Update on general anaesthesia for Caesarean section

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Introduction

The increased use of regional anaesthesia for Caesarean section (CS) has been a consequence of the risk of failed intubation associated with general anaesthesia (GA) for CS, as well as the provision of an improved birth experience and quality of postoperative analgesia. This trend has led to a lack of experience in the practice of rapid sequence intubation and GA in trainee anaesthetists,[1] prompting the suggestion that simulators may become an essential part of anaesthesia training in this scenario.[2] In the USA during the period 1984-2002, the case fatality rate for general anaesthesia decreased from 32.3 to 6.5 per million, while the rate of regional anaesthesia was lower, but increased from 1.9 to 3.8 per million.[3]

Current controversies include the indications for GA and the appropriate use of induction agents, inhalational agents, muscle relaxants, opioids, and oxygen, as well as the influence of co-morbidities on anaesthesia practice. The necessity for tracheal intubation during GA for elective CS has recently been questioned. The prevention of awareness remains an important issue.

Indications for GA

It is important that GA be administered where indicated. The large number of fatalities reported under spinal anaesthesia in the triennium 2005-2007 in South Africa may reflect inappropriate case selection, particularly patients with established hypovolaemia.[4] Elective CS for placenta praevia is not an absolute indication for GA per se; particular considerations in the individual case, in particular previous CS, should be used to inform the decision as to the method of anaesthesia.[5] "Rapid sequence spinal anaesthesia"[6] is probably not a good substitute for GA in cases of imminent foetal demise.

Induction agents

Although not approved for use in pregnancy, many anaesthetists use propofol for induction of GA for CS. One study has shown that propofol 2.8 mg/kg is associated with lower one- and five-minute Apgar scores than thiopentone.[7] There is no advantage to the neonate in using propofol. The use of ketamine is limited by the emergence phenomena, as well as sympathomimetic effects in pre-eclampsia. Etomidate is a useful agent in patients with haemodynamic instability, and is associated with rapid time to sustained neonatal respiration.[8] Small doses of midazolam may be useful in very anxious mothers, with minimal effects on neonatal depression.

Inhalational agents

Sevoflurane and desflurane have been evaluated for maintenance of GA with no adverse maternal or neonatal effects. Sevoflurane was not associated with more rapid recovery than isoflurane.[9] Sevoflurane has also been successfully used for induction of anaesthesia for CS, in patients with needle phobia, or absence of venous access.

Muscle relaxants

Considerable controversy has recently developed surrounding the use of suxamethonium for intubation at elective CS. Opponents cite anaphylaxis and other serious reactions to suxamethonium as reasons to

avoid its routine use. Some authors recommend the use of rocuronium as an alternative. There is little information on placental transfer of sugammadex, in the event of its requirement for the reversal of a large dose of rocuronium. Its great expense and lack of availability precludes its routine use for this purpose.

Opioids

There have been several papers on the use of opioids to obtund the intubation response at CS, in healthy and pre-eclamptic patients. Alfentanil and remifentanil[10] have been studied in healthy patients, and recently remifentanil has been found to effectively obtund the intubation response in preeclampsia.[11,12] There may be an increased requirement for neonatal respiratory support when remifentanil is used, particularly in preterm delivery. Bolus magnesium sulphate, given after thiopentone, has been shown to be very effective in pre-eclampsia.[13] No studies have compared remifentanil with magnesium sulphate in this situation.

100% oxygen

The use of 100% oxygen during GA for CS is associated with a higher umbilical venous oxygen content than 50% oxygen.[14] However, maternal hyperoxia may be associated with increased free radical activity, with as yet uncertain effects on neonatal outcome.[15] A recent publication has shown a marked increase in free radical activity in the mother and the baby during GA for CS, which is independent of the inspired oxygen concentration.[16]

Is tracheal intubation required?

Two recent publications describe the use of the laryngeal mask airway as alternative to tracheal intubation during elective CS.[17,18] The authors claim a very high success rate in terms of first time placement of the device and effective ventilation, zero rates of oxygen saturation < 92%, and zero rates of pulmonary aspiration. These findings are surprising. For example, desaturation occurs rapidly during rapid sequence tracheal intubation for CS. The laryngeal mask airway remains an important component of the failed intubation algorithm, but cannot be recommended as the first-line device for airway management during caesarean delivery.

Awareness

We have come a long way since the 1968 The Lancet publication describing "psychic reactions" during nitrous oxide analgesia for CS (six patients were anaesthetised with 80% nitrous oxide alone [no induction agent]).[19] Moir pioneered the use of halothane in 1970, and awareness was reduced from 20% to less than 1%. Tunstall's use of the isolated forearm technique in 1977 made anaesthetists aware of the risks of conscious awareness with no explicit recall. A recent review gives a reliable approach to the avoidance of awareness.[20]

Rapid sequence induction increases the risk of recall, since surgical incision rapidly follows. Initial overpressure with the inhalational agent is thus logical. Doses of thiopentone up to 7 mg/kg are now permissible, since clinically significant foetal depression is unlikely up to this dose, and maternal awareness is reduced. An EEG study comparing propofol with thiopentone suggested a lighter plane of anaesthesia in the propofol group.[7] A further study has also suggested the possibility of maternal awareness using propofol. A further potential disadvantage of propofol is the long effect-site equilibration time. Thus a dose of no less than 2.5 mg/kg is recommended in haemodynamically stable patients.

In terms of maintenance of anaesthesia, MAC is reduced by 25-40% in pregnancy. If the target anaesthetic concentration is 0.8 MAC of the volatile agent, mean BIS scores < 60 can be achieved,[21] and this allows for adequate uterine contraction.[22] Prior labour is associated with lower intraoperative BIS values; 33% oxygen is probably adequate in the absence of maternal or foetal compromise. This allows for higher concentrations of nitrous oxide, which rapidly equilibrates. A recent study showed pre-delivery BIS values of approximately 60 when using 0.5 MAC of volatile agent in 50% nitrous oxide.[21] Isoflurane and sevoflurane are favoured volatile agents because of their rapid uptake.

Despite the advances described, a recent prospective study from Australia and New Zealand found that awareness remains a significant and avoidable complication of GA for CS.[23]

Conclusion

GA for CS remains a challenge for the modern anaesthesiologist. Basic training in the often intimidating situation of emergency GA for CS for a mother with co-morbidities is an essential component of the responsibilities of educators in anaesthesia.

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