY BLOCK AND LABOUR PAIN RELIEF

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ABSTRACT

This report describes the use of microcatheters to provide continuous spinal analgesia for the relief of labour pain. Bupivacaine 0.025% was administered through a 28G spinal microcatheter resulting in a differential block which provided effective labour pain relief. Conduction by the smaller pain fibres from the uterus were blocked, while relatively sparing the larger A fibres. Motor power, sense of touch, and discrimination between blunt and sharp objects were therefore left relatively intact. Patients were thus spared the discomfort of motor paralysis and an intense sensory block. No patient had hypotension (blood pressure fall greater than 20%). However one patient suffered a severe post-dural puncture headache which required an epidural blood patch. Continuous intra-thecal spinal analgesia is a potential alternative to continuous epidural analgesia in the relief of labour pain.

Keywords: *labour pain, spinal microcatheter, differential blockade*

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INTRODUCTION

The characteristics of the ideal method of labour pain relief include safety, efficacy and ease of administration. Continuous infusion of dilute solutions of bupivacaine into the epidural space produces a differential sensory block. Pain relief is often achieved with minimal motor blockade and without the discomfort of an intense sensory block. Epidural analgesia however requires a high degree of expertise from the anaesthetist and vigilant monitoring from the nursing staff. Complications include systemic toxicity from systemic absorption, inadvertent intravascular administration, accidental dural puncture and nerve injuries. In addition total spinal anaesthesia may occur from unrecognised dural puncture and catheter tip migration.

Continuous subarachnoid spinal analgesia may circumvent some of these problems. Previous work at our institution (unpublished data) revealed that intra-thecal administration of solutions of bupivacaine 0.1% or less frequently resulted in sensory block without motor paralysis. This is advantageous in labour pain relief. We therefore conducted a pilot study and found that labour pain could be alleviated with subarachnoid injections of 0.025% bupivacaine. Not only was motor power spared, but there appeared to be a difference in the type of sensory fibres blocked. Patients were able to feel touch and discriminate between sharp and blunt objects and yet were free from labour pain. In view of these promising results we therefore decided to conduct a controlled study on continuous spinal analgesia. We abandoned this study following several case reports of permanent neurological nerve deficits associated with the use of continuous spinal analgesia. This report describes our initial experiences with this technique.

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METHOD

Approval was obtained from the Hospital Ethics Committee and written consent obtained from patients. Only ASA I patients were studied. All patients received 10 ml/kg of lactated Ringer's solution administered over 15 minutes. Patients were then positioned in the left lateral position, and lumbar puncture performed at the L3/4 intervertebral space using a 22G Quincke spinal needle (CoSpan, Kendall Healthcare; Mansfield, MA). A bolus dose of 6 ml 0.025% bupivacaine was then administered through the spinal needle. The level at which the subarachnoid space was reached was noted and a 28G microcatheter was then introduced 3 to 4 cm in the subarachnoid space. An infusion of 6 ml/hr of 0.025% bupivacaine was commenced. Bupivacaine 0.025% was obtained by diluting isobaric 0.5% bupivacaine with physiological normal saline. Haemodynamic monitoring was achieved by automated non-invasive blood pressure measurement (Dinamap).

Severity of pain was assessed by a visual analogue scale (VAS) consisting of a 100 mm line prior to administration of the local anaesthetic and at hourly intervals. Sensory levels were assessed by sharp and blunt discrimination at 15-minute intervals for the first hour followed by hourly intervals. Motor blockade was graded on a modified Bromage score at similar intervals. One point was allocated for the inability to flex each hip, knee and ankle joint. Thus the maximum score for motor blockade was 6 and a score of 0 indicated the absence of any motor blockade. Patients were interviewed on the day of delivery and on the third and seventh days after delivery.

CASE 1

This 27-year-old patient weighed 65.5 kg and measured 153 cm in height. Insertion of the catheter was accompanied by transient paraesthesia down her left lower limb. After the procedure her average VAS score fell from 56 to 13. On two occasions she requested for additional pain relief and boluses of 4 ml of bupivacaine 0.025% proved effective in alleviating her pain. She was in labour for 12 hours after the catheter was introduced. Progress of her labour was deemed poor and the baby was delivered by Caesarean section under general anaesthesia. Her highest sensory level as indicated by loss of ability to discriminate between a sharp and blunt object was L3. There was no motor

blockade until after 6 hours. The highest motor blockade occurred after 10 hours and the score was 4. Post-operatively the patient was interviewed and found not to have any headache nor nerve injury. This was her first delivery and she assessed the pain relief as 'very good' and was willing for a similar procedures for future deliveries.

CASE 2

This 33-year-old primigravida was 151 cm tall and weighed 51.7 kg. Her VAS score fell from 68 to an average score of 21 after an uneventful catheter insertion. No motor blockade was detectable and there was no sensory level at which she was unable to discriminate between a blunt and sharp object. The baby was delivered by Caesarean section under general anaesthesia 4 hours later when foetal distress was detected. She described her quality of pain relief as 'excellent' and was willing to have a similar mode of pain relief in future.

CASE 3

The procedure was uneventful in this 27-year-old patient who was experiencing her first delivery. This patient had a height of 146 cm and weighed 46 kg. Fifteen minutes after the infusion was started the patient complained of persistent low back pain. This was eradicated by 4ml of bupivacaine 0.05% administered through the catheter. No motor blockade was detected and the highest sensory level was S_2. After approximately 4 hours she had a normal vaginal delivery. Her VAS scores were 10 before commencement of spinal analgesia and 0 after. Two hours after delivery, she complained of a severe headache with symptoms typical of a postdural puncture headache. Her headache was immediately and completely relieved by an epidural blood patch. She assessed the quality of her pain relief as 'excellent' but was undecided as to whether she would be willing to undergo a similar procedure in future.

CASE 4

The catheter was inserted without difficulty in this 29-year-old lady. This was her first full term pregnancy. Her height and weight were 157 cm and 69 kg respectively. Prior to insertion of the catheter her VAS score was 30. Her VAS score after the procedure was 12. No supplementation was necessary. Motor blockade was not detected and the highest sensory level was that of S_2. She delivered vaginally after 2 hours. This patient did not develop any headache and assessed the quality of analgesia as 'very good'. She indicated her willingness to have continuous spinal analgesia for a future delivery.

DISCUSSION

Subarachnoid catheterisation through a 18G spinal needle to provide pain relief for labour was first described by Carpenter et al in 1951[1]. Spinal headache developed in 10% of patients and not surprisingly the technique has not been popular for obstetric use. Benedetti and Tiengo described the administration of intermittent doses of bupivacaine 0.25% through microcatheters to provide relief from labour pain. None of their patients developed a spinal headache and they suggested further investigation with a continuous infusion technique with different local anaesthetic concentrations[2].

Narcotics and local anaesthetic agents are the drugs most commonly used to provide continuous spinal analgesia. Spinal narcotics are associated with maternal drowsiness, vomiting, itch and urinary retention[3]. The potential for respiratory depression necessitates vigilant monitoring thus increasing the burden of the labour suite staff. The possibility of delayed respiratory depression extends the duration of monitoring required.

Spinal analgesia with commonly used local anaesthetic solutions often leads to hypotension, paralysis and a widespread, dense sensory block. Hypotension is potentially detrimental to the well-being of the baby and the use of vasoconstrictors could further compromise uteroplacental blood flow. A complete sensory and motor block is uncomfortable to some patients.

Experience from epidural analgesia has shown that use of dilute local anesthetic solutions provides a less intense sensory block with minimal motor blockade[4-6]. Epidural analgesia is effective and safe when administered by experienced and properly trained staff. However, low back pain, suprapubic pain and perineal pain may be difficult to treat even when combinations of local anaesthetic solutions and narcotics are used. There are, in addition, the risks of subarachnoid puncture and total spinal anaesthesia. Vigilant nursing care is required to detect and treat this infrequent complication.

Continuous spinal analgesia with dilute solution of local anaesthetic removes the risk of total spinal anaesthesia resulting from unrecognised subarachnoid puncture and catheter tip migration. Spinal analgesia is easier to perform as there is no risk of inadvertent dural puncture, and cerebrospinal fluid provides a definite end-point. Toxicity does not occur due to the reduced anaesthetic drug requirements in subarachnoid spinal analgesia. Direct contact of local anaesthetic solutions with nerve roots may provide better pain relief than epidural analgesia. The technological development of the spinal microcatheter combined with a differential block therefore appears promising. Theoretically, postdural puncture headache should be minimised, and the discomfort of paralysed and completely numb lower limbs avoided. To date there have been no reports on the use of differential blockade in continuous subarachnoid spinal analgesia with dilute solutions of bupivacaine.

This report demonstrates that differential blockade can be achieved with 0.025% bupivacaine. The loss of motor power and the ability to discriminate between blunt and sharp objects were relatively spared. All patients however described feeling that the skin over their lower limbs 'was thickened'. This indicates that a differential sensory block had left the larger A fibres unblocked while interfering with neural transmission of smaller fibres. Indeed the extent of the block as indicated by the motor blockade scores and dermatological sensory levels were far below what would have been required to provide labour pain relief. First-stage labour pain may be blocked at the T11 and T12 thoracic ganglia level, or by blocking the sympathetic chain between L5 and T12[7]. No patient had hypotension (as defined by a fall in blood pressure exceeding 20% of the blood pressure before the procedure).

Finer spinal needles and microcatheters should reduce the incidence of spinal headache. The patient with a spinal headache serves as a reminder that postdural puncture headache is likely to remain a problem in this relatively high risk group. Unfortunately, not only was the problem of postdural headache not resolved, but the use of microcatheters has been associated with serious nerve injuries. After these four patients were studied, four patients with cauda equina syndrome following the use of microcatheters were reported[8]. Subsequent to this a further two patients with permanent nerve injuries were reported[9]. It was therefore decided to discontinue this study until the issue of nerve injury had been resolved.

The cause of the nerve injuries remains controversial. Reports suggest that lignocaine 5% may be neurotoxic and that the use of microcatheters results in maldistribution of local anaesthetic agent resulting in certain nerve roots receiving the concentrated drug[10]. Should this prove to be the case, bupivacaine 0.025% would be safer for administration through microcatheters. It was

also noted that several of the patients who suffered irreversible nerve injury received a rather high dose of lignocaine 5%.

In conclusion, the use of bupivacaine 0.025% results in the smaller pain fibres being blocked while sparing the larger motor and sensory fibres. Blood pressure changes were not significant in any of the four patients studied. A large controlled study is required before a recommendation on the dosage of bupivacaine 0.025% is made. Unfortunately the problem of serious nerve injury has to be resolved first. Spinal headache may limit the use of this technique. Controlled studies are required to establish the efficacy and safety of 'continuous differential spinal analgesia'.

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