

Obstetric anaesthesia: Is there anything new under the sun?

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Abstract

Recent years have seen considerable sophistication in the practice of obstetric anaesthesia in the developed world. Important areas include regional anaesthesia in labour, regional anaesthesia for caesarean section (CS), categorization of the urgency of CS, and clearer definition of fetal indications for CS. The physiological basis for management of spinal hypotension is now well understood. Regional anaesthesia for patients with preeclampsia is established, and is rapidly developing in those with cardiac co-morbidities. Maternal awareness during general anaesthesia for CS has been considerably reduced. A better understanding of the pharmacology of oxytocic drugs has facilitated the management of obstetric haemorrhage. However, anaesthesia-related maternal morbidity and mortality in South Africa remains unacceptably high, and a major effort, including the development of a Special Interest Group, is necessary to address the specific problems in obstetric anaesthesia in our country.

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Introduction

In an editorial in 1999, the obstetric anaesthesiologist JC Eisenach lamented the fact that there had been “a progressive decline in the quality of questions addressed by obstetric anaesthesiologists” during the previous 30 years. During the early years of that era, fundamental issues such as the regulation of uteroplacental perfusion and its alteration by regional anaesthesia had been addressed.¹ However, the following brief paper shows that subsequent years have produced valuable research into important issues in obstetric anaesthesia (labour analgesia and anaesthesia for CS), which has significantly affected clinical practice, patient safety, and understanding of the subspecialty.

Important aspects of regional anaesthesia in labour include local anaesthetic potency, new epidural adjuvants, sophisticated methods of administration of local anaesthetic, and non-epidural options. Regional anaesthesia for CS is now perceived to be safer than general anaesthesia, in that tracheal intubation is avoided. The level of urgency of CS has been categorised and cardiocotographic abnormalities that indicate operative delivery are better defined in recent

Royal College of Obstetricians and Gynaecologists (RCOG) guidelines.

Important focuses have been spinal hypotension and its management, regional anaesthesia in pre-eclampsia and in patients with cardiac disease, the place of combined spinal-epidural (CSE) anaesthesia, and regional anaesthesia for placenta praevia.

Aspects of general anaesthesia where important research has been conducted include obtundation of the intubation response in hypertensive patients and reduction of maternal awareness.

Recent pharmacological studies conducted during CS have focused on oxytocic drugs. In addition, the roles of antifibrinolytics and recombinant factor VIIa in obstetric haemorrhage are under scrutiny. Cell salvage in obstetrics has been implemented in the United Kingdom.

The Confidential Enquiry into Maternal Deaths in the United Kingdom (the developed world) and South Africa (often limited resources) have exposed the contributory causes of maternal mortality, which should enable anaesthesiologists to implement changes in practice and gradually close the audit loop.

Regional analgesia for labour

To fully appreciate the relative importance of recent developments in regional anaesthesia in labour, one needs to review the monumental original work of individuals such as Cleland. In the 1930's he showed in anaesthetized dogs that afferent fibres that give rise to the experience of the pain in the first stage of labour enter the spinal cord at T11-T12. Pioneers in epidural analgesia (EA) for labour included Bromage, who wrote a magnificent textbook on the subject, as well as Marx, Shnider, Finster, Bonica, Gutsche and Wong.

The performance of a vast number of labour epidurals has allowed an accurate assessment of the effects of EA, and of the gradual modification of the technique, on the progress and outcome of labour. A recent paper attempted to summarise information which should be made available when taking consent for epidural analgesia for labour, including side effects such as nausea, vomiting, hypotension, headaches, a gradual rise in maternal temperature, and motor block, and issues such as sepsis, neurological damage, new back pain, the timing of placement of the epidural, the incidence of CS and neonatal outcome.² An excellent recent review summarises labour analgesia and obstetric outcomes.³

The concept of the minimum local anaesthetic concentration (MLAC) in a 50-ml volume required to produce effective analgesia in 50% of patients in the first stage of labour, was introduced by Lyons et al in 1995.⁴ Its importance is that an understanding of local anaesthetic potency allows for comparisons of equipotent dosing regimens. This has relevance in testing whether one agent has a benefit over another in terms of motor block. Thus, the initial enthusiasm over the minimal motor blockade associated with ropivacaine was not sustained when the potency ratio relative to that of bupivacaine was established to be 0.6. However, MLAC has some limitations. This measurement only considers the EC50, and not the ED95, which is the measure that is of most interest to anaesthetists. Intermittent boluses, which may be programmed when the sophisticated equipment required is available, are now preferred to continuous epidural infusion, since boluses are believed to spread more evenly in the epidural space.

Sophistication of regional analgesia in labour is a first-world phenomenon and is labour intensive. New epidural adjuvants include neostigmine and clonidine.⁵ These agents have postulated benefits, but a narrow therapeutic range in terms of nausea, vomiting and hypotension, and have not been widely adopted. Combined CSE analgesia has become popular in many units, following the introduction of the "walking epidural" by Morgan.⁶ Simple, low-dose epidural administration also allows for mobility and may reduce pruritus and fetal bradycardia which are associated with intrathecal opiates that are administered as part of the

CSE technique. CSE provides very rapid onset of analgesia and offers versatility in difficult cases.⁷ Patient-controlled EA has many benefits.⁸ Non-epidural options include continuous spinal analgesia, which may be complicated by technical difficulties, as well as postdural puncture headache.⁹ The management of epidural catheters in obstetrics in the setting of coagulation abnormalities has been well reviewed.¹⁰ If there are absolute contraindications to regional anaesthesia, non-regional techniques include intravenous remifentanyl administration. However, the optimal method of administration remains to be established.¹¹ Initial enthusiasm concerning the efficacy of kappa agonists in animals has not translated into effective clinical practice.

Regional anaesthesia for CS

Regional anaesthesia for CS is well established as the method of choice. However, the case fatality rate in the USA for spinal anaesthesia (SA) has increased from 1.9 to 3.8 per million during the past 20 years. The high number of deaths due to SA in the 2005-2007 and 2008-2010 triennia in South Africa may indicate, in addition to training deficiencies, that there was inappropriate case selection, particularly in hypovolaemic patients. An understanding of the importance of the volume status¹² of the parturient presenting for CS cannot be over-emphasised.

To minimise both maternal and fetal risk, CS has been allocated four potential categories in terms of urgency. The clearer definition of cardiocotographic abnormalities has also allowed the identification of normal, suspicious and pathological traces, as defined by the RCOG.¹³ Anaesthetists should at least have a working understanding of these changes.

The management of spinal hypotension has received considerable attention in the past few years, not only because of safety considerations, but also in order to reduce maternal symptoms. The role of the arterial circulation has been elucidated, and the relative importance of aortic caval compression during SA for elective CS has been put into perspective. In terms of fluid management during elective CS, crystalloid coload is preferable to preload. In general, colloids are more effective in reducing hypotension and colloid preload is probably more effective than colloid coload.¹⁴

The vasopressor debate has been concluded. Phenylephrine is the vasopressor of choice when heart rate is maintained in response to SA. This is not only because it produces less fetal acidosis than ephedrine, but also because the initial response to SA for CS in the fluid-replete patient is a partial compensatory increase in the cardiac output (an increase in heart rate and stroke volume) in response to a decrease in systemic vascular resistance. Systemic

vascular resistance is rapidly restored to normal by phenylephrine. At the same time, heart rate, blood pressure and cardiac output are restored. The heart rate response to SA is most important and the baseline heart rate should be maintained as the first priority. The physiological basis for vasopressor management has been the subject of a recent review.¹⁵ An excellent recent review summarises the effects of alpha agonists in obstetric patients.¹⁶ Where heart rate decreases precipitously because of an as yet uncertain reflex mechanism, or where ventricular function is impaired, ephedrine and anticholinergics are indicated.

Most practitioners employ regional anaesthesia for elective CS in patients with placenta praevia who have not had previous CS and do not have demonstrable placenta accreta. Indeed, there are case series that employ SA or CSE techniques, even if an adherent placenta is anticipated. The risk of clinically significant haemorrhage during CS, where a major grade of placenta praevia is present, increases with the number of previous caesarean deliveries.¹⁷

As recently as 2000, many authors favoured epidural anaesthesia for CS in pre-eclampsia. Recent work has established that SA is safe in the absence of contraindications. Most patients with pre-eclampsia have a raised left ventricular stroke work index and diastolic dysfunction, and SA is associated with modest afterload reduction and minimal hypotension.¹⁸ Peripartum cardiomyopathy, by contrast, is associated with severe systolic hypofunction. The mechanism is failure of angiogenesis of pregnancy. The high circulating levels of soluble tyrosine kinase in pre-eclampsia also have an anti-angiogenic effect, but the link between pre-eclampsia and peripartum cardiomyopathy remains tenuous.¹⁹

CSE techniques offer the benefit of excellent intraoperative surgical anaesthesia, particularly in protracted cases, together with very good postoperative analgesia. The haemodynamic benefits of sequential CSE for CS have not been established. An equivalent dose of bupivacaine administered as part of a CSE technique for elective CS may be associated with a clinically significantly higher block than that achieved during single-shot SA. Some papers have described a CSE technique for CS in patients with significant cardiac compromise,²⁰ but the individual lesion requires careful definition (where possible, it should include the use of transthoracic echocardiography),²¹ before a decision can be made concerning careful CSE versus general anaesthesia.

General anaesthesia

The recent introduction of failed intubation drills and supraglottic devices has undoubtedly contributed to the safety of general anaesthesia for CS. After landmark work by Moir and Tunstall on awareness during general

anaesthesia, recent research using Bispectral Index System scores suggests that a volatile anaesthetic concentration of 0.8 of the Minimum Alveolar Concentration should be targeted. This dose should not cause significant uterine atony. Oxygen concentrations above 30% are probably unnecessary in the absence of maternal or fetal compromise. Furthermore, neonatal resuscitation skills are now highly developed, so that an awareness avoidance approach to general anaesthesia for CS is unlikely to impact adversely on neonatal outcome.²²

Early work showed the efficacy of magnesium sulphate in obtunding the intubation response in pre-eclampsia. Recently, remifentanyl has been used effectively, but neonatal respiratory depression is clinically significant. Induction of anaesthesia requires intra-arterial monitoring and careful titration of all anaesthesia agents in patients with pre-eclampsia complicated by pulmonary oedema.

Obstetric haemorrhage

Successful management involves the effective use of oxytocics,²³ skilled surgical intervention and the implementation of a massive transfusion protocol. Currently, there is no certainty as to the correct protocol of the ratio of erythrocyte to plasma to platelets for massive obstetric haemorrhage, and an extrapolation cannot be made from the trauma literature that suggests 1:1:1. Cell salvage in obstetrics has been widely accepted in the UK where this technique is now recommended in all cases that are at risk of excessive haemorrhage.²⁴ The controversy has centred around the inadvertent administration of amniotic fluid, Rhesus sensitisation and possible infection.

A recent systematic review of the use of antifibrinolytics for postpartum haemorrhage concluded that tranexamic acid may reduce blood loss, but that the quality of existing evidence was poor. A major international trial is under way, with the intention of recruiting 15 000 women. There is still limited evidence on the risks and benefits of the use of recombinant factor VIIa in massive postpartum haemorrhage. Reasonable recommendations would be for its use only after failure of conventional therapy, in a dose of 90 µg/kg, in the setting of an adequate haematocrit, platelet count, fibrinogen, pH, temperature and serum calcium level.²⁵

Audit: closing the loop

South Africa is the only country other than the UK in which a formal audit of maternal deaths has been conducted for many years (Confidential Enquiries into Maternal Deaths in South Africa). Through this audit, training institutions have been made aware of the importance of sound training of interns in obstetric anaesthesia. This includes technical aspects of SA and general anaesthesia for CS, the choice

of anaesthetic (dependent upon co-morbidities such as hypovolaemia and cardiac disease), and the degree of responsiveness that is required in patient monitoring. The report also emphasises the crucial importance of collaboration between obstetrician and anaesthesiologist. In the triennium 2008-2010, 121 reported deaths were directly due to anaesthesia, of which 73 involved SA.²⁶ Only a major effort, directed towards training, outreach and improvement in referral patterns, can improve this sad and unacceptable situation. A Special Interest Group in obstetric anaesthesia is envisaged in South Africa, whose goal will be to improve the practice of obstetric anaesthesia, and ultimately significantly improve maternal and fetal outcomes.

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