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Review Article

Current anesthesia for Cesarean Section

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Abstract

The choice of anesthesia for cesarean section should depend on the urgency of the procedure, in addition to the condition of the mother and fetus. It is widely accepted that regional anesthesia for cesarean section is preferable to general anesthesia. Regional techniques have several advantages. They lessen the risk of gastric aspiration, avoid the use of depressant anesthetic drugs and allow the mother to remain awake during delivery. The most common type of regional anesthesia for cesarean section is spinal anesthesia because of its simplicity, cost-effectiveness and speed of onset. It is suitable for cases of an emergent cesarean delivery. Hypotension during spinal anesthesia is a common that is associated with morbidity for both mother and fetus. Epidural anesthesia is preferred when physicians want to minimize the maternal hypotension or when intense motor blockage of the thoracoabdominal segments is not desired. General anesthesia still leads to a higher maternal mortality and should be reserved for absolute emergencies and cases where neuroaxial blockade is contraindicated.

Introduction

Caesarean section termed the origin of the procedure delivery predates the Roman Emperor Julius Cesar (100BC), fortunately, anesthesia-related maternal mortality has been declining during the last few decades. But it still accounts for 3-12% of maternal deaths with the majority occurring due to failed intubation, ventilation, oxygenation and pulmonary aspiration with general anesthesia for cesarean delivery [1]. As such, attention should be placed on improving the success of neuraxial analgesia and anesthesia techniques, augmenting the safety of general anesthesia, and even preventing cesarean deliveries.

General anesthesia

General anesthetic practice for caesarean section has changed during the last decades. Although, general anesthesia still seems to be the method of choice in extremely urgent settings, past anesthetic evidence has shown that general anesthesia is with increased risk of anesthesia-related maternal and neonatal mortality [2]. The morbidity and mortality associated with general anaesthesia, are in relation, pulmonary aspiration of gastric contents and difficulties with tracheal intubation. The choice of anaesthetic technique and drug must be appropriate to the clinical situation undergoing cesarean section. If time is the limiting factor, sometimes general anaesthesia is necessary because it offer rapid induction, reliability, controllability, reproducibility, and avoidance of sympathectomy-induced hypotension. What is right for one patient may not be right for another. Ultimately the choice of anesthesia should be made once the anesthesiologist looks at all the data available and discusses the risks and benefits of each choice with the patient.

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Obstetric patients undergoing caesarean section under general anaesthesia require rapid induction due to high risk of aspiration [3]. Rocuronium provides the shortest onset of action of nondepolarizing blocking agents [4-6]. Abouleish, et al., have used thiopental-rocuronium for rapid sequence induction of anesthesia in patients undergoing elective cesarean section and have shown that rocuronium does not readily cross the placental barrier, as evidenced by a low umbilical venous/maternal venous plasma concentration of rocuronium [7].

The conditions of tracheal intubation are affected not only by the type of muscle relaxants used but also by the choice of anesthetic [8-10]. Ketamine has been shown to improve intubating conditions when used in association with rocuronium [11]. Ketamine can be safely used for the induction of general anesthesia in patients undergoing cesarean section with possible hypovolemia or with acute asthma [12,13]. The drug produces minimal respiratory depression and usually increases arterial blood pressure by 10 to 25 percent. Baraka, et al. [11], have shown that ketamine-rocuronium is suitable for rapid sequence induction of anesthesia whenever succinylcholine is contraindicated, since tracheal intubation can be easily performed at 50% neuromuscular blockade (NMB), 42±14 seconds after the administration of rocuronium. Even if ketamine crosses the placenta rapidly, it does not produce neonatal depression unless used in doses above 1-1.5 mg x kg(-1).

Using ketamine for induction of general anesthesia in parturients who were undergoing cesarean section not only facilitates tracheal intubation at 50% NMB but, may allow the administration of 100% oxygen without anesthetic supplementation until delivery of the newborn [13]. However, because of the sympathomimetic effects of ketamine, it is contraindicated in hypertensive and preeclamptic parturients. Also, recovery after ketamine may be associated with disagreeable dreams or hallucinations [11].

Propofol is an alternative to thiopental for induction of general anaesthesia for cesarean section. In addition propofol is known to depress laryngeal reflexes [14,15]. It crosses the placenta and induces vasodilatation of isolated vessels and may therefore alter fetal placental vascular resistance. Soares de Moura R, et al., have studied that the direct effect of propofol on the fetal placental circulation *in vitro* [16]. They have evaluated that the actions of propofol on vasoconstrictive effects induced by angiotensin II, bradykinin, prostaglandin F and potassium chloride. Propofol induced vasodilatation and inhibited the vasoconstrictive effects of bradykinin and prostaglandin F, in the human placenta. These findings suggest that propofol may not reduce fetal placental blood flow. Since propofol reduced the vasoconstricting effect of potassium chloride but not that of angiotensin II, they have proposed that the vasodilatory effect of propofol in the human placenta involves inhibition of Ca (2+) channels.

There has been much recent interest in the use of low concentrations of sevoflurane, desflurane, and isoflurane as supplements to nitrous oxide anesthesia. These agents decrease the incidence of recall and awareness of intraoperative events and permit increased inspired oxygen tension in the mother. The main disadvantages of these agents are that uterine muscle tone may decrease and postpartum blood loss may increase. Halothane, isoflurane, and enflurane decrease uterine contractility and tone in a dose-related fashion [17].

The success of the anaesthesia methods was determined by assessing the Apgar scores of the newborn baby. Maternal outcome studies have primarily focused on maternal mortality, and neonatal outcome studies have focused on umbilical cord pH, Apgar score, the need for ventilatory assistance at birth and neurobehavioral score [18]. The baby can be affected directly by transplacental drug transfer or indirectly by alteration of foetal-placental perfusion, or both. The risks of direct effects from placenta transfer are greatest with general anaesthesia, because maternal drug exposure is greater for caesarean delivery.

Rocuronium is a monoquaternary, aminosteroidal, nondepolarizing neuromuscular blocking drug with a rapid onset of action [6]. Rocuronium had no untoward effects on the neonates, evaluated by 1 and 5 min Apgar scores, time to sustained respiration, total and muscular neuroadaptive capacity scores, acid-base status and blood-gas tensions in umbilical arterial and venous blood. Abouleish et al. [7], have shown that at delivery in 32 patients, concentration of rocuronium in maternal venous (MV) and umbilical venous (UV) plasma were 2^{41}2 (180) ng ml–1 and 389^{6} (27.8) ng ml–^{1}, respectively (UV/MV ratio 0.16). In 12 patients, the mean concentration of rocuronium in umbilical arterial (UA) plasma was 271^{2} (34.7) ng ml–1 with a UA/UV ratio of 0.62. 17-Desaetylrocuronium (Org 9943), the main metaolite of rocuronium was below the sensitivity level (25 ng ml–1) in umbilical venous and arterial plasma; the maternal venous plasma concentration was ^{1}78 (31) ng ml–^{1}.

Regional anesthesia

For elective caserian section, regional anesthesia is preferenced a technique to general anesthesia because of maternal and fetal high morbidity and mortality. Epidural or spinal anesthesia for cesarean section allows the mother to be awake, minimizes or completely avoids the problem of maternal aspiration, and avoids neonatal drug depression from general anesthetics [19]. Complications of regional anesthesia techniques are rarely high sensorial blockage or local anesthetic toxicity. Bupivacaine has a lot of advantages for this purpose but cardiotoxicity disturbs its clinic profile. Cardiotoxicity is important for the development of quick hypoxia during pregnancy and difficulties in cardiogenic resuscitation [20].

A subarachnoid block is easily administered and rapidly and reliably produces profound analgesia. Nevertheless, many anesthesiologists prefer the continuous epidural technique because they believe that hypotension occurs less precipitously and is therefore making it easier to prevent or treat. Also, the level of anesthesia is easier to control because more drug can be injected through the epidural catheter if the initial dose does not produce a satisfactory block. The Practical Guidelines for Obstetrical Anesthesia from the ASA Task Force on Obstetrical Anesthesia state that cesarean delivery can be successfully managed with all conduction techniques (spinal, epidural, CSE). The report also notes that general anesthesia may be associated with increased maternal mortality /morbidity as well as lower specific technique should be based on specific case-by-case assessment of medical, anesthetic, and obstetric issues [21].

Potentially reduced recovery times and toxicity profiles have fostered a growing interest in the newer local anesthetics, ropivacaine and levobupivacaine. Levo (L) bupivacaine represents a single enantiomer of the racemic bupivacaine currently in use. However, when compared with racemic bupivacaine, it iş remains clinically less cardiotoxic than bupivacaine Levo (L) bupivacaine represents a single enantiomer of the racemic bupivacaine currently in use. Clinical investigations appear to demonstrate that levobupivacaine offers similar blocking characteristics and complication profiles [22-26]. Dogan et al., have investegated to compare maternal and fetal effects of intrathecal bupivacaine and levobupivacaine which was the enantiomer of bupivacaine. At the end of the study in bupivacaine group decrease of heart rate, hypotension and peripheral oxygen saturation were detected and longer duration of sensorial blockage, slower sempatic blockage and less motor blockage were noted in levobupivacaine group. In conclusion have been shown that in spinal anesthesia undergoing caserian section, levobupivacaine was less toxic than bupivacaine group and more potent anesthetic and had no effects unwished for neonates [20].

The safety of the lower concentrations (0.5%) of bupivacaine currently in epidural use for cesarean deliveries, the availability of other epidural local anesthetics and the greater attention to safe practices may limit any potential value of ropivacaine and L-bupivacaine [22-26.]

The use of central neuraxial techniques for cesarean delivery has grown in large measure due to their overall maternal and fetal safety profiles. Maternal hypotension, however, frequently follows such techniques and when severe and sustained can lead to impairment of the uterine and intervillous blood flow, and result in fetal hypoxia, acidosis, and neonatal epression [27]. Three interventions, including left uterine displacement, intravascular volüme expansion, and vasopressor prophylaxis and treatment, have attempted to reduce the incidence of hypotension with variable success [28,29]. An intriguing mechanistic look at the etiology of hypotension has suggested that smaller local anesthetic doses may be a beneficial intervention. Adjuvant medications (for exp.fentanyl 25-50 µgr intratechal) are utilized to express their own benefits and reduce the dose and side effects of local anesthetics [30]. For cesarean delivery, this means a prolongation of post-operative analgesia and a reduction of motor blockade.

Hypotension during spinal anesthesia for cesarean delivery can have detrimental effects on both mother and neonate; these effects include decreased uteroplacental blood flow, impaired fetal oxygenation with asphyxial stress and fetal acidosis, and maternal symptoms of low cardiac output, such as nausea, vomiting, dizziness, and decreased consciousness [31]. Therefore, there has been much attention in the literature to methods of preventing and treating hypotension in obstetric anesthesia. Uterine displacement is routine, whereas the use of IV fluid preload is controversial [32]. Despite these conservative measures, a vasopressor drug is often required. The drug usually recommended in this context is ephedrine, which is effective in restoring maternal arterial pressure after hypotension [31].

Despite the wide acceptance of ephedrine as the vasopressor of choice for obstetric anesthesia [31,33], its superiority over other vasopressors has not been clearly defined. Historically, ephedrine was recommended on the basis of observations in pregnant sheep that showed it was more effective for increasing arterial pressure with better preservation of uteroplacental blood flow compared with other vasopressors [34,35]. This was explained by ephedrine's predominant β-effect that caused an increase in arterial pressure by increasing cardiac output rather than by vasoconstriction. Accordingly, the use of pure α-agonists such as phenylephrine has generally been avoided because of concerns about their potential adverse effect on uterine blood flow [34,35]. Extrapolation from animal studies to humans may not be appropriate because there are species differences and differences in dose, titration, and duration of the administration and use of IV prehydration to consider. The effectiveness of norepinephrine on the increase in blood pressure accompanying. Results of several trials suggest that phenylephrine [36-39], may have similar efficacy to ephedrine for preventing and treating hypotension during spinal anesthesia.

Uterine contraction is the main mechanism for reduction of uterine bleeding after delivery. The uterus is massaged, and oxytocin is administered as the first line uterotonic medication. Protocols for infusion of oxytocin vary by institution, but should include either administration of small, slow bolus doses (ie, <3 units IV), or controlled infusion. At one author's institution, oxytocin 18 milliunits/minute IV is administered by controlled infusion, started after cord clamping, titrated as needed for bleeding up to 36 milliunits/minute. If a bolus injection is given after cesarean delivery, some studies suggest that the addition of an oxytocin infusion reduces delayed blood loss and the need for blood transfusion and/or additional uterotonic agents compared with bolus injection alone [40,41]. Parturients who receive oxytocin during labor may become desensitized, and require higher doses of oxytocin for a uterotonic effect [42,43].

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