Combined spinal-epidural analgesia in advanced labour

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The combined spinal-epidural technique is a modification of epidural analgesia which combines the rapid onset of spinal analgesia with the flexibility of an epidural catheter. We sought to evaluate the effectiveness of an intrathecal opioid – low-dose local anaesthetic combination for parturients in advanced labour, a setting where satisfactory epidural analgesia is often difficult to achieve. The technique was evaluated in an open-label, non-randomized trial using parturients in advanced, active labour for the provision of pain relief during the late first stage and second stage of labour. Thirty-eight term parturients in active, advanced labour received a spinal injection of bupivacaine 2.5 mg and sufentanil, 10 μg, via a 25- or 27-gauge Whitacre needle placed into the subarachnoid space through a 17- or 18-gauge Weiss epidural needle which had been placed into the epidural space. This was followed by placement of an epidural catheter for supplemental analgesia if required. Onset of analgesia was noted by asking patients if their contractions were comfortable. Motor blockade was assessed using the Bromage criteria. Patients were asked if they experienced either pruritus or nausea on a four-point scale (none, mild, moderate, severe). The mean cervical dilatation at placement of the spinal medication was 6.1 ± 2.2 cm. Thirty-two patients had spontaneous vaginal delivery, two were delivered by outlet forceps, and four by Caesarean section. Onset of analgesia was rapid (< five minutes) in all cases. Twenty-three patients (60%) delivered vaginally with no additional anaesthetic. The remaining 15 had supplemental local anaesthetic given via the epidural catheter, a mean of 123 ± 33 min after the original spinal dose. Side effects were limited to pruritus in eight (21%) patients, and mild lower extremity motor weakness in one patient. One patient experienced transient hypotension. No patient developed postdural puncture headache. This technique allows for profound analgesia with a rapid onset and few bothersome side effects. In particular, the absence of motor blockade may facilitate maternal expulsive efforts or positioning during the second stage of labour.

La technique combinée rachi-épidurale est une modification de l'analgésie épidurale qui associe le court délai d'une analgésie rachidienne avec la maniabilité d'un cathéter épidural. Nous évaluons l'efficacité de la combinaison d'un opiacé intrathécal et d'une faible dose d'anesthésique local chez des parturientes en travail avancé, moment où une analgésie épidurale satisfaisante est souvent difficile à obtenir. Cette technique est évaluée au cours d'une étude ouverte, non aléatoire chez des parturientes en travail avancé et actif, afin d'avoir une disparition des douleurs pour la fin de la première étape et à la deuxième étape du travail. Trente huit patientes à terme en travail actif et avancé reçoivent une injection rachidienne de 2,5 mg de bupivacaïne et de 10 μg de sufentanyl par une aiguille Whitacre de calibre 25 ou 27 gauge placée dans l'espace sous-arachnoïdien à travers une aiguille épidurale Weiss de calibre 17 ou 18 qui est placée dans l'espace épidural. Ensuite, on place le cathéter épidural pour une analgésie supplémentaire si nécessaire. Le début de l'analgésic est appréciée en interrogeant les patientes sur leur confort pendant les contractions. Le bloc moteur est évalué selon les critères de Bromage. On demande aux patientes si elles éprouvent du prurit ou des nausées dont l'intensité est graduée en quatre niveaux (aucun, léger, modéré, sévère). La dilatation moyenne du col au moment de l'installation de l'analgésie rachidienne est de 6,1 ± 2,2 cm. Trente-deux patientes ont accouché spontanément par voie vaginale, deux ont été accouchées au moyen d'un forceps de sortie, et quatre par césarienne. Le début de l'analgésie est rapide (<5 min) dans tous les cas. Vingt-trois patientes (60%) ont accouché par voie vaginale sans adjonction d'anesthésique. Les 15 restantes ont reçu un supplément d'anesthésique local par le cathéter épidural, à environ 123 ± 33 min après la dose rachidienne de départ. Les effets secondaires se sont limités au prurit chez huit patientes (21%), et à une faiblesse légère des extrémités inférieures chez une patiente. Une patiente a eu une hypotension transitoire. Aucune patiente n'a eu de céphalée postponction dure-mérienne. Cette technique procure une analgésie intense avec un début rapide et peu d'effets secondaires

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ennuyeux. En particulier, l'absence de bloc moteur peut faciliter les efforts maternels d'expulsion ou de positionnement pendant la deuxième étape du travail.

Regional analgesia is a popular and effective means of providing pain relief during labour. Epidural analgesia, using local anaesthetics either with or without epidural opioids, is a popular technique.[1] In particular, the use of epidural opioids with low-dose local anaesthetic solutions for continuous epidural infusion has allowed for excellent analgesia with a low incidence of side effects such as hypotension or motor blockade.[2-6] Recently, the use of a combined spinal-epidural technique has gained popularity in a variety of clinical settings.[5-13] In early labour, this technique may allow for pure opioid analgesia to be given without fear of local anaesthetic-induced side effects. However, pure spinal opioid analgesia is often less than optimal for the patient in advanced labour, and epidural analgesia is often accompanied by a slow onset time for the patient in severe pain. A recent report describes the successful use of an intrathecal bupivacaine (2.5 mg) and fentanyl (25 μg) combination for patients in early labour.[13] We sought to evaluate the use of a similar regimen using sufentanil, 10 μg plus low-dose local anaesthetic (bupivacaine, 2.5 mg) for the patient in advanced labour who requests regional anaesthesia. We specifically chose a short-acting opioid (sufentanil), rather than morphine, because the long latency period, prolonged duration, and high incidence of side effects associated with intrathecal morphine was not felt to be desirable in this patient population.[5-7]

Methods

The protocol was approved by the Human Subjects Committee of our hospitals, and all patients consented to combined spinal-epidural analgesia. Inclusion criteria were a cervical dilatation of greater than five cm or a history of fast labours. All patients had uncomplicated medical and obstetric histories, were receiving an intravenous infusion of lactated Ringer's solution, and had normal continuous electronic fetal heart monitoring. Upon request for analgesia, a standard 3½ inch, 17- or 18-gauge epidural needle was inserted into the epidural space. A $4^{11}/_{16}$ inch 25 or 27 gauge, Whitacre point spinal needle (Becton-Dickinson, Franklin Lakes, NJ) was inserted through the epidural needle into the subarachnoid space. Proper position was confirmed by free flow of clear cerebrospinal fluid. One ml of a solution containing 2.5 mg $\times$ ml^{-1} of isobaric bupivacaine without dextrose (Sensorcaine, Astra, Westboro, MA) and 2 ml containing 10 μg $\times$ 2 ml^{-1} of sufentanil (Janssen, Piscataway, NJ) in a total volume of 3 ml was injected into the subarachnoid space. The spinal needle was removed and a 20-gauge epidural catheter was placed 2–3 cm into the epidural space, but no medications were injected via this catheter. When additional analgesia was requested by the patient, the epidural catheter was used for local anaesthetic injection (bupivacaine, 0.25% or 2-chloroprocaine 3%). These medications were given in 3 ml incremental doses until satisfactory analgesia was achieved. Onset of analgesia was noted by asking patients at five-minute intervals following drug injection if their contractions were comfortable. Duration of analgesia was defined as the time from drug injection until first request for additional pain relief. (Duration of analgesia was only recorded for those patients who actually requested additional medications. This variable was not relevant in those who delivered without further analgesics other than the original intrathecal injection). Motor blockade was assessed using the Bromage criteria (0 = full ability to move legs, I = ability to move toes and partially move knees, II = ability to move toes but not knees, III = inability to move toes or knees). Patients were asked if they experienced pruritus or nausea, and if so, to grade this on a four point scale (none, mild, moderate, severe). Blood pressure and pulse were monitored every five minutes for 30 min following the drug injection, and every 15 min thereafter. Data are presented as mean ± SD. Patients were visited daily during hospitalization to determine satisfaction with their anaesthetic and incidence of post-dural puncture headache.

Results

Thirty-eight patients were enrolled in the study; 35 were multiparous and three were primiparous. The mean age was 28 ± 5 yr, height 167 ± 4 cm, weight 75 ± 15 kg. Thirty-two patients had spontaneous vaginal delivery, two were assisted with outlet forceps, and four were delivered by Caesarean section (three for fetal distress and one for failure to descend).

The mean cervical dilatation at placement of the spinal medication was 6.1 ± 2.2 cm. All patients achieved satisfactory analgesia in less than five minutes. Twenty-three patients delivered with no further supplemental analgesic medications; the duration from anaesthetic administration to delivery in these patients was 84 ± 45 mins. Fifteen required supplemental epidural local anaesthetic, a mean of 123 ± 33 min after the spinal drug was administered. For all cases, the mean duration from spinal drug administration to delivery was 127 ± 99 min. All neonates were vigorous; four neonates had a five-minute Apgar score of eight, the remaining 34 had five-minute Apgar scores of nine.

Pruritus was experienced by eight patients (21%). Six rated the pruritus as mild, and two as moderate. Two patients who experienced moderate pruritus were treated

with 25 mg diphenhydramine approximately one hour after drug injection, with prompt relief. The others resolved spontaneously within one hour without treatment. One patient experienced mild lower extremity motor weakness (Bromage I), all other patients retained full motor strength until supplemental epidural local anaesthetic was required. One patient experienced a mild, transient decrease in blood pressure, treated with one dose of ephedrine, 10 mg *iv.* No patient experienced nausea, or post-dural puncture headache. All patients, nurses and obstetricians were extremely satisfied with the quality of the spinal analgesia and expressed a willingness to utilize this method of pain relief in future deliveries.

Discussion

The patient with advanced cervical dilatation or a rapidly progressing labour may prove difficult to provide effective regional analgesia. Routine epidural analgesia is often not effective in this setting owing to the latency period (often 15–30 min) between drug injection and analgesia. Alternatively, a temptation to overcome this latency period by administering large doses of epidural local anaesthetics may produce undesirable motor blockade during the second stage of labour. The use of opioids, such as fentanyl or sufentanil, either epidural or spinal, has gained popularity recently as these medications have a rapid onset of pain relief and, unlike local anaesthetics, do not produce motor blockade or hypotension.[14,15] However, while opioids may provide satisfactory analgesia for early labour, their effectiveness during the second stage is often less than optimal.[16]

Spinal anaesthesia has been used in obstetrical settings for most of this century.[17] Classically, spinal anaesthesia for labour using local anaesthetics has the advantage of rapid and profound pain relief, at the expense of a high incidence of profound motor blockade and hypotension.[1,11] However, very small doses of local anaesthetic (such as bupivacaine 2.5 mg) are less likely to cause these undesirable effects. The rationale for the addition of an intrathecal opioid (sufentanil, 10 μg) is to enhance the quality of the block without increasing the incidence of bothersome side effects. The use of such a combined spinal-epidural technique will afford the rapidity of spinal analgesia with the versatility of epidural analgesia. A recent study showed that while neither low-dose intrathecal morphine (0.2 mg) nor low-dose epidural bupivacaine (10 ml, 0.125%) produced effective pain relief for the first stage of labour, the combination given by a combined spinal-epidural technique produced excellent analgesia.[5] Although we are not aware of published studies using these particular medications in late labour, our personal experience is that these are inadequate for providing effective pain relief in that setting. Moreover, we chose not to use intrathecal morphine owing to the high incidence of undesirable effects.[5-7]

In our series, only one patient developed minimal motor weakness after drug administration. Collis *et al.* have used a similar technique (with similar medication doses) in early labour, and have routinely allowed patients to ambulate without apparent difficulty.[13] In contrast, this same group has shown that using slightly more intrathecal local anaesthetic than was used in our study (5 mg bupivacaine) produced an unacceptably high incidence of motor blockade in labouring patients.[12] Our observed lack of motor blockade may (although not proven by our series) facilitate maternal expulsive effects during the second stage, or allow the use of various alternative birthing positions not readily feasible or safe with traditional lumbar epidural anaesthesia.

The possibility of post-dural puncture headache (PDPH) is always a concern when spinal analgesia is performed. One of the major disadvantages of spinal anaesthesia in obstetrics is the relatively high incidence of PDPH in this patient population. None of our patients, nor those in larger series using a similar technique,[8,12-14,18] experienced PDPH. The use of small-bore, conical point spinal needles (such as the Whitacre) has reduced the incidence and severity of PDPH to less than 1% in the obstetric population, thus increasing the feasibility and acceptance of spinal anaesthetic techniques in parturients.[19]

The principal finding of this open-label, non-randomized trial is that parturients in advanced, active labour can be provided with a rapid onset of profound analgesia with minimal motor blockade or other side effects. Sixty percent of our patients delivered with no further analgesic supplementation after the spinal medication. The remainder were able to have their analgesia effectively supplemented by the epidural catheter either for additional pain relief, or in six cases, operative delivery, thus demonstrating the flexibility of this technique.

It is possible that the use of this technique, as described herein, may reduce costs associated with labour analgesia. All of our patients delivered with only the original intrathecal dose, or a small amount of epidural local anaesthetic as a supplemental bolus. This avoids the requirement for setting up infusion devices, tubing, and solutions routinely used for continuous epidural infusion techniques. Alternatively, the added costs of an additional spinal needed must be considered. Formal cost analysis will be addressed in future studies.

The use of combined spinal-epidural anaesthesia is rapidly gaining popularity in obstetrical and other settings. Different combinations of local anaesthetics and opioids will allow for enhanced flexibility in fine-tuning an anaesthetic to patients' clinical circumstances. In particular,

the combination of intrathecal low-dose local anaesthetic and a short-acting opioid is highly effective and safe for analgesia in advanced first or second stage of labour, whilst the presence of the epidural catheter allows for supplementation of analgesia if required or anaesthesia for surgical delivery or post-partum perineorrhaphy. Further studies are warranted to assess optimal dosing regimens, side effect profile, and effect on the progress of labour for this increasingly popular and useful procedure.

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