

Combined spinal epidural analgesia for labor and delivery : a review

M. VAN DE VELDE

INTRODUCTION

More than a decade has passed since American trials evaluated the use of spinal opioids during labor and since European randomized trials compared conventional epidural analgesia with combined spinal epidural (CSE) analgesia (17, 28). Since then CSE analgesia has gained worldwide acceptance and is becoming increasingly popular as the method of choice for labor pain relief (90, 103). The obstetric anesthetists community is divided and several authors feel it should be the technique of choice, whilst others reserve CSE for certain indications (27, 99, 108,109). Numerous (> 200 trials, performing a literature search using CSE, combined spinal epidural analgesia and labor as search terms, were identified) studies compared CSE with conventional epidural or evaluated various intrathecal drug combinations. The purpose of this manuscript is to review the available literature and draw conclusions regarding the place of CSE in the management of labor pain. This review will evaluate efficacy and safety of CSE and make comparisons with conventional epidural analgesia, advise on the ideal spinal drug combination and give recommendations regarding maintenance of epidural analgesia once the spinal component wears off.

CHARACTERISTICS OF LABOR PAIN RELIEF : CSE VS CONVENTIONAL EPIDURAL

Onset time of analgesia

Arguably the most obvious advantage of the CSE technique is the rapid and spectacular onset of effective analgesia with minute concentrations of local anesthetics with or without adjuvant drugs. Consistently, effective labor analgesia is accomplished within 4-6 minutes following the intrathecal injection of drugs (1, 17, 28, 29, 30, 48, 61, 62, 80, 94, 117, 122, 124, 127) (Fig. 1). Following conventional epidural analgesia, initial analgesia is

usually achieved between 15 and 25 minutes. Some detractors argue that conventional epidural analgesia provides equally fast analgesia (80).

It is important to note, however, that although the onset time of epidural analgesia might be reasonable, the reported values are means. With epidural analgesia a wide inter-patient variability exists with respect to onset time of analgesia depending on parity, stage of labor and other relevant obstetric and non-obstetrical factors. Especially during late labor, analgesia following an epidural injection is often delayed and only successful if large doses are administered. With CSE, onset time is short in all patients irrespective of the stage of labor, the dose of local anesthetic used and other relevant factors.

Quality of pain relief : VAS scores, satisfaction and anesthetist intervention rate

Several trials demonstrated lower VAS scores for labor pain with CSE as compared to epidural analgesia (29, 122). However, other comparative trials could not demonstrate a difference in VAS scores for pain (57, 80, 101). No trials report higher VAS scores with CSE. Most anesthesiologists would agree that CSE provides better quality analgesia throughout the course of labor (68). Interestingly, HESS *et al.* investigated the factors associated with breakthrough pain during neuraxial labor analgesia and found that patients treated with conventional epidural analgesia were three times as likely to experience recurrent breakthrough pain as compared to CSE treated women (59). The presence of a dural puncture may facilitate the passage of epidurally administered

M. VAN DE VELDE, M.D., Ph.D., Department of Anesthesiology, University Hospitals Gasthuisberg, Katholieke Universiteit Leuven, Herestraat 49, B-3000 Leuven, Belgium.

Correspondence address : Marc Van de Velde, Director Obstetric Anesthesia and Extra Muros Anesthesia, Department of Anesthesiology, University Hospitals Gasthuisberg, Herestraat 49, B-3000 Leuven, Belgium. E-mail : marc.vandvelde@uz.kuleuven.ac.be.

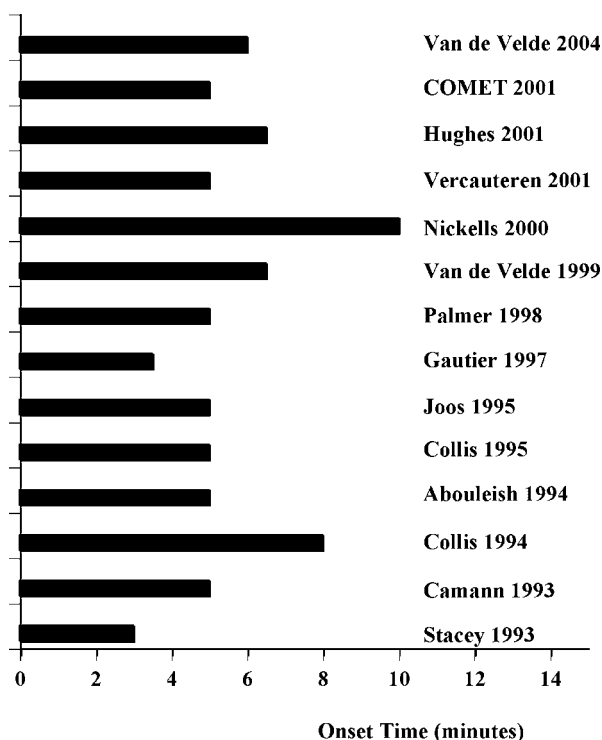


Fig. 1. — Reported onset time of CSE analgesia during labor.

drugs during maintenance of analgesia to the cerebrospinal fluid. At least in animals such an effect has been reported (120). LEIGHTON *et al.* also reported that epidural bupivacaine blocked more dermatomes when administered following an initial dural puncture as compared to epidural bupivacaine administered without prior dural puncture (69). Most importantly probably is that many studies report a higher patient satisfaction with CSE (29, 30, 40, 124).

Local anesthetic consumption

Despite similar or improved quality of analgesia, local anesthetic requirements are significantly reduced with CSE as compared to low dose conventional epidural techniques (29, 30, 124). Discussion remains whether this is the result of the omission of the initial epidural bolus or that also during labor a dose sparing effect persists. The presence of the dural hole and the facilitated passage of epidurally administered local anesthetics could offer part of the explanation.

Duration of initial analgesia

Duration of initial spinal analgesia is usually similar to the duration of an initial epidural bolus

(57, 80, 124). Spinal analgesia typically lasts for 90-150 minutes, but a wide variety exists depending on administered spinal drugs and pain modulating factors such as parity, stage of labor, speed of labor, etc... (17, 21, 36, 42, 61, 75, 89, 91, 116, 128). In ideal circumstances and using multi-drug combinations spinal analgesia might last for more than 4 hours (36, 89). Many authors continue the search for long lasting spinal analgesia, hoping that single shot spinal analgesia would ultimately be achieved. Despite extensive research, disappointingly, no more (and often less) than 50% of patients deliver during initial spinal analgesia (128).

Epidural catheter reliability

Following initial spinal analgesia, bilateral analgesia and sensory changes occur, making testing of the epidural catheter difficult. The epidural catheter cannot prove itself and many may question the reliability of the catheter to achieve bilateral analgesia once the spinal dose is worn off. However various investigators noted that the reliability of epidural catheters following CSE was similar or increased as compared to stand alone epidural catheters (31, 82, 84, 123) (Table 1). When using a CSE technique, a perfect midline approach is required to identify the subarachnoid space and consequently more epidural catheters reliably are positioned into the epidural space (123).

Failed spinal component

Failure to identify the spinal space and produce good spinal analgesia is reported in 0-5% of patients. As with every technique failure may occur, but in these instances the epidural catheter can still be used to provide analgesia.

COMPLICATIONS OF LABOR ANALGESIA : CSE ANALGESIA VS CONVENTIONAL EPIDURAL ANALGESIA

Pruritus

This is the most common side effect of intrathecal opioids, occurring in almost all patients, if directly questioned (29, 124). It usually develops shortly after analgesia. It is mild and hardly ever requires antipruritic therapy. Opioid induced itching is dose-dependant and can be modulated by other adjuvant drugs such as epinephrine (10, 17). Since patients hardly ever require therapy and seldom report pruritus as a reason for dissatisfaction,

Table 1

Reliability of epidural catheters : % of failed epidural catheters not producing adequate analgesia and that were resited

	CSE	Epidural
NORRIS 2000 (82)	0.2%	1.3%
COMET 2001 (31)	4.0%	6.8%
VAN DE VELDE 2001 (123)	1.49%	3.18%

pruritus is no reason to refrain from using CSE and intrathecal opioids.

Nausea

Nausea and vomiting are very rare complications during CSE and conventional epidural analgesia. No differences in the incidence of nausea have been reported when comparing the two techniques. We must remember that nausea is a part of the natural birth process especially during induced labour.

Hypotension

As with any neuraxial technique, hypotension can occur following labour analgesia. Both CSE and conventional epidural analgesia have been associated with usually mild hypotension, which is easily treated (85). Hypotension following the spinal injection is transient and occurs within the first 30 minutes following initiation of analgesia (115). Hypotension occurs due to sympathetic blockade, alleviation of pain and perhaps because incorrect baseline values are used as reference (11). Indeed if blood pressure immediately preceding the block is taken as baseline value, the diagnosis of hypotension may be made inappropriately. Pain and discomfort induce hypertension and cloud the issue. Various authors therefore recommend to use the prenatal blood pressure as the baseline value.

Although opioids do not produce sympatholysis, hypotension is observed with pure intrathecal opioid analgesia (20, 71, 78, 106). When local anaesthetics are combined, hypotension seems to be more pronounced, but clinically usually easily treated (124). Intrathecal clonidine, however, is often associated with severe hypotension and this author can not recommend it's routine use based on his personal experience with this drug. Hypotension can be severe and is often protracted

requiring prolonged supportive vasopressor therapy (21, 97).

Respiratory depression

Respiratory depression is a recognized complication of intrathecal opioids during labor, probably as a result of rostral spread. Several case reports have demonstrated that lipid soluble opioids may induce this potentially life threatening complication (8, 44, 52, 55, 61, 64, 70, 93). In some, but not all, cases respiratory arrest occurred in relatively short stature women who had received parenteral or epidural opioids prior to the spinal injection. Fortunately, respiratory depression occurred typically within the first 30 minutes and was easily treated and reversed using naloxone. FERROUZ *et al.* performed a retrospective chart analysis and reported 1 respiratory arrest in over 5000 CSE performed with 10 µg spinal sufentanil (44). As this complication is rare, most authors advocate vigilance and advise to use lower doses of intrathecal opioids than those initially used on empirical grounds (4).

Other complications related to excessive rostral spread of opioids and local anaesthetics have been described and include : aphonia, aphagia, dysphagia, altered levels of consciousness, high sensory block, etc... (34, 45, 53, 67, 111). Also sudden hypoglycemia has been described (33).

Central nervous system infections

Some authorities claim that the risk of central nervous system infections is increased secondary to the breach of the dura (14). However, Camann and Birnbach both agree that at the moment there is no scientific evidence indicating that CSE analgesia is associated with more infectious problems than epidural analgesia (11, 18). Indeed several case reports of meningitis or epidural abscess have been reported following CSE anesthesia in obstetric patients (6, 13, 19, 54), but also with simple spinal anesthesia and conventional epidural techniques central nervous system infections have been reported (9, 38, 79, 104). Despite these occasional case reports, CNS infections remain extremely rare irrespective of the neuraxial technique used. Six publications evaluate the risk of infections following neuraxial anesthesia in obstetric patients (4, 32, 56, 92, 96, 112). In over 900.000 patients only 2 cases of epidural abscess and 3 cases of meningitis were reported. Most authors, however, agree that strict aseptic techniques are of vital importance to prevent serious infections.

Neurologic complications

As with any regional technique the potential for nerve damage is present. Several case reports in pregnant women of damage to the conus medullaris have been reported when using CSE (105). Especially with CSE it is imperative not to perform the block above lumbar interspace L2-L3 since the conus medullaris might extend until L2.

Post dural puncture headache (PDPH)

Since CSE includes a dural puncture, there is a theoretical risk of postdural puncture headache (PDPH). This is a devastating complication in an otherwise healthy mother, keen on taking care for her newborn child. However the use of small-gauge atraumatic spinal needles (26-29 G) has dramatically decreased the problem. From the available literature it seems that PDPH occurs in no more than 1% of patients. Furthermore the incidence is not increased as compared to conventional epidural analgesia (11, 29, 31, 40, 68, 71, 76, 84, 85, 123). NORRIS *et al.* reported that unintended dural puncture with the epidural needle occurs much more frequent when using conventional epidural analgesia as compared to CSE (85). Rarely the spinal needle itself is responsible for PDPH. Usually a dural tap with either the Tuohy needle or the epidural catheter causes postural headache. It is also worthwhile to mention several reports advising to insert the epidural catheter in the subarachnoid space following an accidental dural tap. The incidence of PDPH and bloodpatching seems reduced when the epidural catheter is threaded intrathecally (24, 86, 110, 114).

Of interest is that air should be replaced by saline in the loss of resistance technique, as air might cause more PDPH, increase its severity and induce other problems with your epidural block (2).

Motor block

For many years, strategies to reduce the incidence and severity of motor block, associated with epidural analgesia, have been designed. Lower concentrations of local anesthetic solutions, the addition of opioids and other adjuvant drugs, the introduction of patient controlled epidural analgesia and the use of newer local anesthetic agents have been instrumental in reducing problematic motor block. Low dose epidurals are successfully used to allow

laboring women to maintain mobility whilst being completely pain free (30, 76). With CSE it is easier to provide effective analgesia with no or very minute doses of local anesthetics. As already described, CSE decreased total local anesthetic consumption (29, 30, 124) and decreased the occurrence of motor block compared to standard epidural techniques (29, 30, 76, 124).

Some authors have questioned the safety of walking during labor and neuraxial analgesia. However, several authors demonstrated that with CSE motor function and balance remained intact, whilst low dose epidurals induced clinically detectable dorsal column deficits (15, 37, 98). Ambulation is become common practice and can be advised, provided adequate precautions, written protocols and testing of motor function following initiation of analgesia is performed. Motor function testing is straightforward and includes the ability to perform a deep knee bend unassisted and to perform a straight leg lift for 30 seconds with the eyes closed. It remains unclear how epidural maintenance of analgesia affects postural stability and motor function (37).

Caution is required when using epidural test doses following insertion of an epidural catheter, since test doses can significantly impair motor strength (25). Controversy also exists on the effects of spinally administered epinephrine (127) on motor block. Whilst minute doses do not impair motor function, larger doses have a significant impact. However it remains debatable whether a small dose of intrathecal epinephrine conveys any clinical benefits in terms of prolonged spinal analgesia.

Although reduced motor block and ambulation during neuraxial analgesia are certainly feasible, controversy concerning the benefits of ambulation remains (15, 43). Several trials demonstrated that ambulation during labor does not affect the outcome of labor (76), whilst others did note a beneficial effect of ambulation. In patients without epidural analgesia, ambulation halved the operative delivery rate (3). Ambulation also reduced the length of the second stage of labor (50). In the COMET trial mobile techniques of labor analgesia were associated with an improved labor outcome (30, 31). Despite this controversy, those women actually using ambulation during labor prefer ambulation as it increases their feelings of self control. It was also noted that epidural top-ups administered during ambulation induced less hypotension than top-ups administered in the supine position (7).

Progress and outcome of labor

Epidural analgesia has been implicated in prolonged labors, an increased instrumental delivery rate and an increased Cesarean section rate. Extensive research has now lead to unanimous consensus that epidural analgesia does not produce more instrumental vaginal and operative deliveries. However, epidural analgesia prolongs the duration of the first stage of labor and increases the need for exogenous oxytocin.

TSEN *et al.* demonstrated in a prospective, randomized trial that CSE is associated with an increased cervical dilation rate. Patients randomized to CSE analgesia experienced a doubling of the mean cervical dilation rate and a reduced duration of the first stage of labor as compared to epidural analgesia (121). Several mechanisms have been proposed to explain these observations. First, CSE rapidly reduces epinephrine plasma levels. Since epinephrine is tocolytic (113), CSE quickly enhances uterine activity. Because analgesia and epinephrine reductions occur much more rapidly than with conventional epidural analgesia, progression of labor could be enhanced. Second, since high doses of local anesthetics are avoided with CSE, the in vitro and in vivo observations that bupivacaine impairs uterine activity are also avoided (74, 129). Disappointingly, several randomized trials comparing CSE with conventional epidural analgesia could not demonstrate a difference in labor duration (30, 84, 122, 124).

CSE as compared with low dose epidural strategies was not associated with an increased spontaneous vaginal delivery rate in most trials (29, 30, 40, 84, 101, 122, 124). Only one trial reported less instrumental vaginal deliveries with CSE as compared to epidural analgesia (76).

Fetal heart rate changes

Abnormal fetal heart rate recordings and fetal bradycardia are worrisome side effects that may follow any type of effective labor analgesia. Some authors reported that this complication could be more common following intrathecal opioids than following conventional epidural analgesia (22, 23, 60). CLARKE *et al.* were the first to describe in detail the association between intrathecal opioids, uterine hyperactivity and fetal bradycardia in the absence of maternal hypotension (22). Since then several non-randomized trials have evaluated the incidence of fetal heart rate changes following either intrathecal opioids and conventional epidural analgesia

(63, 81, 95, 123, 125). NIELSEN *et al.* and EBERLE *et al.* did not observe an increased incidence of fetal heart rate abnormalities, whilst all other non-randomised reports noted at least a doubling of the incidence of worrisome fetal heart rate changes (4) (Table 2).

Recently, MARDIROSSOF *et al.* performed a meta analysis of all prospective trials comparing intrathecal opioid analgesia with non-intrathecal opioid analgesia with respect to fetal bradycardia (73). These authors concluded that intrathecal opioids were associated with significantly more fetal heart rate abnormalities. Vercauteren suggested that the incidence of fetal bradycardia depended on the dose of the intrathecal opioid (126). VAN DE VELDE *et al.* performed a prospective, randomized trial specifically designed to evaluate the effects of intrathecal opioids on the incidence of worrisome fetal heart rate changes (124). These authors concluded that high doses of intrathecal opioids increased the incidence of fetal heart rate abnormalities despite a reduced incidence of hypotension.

The presumed mechanism of opioid induced non-reassuring fetal heart rate tracings is uterine hyperactivity caused by rapid analgesia and as a result a rapid decrease in maternal circulating catecholamines. Based on laboratory investigations by SEGAL *et al.* increased myometrical tone and increased uterine vascular resistance may be caused by the decrease of epinephrine levels in the continuing presence of high norepinephrine levels when CSE analgesia is performed (20, 113). If speed of onset of labor pain relief is important, it remains unclear why this only occurs when high doses of intrathecal opioids are used. Why does fetal distress not occur following CSE using a mixture of bupivacaine and a small dose of sufentanil, despite equally fast pain relief? Especially since the latter strategy of labor analgesia produces more severe hypotension.

Further study into the mechanism therefore seems required. Other mechanisms, such as direct central effects of sufentanil, are possibly involved. We can only speculate about alternative pathophysiological mechanisms. Maternal rostral spread of spinal opioids may centrally affect the release of oxytocin and subsequently induce uterine hyperactivity. It is known that intravenous opioids have central effects and alter the release of various central peptides, including oxytocin and vasopressin (107). In a recent interesting paper, STOCCHÉ *et al.* studied the release of oxytocin in women in first stage labor undergoing regional analgesia (118).

Table 2

Incidence (%) of fetal heart rate abnormalities following CSE or conventional epidural analgesia as reported using a non-randomised study design

	CSE	Conventional epidural
NIELSEN 1996 (63)	15.4%	18.8%
EBERLE 1998 (41)	3.9%	3.9%
KAHN 1998 (63)	5.6%	2.5%
PALMER 1999 (95)	12%	6%
VAN DE VELDE 2001 (125)	11.4%	5.9%

They compared conventional epidural analgesia using plain bupivacaine 0.25% with intrathecal sufentanil 10 µg and measured maternal plasma oxytocin levels at 15, 30, 60 and 90 minutes after induction of analgesia. Intrathecal sufentanil decreased the plasma concentration of oxytocin. These results contradict with the hypothesis that spinal opioids may induce uterine hyperactivity by modulating central oxytocin release. However the authors themselves admit they only infrequently sampled blood. As oxytocin release typically occurs in spurts, has an extremely short plasma half-life and as the authors only performed their first sampling at 15 minutes, they may have missed an initial increase in oxytocin release followed by the observed decrease in plasma oxytocin. More work is therefore required to elucidate the mechanism responsible for uterine hyperactivity and fetal bradycardia occurring after intrathecal opioids.

It is important to note that neonatal and obstetric outcome is not affected by the use of intrathecal opioids. In none of the reports emergent C-sections had to be performed as a result of sufentanil induced non-reassuring fetal heart rate tracings (41, 63, 73, 81, 95, 124, 125, 127). Also neonatal outcome, as assessed by Apgar scores, umbilical artery pH and admittance to the neonatal intensive care, was unaffected by the technique used. Albright and Forster performed an institutional retrospective survey involving 2500 patient records and observed no increase in emergency Cesarean delivery associated to the use of intrathecal opioids (5). Only GAMBLING *et al.* contradicted this and reported an increased C-section rate due to more non-reassuring fetal heart rate abnormalities (47). However also in their study neonatal outcome was good and not different from the epidural group.

TESTING THE EPIDURAL CATHETER FOLLOWING CSE

Since epidural catheters can inadvertently be misplaced in either the cerebrospinal fluid or in an

epidural vein, anesthetists have been using test doses to verify the correct position of the catheter. Unfortunately, test doses are neither sensitive nor specific (26, 83). Furthermore epinephrine containing test doses can induce motor impairment and thus complicate ambulation during labour (25). Some authors also suggested that an epinephrine containing test dose has potential adverse effects on uteroplacental perfusion (72). As a result several authors suggested to abandon routine testing of the epidural catheter, since adequate analgesia confirms the correct position of the catheter without prior testing (12).

With CSE, analgesia occurs rapidly and testing the functionality of the epidural catheter is not possible until the initial spinal dose wears off. Many authors consider the fact that the reliability of the epidural catheter is uncertain during this period as a major disadvantage of CSE. Their concern is related to the possibility that the catheter may be dysfunctional when an emergency cesarean section is required. Especially in high risk pregnancies this is considered a major drawback. However, it is important to note that even with a well tested epidural catheter, we can never be absolutely sure that several hours later the catheter remains correctly positioned. Even with conventional epidural catheters fractionated dosing or a de novo test dose are required the moment the catheter is used for the injection of high doses of local anesthetics.

A second concern involves the fact that some authors do not want to initiate epidural analgesia immediately after the spinal dose. Only when the epidural catheter is formally tested once the spinal dose has worn off, the catheter is used throughout labor. As a result most patients will experience breakthrough pain. However, several authors initiate an epidural infusion immediately following the initial spinal dose (46). With low volume, low dose techniques, the risk of total spinal anesthesia or toxic side effects is minimal. These doses cannot produce systemic toxicity or total spinal anesthesia even when direct intravascular or intrathecal injection occurs. However if a continuous epidural infusion or patient controlled epidural analgesia does not produce adequate analgesia, one must consider an intravascular position of the catheter.

INTRATHECAL DRUG COMBINATIONS

Local anesthetics

Currently bupivacaine is mostly used for intrathecal labor analgesia, usually in combination

with opioids. Also levobupivacaine and ropivacaine have been used successfully during labor analgesia.

Opioids

Plain intrathecal opioids are successful in producing labor analgesia. PALMER *et al.* established that fentanyl 25 µg was the optimal intrathecal dose (94). Increasing the dose above 25 µg did not improve the duration or quality of analgesia, but increased the incidence of side effects. For sufentanil an ED₉₅ of 8.9 µg was established (58). However, certainly in Europe, most anaesthesiologists prefer the intrathecal combination of local anaesthetics and opioids. Adding opioids to the spinal mixture, reduces the ED₅₀ of the local anaesthetic agent and prolongs dose-dependently the duration of initial spinal analgesia (119). Therefore most authors recommend a local anesthetic / opioid combination for initial spinal analgesia.

Respiratory depression following intrathecal opioids has been described. This occurred usually in small patients receiving high doses of opioids following initial parenteral opioid analgesia. Respiratory depression occurred within 30 minutes from injection. Vigilance following the intrathecal injection of opioids is therefore required. During labour analgesia, intrathecal opioids have been associated with new onset foetal heart rate changes (22, 124). Usually these changes were related to uterine hyperactivity and not maternal hypotension. Several authors postulated that an imbalance between maternal catecholamines following rapid spinal analgesia produces uterine hypertonicity. It remains unclear why this only occurs following high dose intrathecal opioids and not following the combination of lower doses of opioids and local anaesthetics (124).

Clonidine

CHIARI *et al.* studied the use of pure spinal clonidine labour analgesia (21). This seems not feasible since doses producing adequate analgesia also induce unacceptable side effects such as hypotension. Adding lower doses of clonidine (15-45 µg) to spinal analgesics does improve the duration and quality of initial spinal analgesia (75, 91). However, especially when clonidine is combined with local anaesthetic agents, significant and prolonged hypotension is likely to occur (91, 97).

Epinephrine

Epidurally administered epinephrine significantly reduces the MLAC concentration of bupivacaine in labouring patients and improves the quality of analgesia (100). Also for spinal use epinephrine, combined with local anaesthetics and opioids, has been evaluated in a wide range of doses from 2.25-100 µg. Duration of intrathecal analgesia was consistently prolonged (48).

Unfortunately, epinephrine also induces an increased incidence of maternal motor deficit especially when administered epidurally or intrathecally (25, 51). VERCAUTEREN, however, reported that minute doses (2.25 µg) of spinal epinephrine were not associated with more motor block (127). Epidural epinephrine might also prolong labour duration by β-agonist effects, especially when higher doses are infused in the epidural space (39, 87, 88). Furthermore adding epinephrine to pharmacist pre-prepared solutions complicates storage and significantly increases the price of handling and preparation. Thus, this author has abandoned the addition of epinephrine from the local anaesthetic solution used for spinal and epidural administration.

Neostigmine

NELSON *et al.* investigated the analgesic potential and side effect profile of 5, 10, 20 µg intrathecal neostigmine alone (77). From this first phase, these investigators chose 10 µg as the optimal dose to be added to intrathecal sufentanil and determined the ED₅₀ of spinal sufentanil with and without neostigmine. Neostigmine successfully reduced the ED₅₀ of spinal sufentanil. In a further step, they compared twice the ED₅₀ of spinal sufentanil with neostigmine to twice the ED₅₀ of plain spinal sufentanil. A synergistic effect on duration of analgesia of neostigmine was observed. D'ANGELO *et al.* however reported no increase in analgesic duration with neostigmine as part of a multi-drug combination (local anaesthetic, opioid, clonidine and neostigmine) (35). Furthermore several authors reported a very high incidence of severe nausea and vomiting (89).

Other drugs : magnesium and adenosine

Both adenosine and magnesium have been added to intrathecal opioids to relieve labour pain (16, 102). No significant advantages of adding adenosine to the analgesic mixture were observed.

Magnesium prolonged intrathecal fentanyl analgesia.

GENERAL CONCLUSIONS

CSE analgesia is rapidly becoming the most popular technique for labor pain relief. Although various authors limit the use of the technique to specific indications, a wide variety of indications has been described by different authors. As a result, almost all patients fall in one of these categories. CSE analgesia provides rapid, highly effective analgesia with minimal motor block, reduced local anesthetic doses and perhaps an improved obstetric outcome. Maternal satisfaction is improved. Epidural catheter reliability seems to be enhanced. PDPH and infections do not occur more frequently as with conventional epidural analgesia. Non reassuring fetal heart rate tracings occur significantly more frequent following high doses of intrathecal opioids. Occasionally, respiratory depression, following high doses of opioids intrathecally, can occur.

This author strongly recommends using CSE as the standard technique of labor analgesia.

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