Update on obstetrical anaesthesia

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This Continuing Medical Education article is intended to review some of the current topics of interest in obstetrical anaesthesia. Since a complete review of the whole topic has now achieved text book status, a discussion of some of the more controversial areas is presented. The first part of the article deals with regional anaesthesia, while the second part covers other methods of analgesia and anaesthesia. Finally a short discussion on the problems of "informed consent" is included.

Regional anaesthesia

Drugs used in regional anaesthesia

LOCAL ANAESTHETICS

No new local anaesthetics have been introduced in the last five years but those available wax and wane in popularity. Lidocaine has been vindicated in several studies which have examined the effects of this drug on the newborn.^{1,2} In 1974-76, neurobehavioural testing of normal newborns suggested that lidocaine used for epidural analgesia produced "floppy" babies.³ Recently a larger series⁴ using a different and more thorough neonatal assessment, showed convincingly that the previous findings with lidocaine were not clinically significant and that lidocaine was still an extremely useful agent in obstetrics.

The carbonation of lidocaine, thought to speed onset and produce a more reliable block, has been shown in a recent study to be similar in these properties to lidocaine-HCl.⁵ Lidocaine-CO₂ still has a lower incidence of missed segments and because of this is extremely useful for Caesarean section.

Bupivacaine has become less popular because of severe cardiovascular toxicity following inadvertent intravascular injection. Maternal fatalities have been reported in the United States.⁶ In animal experiments comparing lidocaine and bupivacaine, the adverse cardiac effects of the latter were more

profound,^{7,8} resulting in decreased myocardial contractility and ventricular arrhythmias, which were persistent for prolonged periods of time.

Bupivacaine can be considered to be four to six times more toxic than lidocaine.⁹ In animals rendered hypoxic and/or acidotic prior to exposure to bupivacaine, the effects were even more marked.¹⁰ Resuscitation, both in the clinical and experimental situation is prolonged and may require the use of drugs such as bretylium for the control of arrhythmias along with the conventional techniques for support of the respiratory and cardiovascular systems.

The above studies resulted in the recommended withdrawal of 0.75 per cent bupivacaine for obstetrical anaesthesia.¹¹ The recommended maximum dose of 0.25 or 0.50 per cent bupivacaine for a single epidural injection is 0.5 mg·kg⁻¹. It is our feeling that the total dose for a continuous epidural should not exceed 150 mg in eight hours.

2-Chloroprocaine gained popularity several years ago because of its low potential for cardiovascular toxicity, related to rapid metabolism by plasma cholinesterase. Blood levels in mother and newborn could only be detected by very sensitive assays.¹² It was thought to be an ideal drug for continuous epidural anaesthetics because of its minimal effects on the newborn. However, there were three reports of irreversible nerve damage with 2-chloroprocaine over a period of six months.¹³⁻¹⁵ There were then hasty conclusions reached questioning the safety of the drug. Ultimately, the safety of 2-chloroprocaine was improved by increasing the pH of the solution from 3.0 to 5.0, decreasing the amount of sodium bisulphite used to maintain the drug in solution, and cautioning users not to inject through the epidural needle but rather to inject

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slowly through a catheter. Since 1980 there have been no further clinical reports of nerve damage with 2-chloroprocaine.

At the present time, 2-chloroprocaine may be regarded as no more likely to produce neurotoxicity than the other local anesthetics available. Because of the superiority of carbonated lidocaine for operative procedures and low dose bupivacaine for labour, it is likely to see little use in Canada in any case.

The main advantage of 2-chloroprocaine, as mentioned above, is its rapid metabolism in the blood. The drug is short-acting (45–60 min) in epidural analgesia which may be an advantage or disadvantage depending on the situation. For Caesarean sections the duration is usually not sufficient and reinjection is necessary.

VASOCONSTRICTORS

The only vasoconstrictor commonly added to local anaesthetics for obstetrics is epinephrine. It is recommended that a test dose of 2 or 3 ml of local anaesthetic containing 1/200,000 epinephrine be used to help detect an intravascular injection.¹⁶ For continuous epidurals it has been the custom not to add epinephrine to subsequent doses because of possible decreased uterine blood flow and decreased uterine contractility resulting from the systemic absorption. Epinephrine (10–50 µg IV) has been shown in animal models to produce vasoconstriction of the uterine arteries and to decrease uterine contractions.¹⁷ A recent study by Abboud *et al.* questions whether epinephrine (1:300,000) added to local anaesthetics has any effect on uterine contractions.¹⁸ In their patients, epinephrine reduced the amount of local anaesthetic required and prolonged the duration of the block without prolonging the first stage of labour. As this was not a particularly large study and uterine "activity" is notoriously difficult to measure precisely, the effect of epinephrine on uterine contractility remains to be elucidated. When epinephrine is to be used, it should be added carefully to the anaesthetic solution just prior to administration. This is done because commercially prepared solutions have the pH adjusted downward, resulting in a more marked delay in onset of activity. For the most part, anaesthetists should consider using epinephrine when large doses of lidocaine are to be used

(as at Caesarean section) but should avoid epinephrine when smaller doses of local anaesthetic are used during labour.

NARCOTICS

There have recently been many reports of the use of narcotics in the epidural or subarachnoid space for obstetrical analgesia and/or postoperative pain relief. Subarachnoid or epidural narcotics provide reasonably good pain relief in the first stage of labour.^{19,20} Onset of analgesia depends on the agent used, i.e., fentanyl, 10–15 minutes;²¹ morphine, 40–45 minutes.²² Side effects include nausea, itching, and dizziness,²³ but no motor or sympathetic block. The incidence of side effects varies with the drug used. For example, morphine causes 40 per cent of patients to experience nausea or itching, while fentanyl causes only a 15 per cent incidence of the same side effects.

During delivery and for post-partum pain relief for episiotomies, narcotics are not as effective as local anaesthetics. A recent study²⁴ suggested that epidural morphine was only marginally better for post-partum episiotomy pain than a placebo of 0.9 per cent saline. This lack of effect in some situations is not clearly understood.

The irritating side effects of nausea, itching and drowsiness can be reduced without a reduction in analgesia by careful titration of intravenous naloxone.²⁵ This is also true for respiratory depression. This latter side effect is particularly a problem with morphine because of its delayed onset.²⁶ Respiratory depression can occur from as long as twelve to twenty-four hours after injection. The more lipid-soluble narcotics, such as fentanyl, are less likely to cause respiratory depression because they are more effectively removed from the subarachnoid and epidural space and seldom reach the brain stem in sufficient amounts to cause depression of respiratory function.²⁷ Following the administration of any narcotic into the subarachnoid or epidural space, close observation of the patient is required to guard against the serious, if infrequent, complication of delayed respiratory depression.

Epidural narcotics would seem to be most useful in providing postoperative analgesia following Caesarean section.^{28–30} Fentanyl (50 µg) or morphine (2–5 mg) in 10 ml of preservative-free saline is injected through the catheter at the end of the

Caesarean section. Good to excellent pain relief can be obtained for three hours with fentanyl and six to eight hours with morphine. During this time intramuscular injections of narcotics should be avoided to minimize the chances of respiratory depression. Patients should be under close observation and the recovery area nurses should be aware of the potential for respiratory depression.

Epinephrine added to the narcotic solution may increase the duration of pain relief but may also increase the incidence of side effects.³⁰

For more detail on the use of narcotics in the intrathecal or epidural space, please see the excellent review by Cousins and Mather.³¹

Techniques for regional anaesthesia

There has been a shift to using continuous epidural infusions rather than intermittent top-ups for pain relief in labouring patients.³² The proposed advantages of this technique are:

- 1 less total drug required for pain relief,
- 2 less likelihood of toxic reactions, and
- 3 better quality of pain relief.

In one study the actual amount of local anaesthetic required was not significantly different but there were no toxic reactions reported and pain relief was reported as good to excellent.³³ In addition to the infusion, however, bolus injections were required in 15–20 per cent of patients, particularly in the second stage of labour. The duration of the second stage and the incidence of forceps delivery have not been affected by the switch to the constant infusion technique.³⁴

The development of compact, accurate infusion pumps, which have adjustable rates over a wide range of infusion volumes, has made the technique of constant infusion much more attractive, particularly in hospitals where anaesthesia personnel are in short supply. It is very important, however, that nurses and physicians attending these obstetrical patients still watch carefully for hypotension, which may occur with any regional block. Changes in central nervous system and respiratory function may be warning signs of a subarachnoid or intravascular injection. These patients should never be left unattended and an anaesthetist must always be available to treat any complications which may develop.

If intermittent injections are used, a method of detecting the intravascular injection of local

anaesthetic has been recommended by Moore and others.¹⁶ Epinephrine (1:200,000) is added to the test dose prior to each injection through the epidural catheter.¹⁶ This amount of epinephrine should result in a transient increase in heart rate if the local anaesthetic has been injected intravenously. A test dose of 2–3 ml of local anaesthetic should always be given prior to each bolus injection through an epidural catheter to detect either a subarachnoid or an intravascular injection. Five minutes should elapse after the test dose and the patient should be questioned about changes in sensation, ability to move her legs and the presence of other symptoms such as tinnitus, dizziness, or circumoral numbness.

Other regional anaesthesia techniques have not changed greatly in the last decade. Spinal, paracervical, and pudendal blocks are less popular now with the increased popularity of continuous epidural analgesia.

Special considerations

After considering the various technical aspects of regional anaesthesia and local anaesthetics available, we still need to evaluate the advantages and disadvantages of these blocks for obstetrical patients. The advantages of regional anaesthesia for Caesarean section, both elective and emergency, are clear. The anaesthetist can avoid manipulation of the maternal airway, depressant effects of general anaesthetic agents on the newborn, and can also provide postoperative pain relief with epidural narcotics. Spinal anaesthesia also provides a rapid technique for emergency Caesarean section particularly for mild or moderate foetal distress.³⁵ Epidural analgesia actually results in more stable cardiovascular parameters in the pre-eclamptic patient, especially if the need for a Caesarean section arises. Except for patients with maternal haemorrhage, clotting disorders, and severe sudden foetal distress, regional anaesthesia is usually the method of choice for Caesarean section.

In the labouring patient the situation is somewhat more complex. Epidural analgesia provides excellent pain relief in first stage but obliges the labour floor staff to closely observe the patient for the development of supine hypotension. Although there is now little concern that epidural analgesia will prolong the first stage of labour, the presence of analgesia requires closer observation of the contrac-

tion pattern and cervical dilatation.³⁷ The real controversy still surrounds the effects on the second stage of labour.³⁸ In many studies, both the continuous infusion technique and intermittent injections lead to a higher incidence of forceps deliveries (30–50 per cent compared to 10–15 per cent in patients without epidural analgesia). The duration of the second stage of labour may be prolonged for patients with epidural anaesthetics compared to those without.³⁹ Neither of these factors will threaten either the mother or neonate provided a safe forceps delivery can be achieved, and the close monitoring of both mother and baby continues throughout second stage and after delivery. It is obvious that epidural anaesthetics are “expensive” in terms of the trained personnel and equipment required to provide proper care of these patients.

Many obstetrical anaesthetists think that epidural analgesia is especially useful in the second stage of labour, particularly to prevent maternal distress resulting in an uncontrolled patient who cannot be monitored and will not co-operate. This is particularly true if a trial of forceps for delivery is being considered. Certainly the alternative of general anaesthesia carries the risks of aspiration or failed intubation of the maternal airway. The incidence of aspiration pneumonitis in obstetrical patients is declining, likely due, in part, to the increased use of epidural anaesthesia which makes emergency general anaesthesia necessary less frequently.⁴⁰

The two major complications of epidural anaesthesia, intravascular injection and total spinal block, must be continuously kept in mind by the obstetric anaesthetist. The commitment to maternal safety must be the uppermost consideration by the labour floor staff or the price of maximal analgesia will be too high.⁴¹

Inhalation agents in obstetrics

Methoxyflurane has had little or no use in surgical anaesthesia for several years. It has, however, continued to be used in obstetrics. It has proven especially useful as an inhaled analgesic during any stage of labor. Advantages included effective pain relief without loss of consciousness, no increase in uterine bleeding, safety and effectiveness during prolonged administration, and usefulness as a self-administered analgesic.⁴⁴ Now that methoxyflurane is no longer available, obstetric anaesthetists must find an effective substitute.

Both enflurane and isoflurane have been studied as inhalation analgesic agents in labouring patients. Enflurane is effective in producing analgesia for the second stage of labour,⁴⁵ while isoflurane is effective for producing analgesia for both the first and second stages.⁴⁶ Unfortunately, both agents have properties which preclude their routine use as analgesics in obstetric units. They are relatively insoluble, so that alveolar (and brain) concentrations of these agents rise fairly rapidly, with the risk of loss of consciousness and the further risk of aspiration or airway obstruction. They both have a pungent odor and poor patient acceptance. They require rather more complicated vaporizers than the simple hand held draw over units used for trichloroethylene and methoxyflurane. And finally, they are both relatively expensive.

Mainly because of the danger of maternal anaesthesia with enflurane and isoflurane, we have elected to replace methoxyflurane with 50 per cent nitrous oxide in oxygen (Entonox, Nitronox) for analgesia during labour. Nitrous oxide is a rapid, effective analgesic which can be safely self-administered. The main disadvantage of nitrous oxide is that it must be discontinued should the need arise to give 100 per cent oxygen to the mother.

In Caesarean section anaesthesia, halothane (0.5 per cent), isoflurane (0.75 per cent), and enflurane (1.0 per cent) have proven to provide safe maternal anaesthesia without increasing blood loss.⁴⁷ Any one of these agents can be given with 50 per cent nitrous oxide/50 per cent oxygen prior to the delivery of the baby. They reduce the incidence of maternal awareness without compromising the neonate. After delivery, they may be continued with a higher nitrous oxide concentration, or discontinued and the technique changed to nitrous oxide supplemented by narcotic.

Aspiration prophylaxis

No area of obstetric anaesthesia has undergone so many changes in so short a period of time as has the prevention of aspiration pneumonitis in the parturient. Because of this, many practitioners are confused as to the current preferred method to manage obstetric patients. Since Mendelsohn published his classic article in 1946,⁴⁸ obstetric anaesthetists have been searching for ways to reduce the risk of aspiration in the pregnant patient.

In the early 1970's, particulate antacids appeared

to be the standard until the demonstration that the pneumonitis caused by these agents might be as bad as, or worse than that caused by gastric acid.⁴⁹ Clear antacid (0.3 M sodium citrate) appears to be safer, but the timing of administration and the dose are critical factors.⁵⁰ Ongoing investigations have identified possible uses for H₂-receptor antagonists,⁵¹ to raise gastric pH above the critical level of 2.5, and metoclopramide⁵² to reduce the volume of gastric acid.

It appears that the best prophylaxis against aspiration pneumonitis continues to be:

- 1 awareness of the maternal risk
- 2 increased use of regional anaesthesia in order to avoid heavy sedation or general anaesthesia whenever possible, and
- 3 using a rapid sequence induction with cricoid pressure whenever general anaesthesia is necessary.

If one feels compelled to increase gastric pH, a regime of cimetidine 300 mg p.o. the evening before surgery plus 300 mg IM or IV one to three hours preoperatively is effective. In emergency procedures where general anaesthesia is planned, sodium citrate 0.3 M, 30 ml can be given shortly before induction.

In the absence of convincing evidence that any regime of raising gastric pH actually reduces maternal morbidity and mortality, the use of cimetidine and/or sodium citrate in obstetric patients is by no means universal in Canada.

Muscle relaxants

Because of the high degree of ionization at physiologic pH, placental transfer of all current muscle relaxants is insufficient to cause clinical effects in the newborn. Stated another way, anaesthetists should choose the relaxant used at Caesarean section by considering maternal effects, unrelated to placental transfer. Pancuronium seems to have supplanted d-tubocurarine, gallamine and succinylcholine infusions as the muscle relaxant of choice at Caesarean section. Pharmacokinetic investigations have confirmed the safety of pancuronium and the newer muscle relaxants, atracurium and vecuronium for use in obstetrics.^{53,54}

Surgery during pregnancy

Since Shnider and Webster⁵⁵ warned that anaesthesia and surgery during pregnancy might increase the

possibility of foetal wastage, there has been little information to confirm or dispute this observation. Evidence from other studies⁵⁶ suggests that some two per cent of pregnant women will have surgery during their pregnancy.

A recent, large study⁵⁷ attempted to remove observer and respondent bias from the study design and is perhaps as close as we have come to determining whether anaesthesia causes an increased abortion rate. The results confirm the previous suggestion that anaesthesia and surgery is inadvisable during any stage of pregnancy. Elective procedures should be postponed until after the pregnancy, while urgent or emergent procedures should be done with local or regional anaesthesia whenever possible. When general anaesthesia is necessary, an inhalation technique using isoflurane or halothane would seem preferable since these agents have uterine relaxant properties and may have a beneficial effect on uterine perfusion.⁵⁸

Informed consent

The question of whether there should be a specific consent form for obstetric anaesthetic procedures has been arising regularly in recent years. Certainly, legal actions against anaesthetists are increasing in frequency and dollar value and it would be unrealistic to believe that obstetric anaesthetists will escape unscathed. Unfortunately, the place of consent forms in determining whether "informed consent" has been given, has not totally been clarified.

The signed consent form does not guarantee that the patient has given her informed consent to a procedure. It is evidence that she has consented to something, but it is not a substitute for a careful explanation to the patient (and her partner) of the anaesthetic choices and risks. Unlike elective surgical patients, the obstetrical patient is seldom given the benefit of a preanaesthetic visit.^{59,60} As a consequence, she often does not know who her anaesthetist is, does not understand what he or she is doing, and cannot possibly have given truly informed consent.

Rather than hiding inadequate patient preparation behind a probably meaningless consent form, obstetric anaesthetists should strive for better antepartum and/or intrapartum education of their patients.

Included in this should be personal identification of her attending anaesthetist prior to any procedure being undertaken.

The American Hospital Association published a patient's "bill of rights" in 1975 which has been reprinted and expanded in the Canadian Patient's Book of Rights.⁶¹ An excerpt from these documents reads: "... when the patient requests information concerning medical alternatives, the patient has the right to such information. The patient also has the right to know the name of the person responsible for her procedures and/or treatment." Even a signed consent form does not ensure that these rights have been assured.

Conclusion

Obstetrical anaesthesia is a rewarding section of our specialty for many anaesthetists; it is studiously avoided by some, and at times provokes terror in all. Most patients have safe and often pain-free deliveries because of the specialized techniques available in obstetrical anaesthesia. It is a mistake, however, for anaesthetists to treat these patients in a casual manner. Close monitoring, close observation, and a careful respect for sudden disasters are of paramount importance when providing anaesthesia or analgesia for the obstetrical patient.

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