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REVIEW

Rethinking the rapid sequence induction in obstetrics

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SUMMARY

The use of general anaesthesia for caesarean delivery is decreasing, leading to less experience during anaesthesia training. Pregnant women have been known to be at higher risk for aspiration and difficult intubation. Rapid sequence induction is an integral dogma in the induction of general anaesthesia although several components of this process remain controversial. This review addresses several aspects, including the evidence for rapid sequence induction, use of cricoid pressure, choice of induction agent, use of succinylcholine, use of rocuronium with sugammadex for emergency neuromuscular blockade reversal and issues with opioid utilisation prior to delivery. The efficacy and safety of rapid sequence induction would be addressed.

1. Introduction

General anaesthesia for caesarean section is fast becoming a lost art. This is especially so in the elective setting with the vast majority of caesarean deliveries performed under regional anaesthesia. It poses a challenge for obstetric anaesthesia training as fewer trainee residents would have experience dealing with a difficult obstetric airway. General anaesthesia is arguably faster than regional anaesthesia in allowing emergent caesarean delivery, especially in the presence of maternal or foetal compromise.[1–3] Furthermore, general anaesthesia may be necessary if there are contraindications to regional techniques such as coagulopathy and patient refusal.

Foetal outcomes after general anaesthesia are generally similar to regional anaesthesia.[4] The major concern of general anaesthesia is the risk of a failed intubation that has an incidence eight times that of the general surgical population.[5] The risk of aspiration, effects on the foetus and awareness are other considerations when performing general anaesthesia for caesarean delivery. In this review, we seek to review an important aspect of general anaesthesia in the obstetric population – the rapid sequence induction.

2. Rapid sequence induction

The traditional rapid sequence induction consists of a calculated dose of thiopentone and succinylcholine before loss of consciousness alongside the application of cricoid pressure. The primary aim of this practice is to secure a definitive airway or the placement of an endotracheal tube as quickly as possible after loss of consciousness. This has been the gold standard during induction of general anaesthesia for caesarean delivery. 1062 of 1095 parturients (97%) reviewed over 2 years in 13 high-load Australian maternity hospitals with planned tracheal intubation for general anaesthesia in caesarean section received rapid sequence induction.[6] Despite the common practice of the rapid sequence induction technique, the practice is still controversial with no clinical trials to definitively support its effectiveness.

The original rapid sequence induction that began with the introduction of succinylcholine was without cricoid pressure as cricoid pressure was only described later in 1961.[7] The practice of cricoid pressure seeks to prevent gastric aspiration and allows a means by which an ideal intubating condition can be attained quickly with the use of a rapid onset short acting muscle relaxant like succinylcholine. This is of particular relevance in the obstetric population, as pregnant women are at higher risk and known to be more susceptible to aspiration due to a decreased lower oesophageal sphincter competence. During labour, this risk increases substantially with decreased gastric motility, likely influenced by the pain and stress of labour.[8]

Classical textbook teachings list hallmarks of rapid sequence induction as preoxygenation with 100% oxygen, administration of a predetermined induction dose, application of cricoid pressure and intubation with a cuffed endotracheal tube.[9–11] This has since evolved with the inundation of new drugs and the questioning of old techniques and beliefs.

Thiopentone 3–5 mg/kg with succinylcholine 1–1.5 mg/kg have been the standard drugs for the past 50 years. The entries of new drugs like propofol, rocuronium and sugammadex have provided

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potential attractive alternatives. Opioids that have previously been shunned during the induction of obstetric patients for a caesarean section for fear of neonatal respiratory depression are currently having their use in obstetric induction reviewed. Of particular interest is the use of short-acting opioids in reducing excessive sympathetic response to tracheal intubation in a bid to maintain haemodynamic stability. This is especially relevant in selected cases such as preeclampsia and with the advent of ultra-short acting opioids such as remifentanil. The role of these new pharmacological agents is still controversial and needs to be defined with regards to its efficacy and safety. Hence, it is time to rethink the rapid sequence induction in obstetric practice to challenge the current practice.

3. Controversies of cricoid pressure

Aspiration of gastric contents is an uncommon but commonly feared complication as it is potentially fatal. To prevent aspiration, Selick introduced the technique of cricoid pressure as an integral part of the rapid sequence induction.[12–14] However, this practice has been controversial.

Cricoid pressure, synonymous with the "Selick manoeuvre", was initially described vaguely in Selick's original paper as a one-handed technique of pressure application to the midline of the cricoid cartilage with "firm" pressure to occlude the oesophagus against the fifth cervical vertebrae.[7] Later, Vanner and Asai quantified the amount of effective cricoid pressure force needed as 10 Newton (N) before induction of anaesthesia, followed by an increase to 30 N in anaesthetised patients.[14]

A survey performed in Wales showed that a vast majority of 392 out of 399 responding anaesthetists (98%) performed the rapid sequence induction with cricoid pressure for elective caesarean section.[15] However, contrary to its widespread popularity, evidence that supports the role of cricoid pressure in preventing aspiration is surprisingly lacking.[12,14,16,17] The evidence for cricoid pressure is mainly from anecdotal evidence and expert opinion. In fact, recent evidence may suggest that the practice of cricoid pressure may have some shortcomings that require assessment and evaluation.

Radiological studies have suggested that cricoid pressure may not be effective in preventing aspiration. Computed tomography analysing the anatomical basis of cricoid pressure showed that only part of the oesophageal lumen was obliterated when cricoid pressure was applied, even when the cricoid cartilage and cervical vertebrae were approximated.[18] However, to begin with, almost 50% of cricoid pressure is delivered such that there is lateral oesophageal displacement relative to the cricoid cartilage.[19] Hence, a complete occlusion of upper oesophagus by the cricoid ring may not hold true.

Evidence is also emerging that cricoid pressure may potentially be harmful as it may interfere with airway management through a multitude of mechanisms. Cricoid distortion can disrupt airway patency. During the interval between induction and intubation, a disruption in airway patency can cause rapid desaturation.[20] Application of cricoid pressure has also been shown in several randomised controlled trials to make airway management with the direct laryngoscope, lightwand and flexible fibreoptic bronchoscope more challenging.[21,22] However, a large patient randomised control trial involving 700 patients undergoing general anaesthesia for non-obstetric elective surgery by Turgeon et al. found no such effect.[23]

So, should one still maintain cricoid pressure for the rapid sequence induction in obstetrics? It has shown tenacity in maintaining its place as the standard of care, especially in high aspiration risk patients. However, in the event the airway is compromised by distortion, or airway instrumentation is challenging, one may consider a partial or complete release of cricoid pressure to improve airway visualisation.

4. Use of thiopentone as induction agent

The ideal induction drug for rapid sequence intubation in the obstetric population would be a short acting agent, free of adverse haemodynamic effects, effective at blunting the sympathetic response arising from intubation, provides reliable anaesthesia and amnesia, facilitates ease of intubation even in event of inadequate paralysis and have no adverse effects on foetal and maternal outcomes.

A recent national survey in the UK polled all consultant members of the Obstetric Anaesthetist Association with regards to their preferred drug of choice for induction of anaesthesia. A majority of the respondents have used thiopentone for induction. Interestingly, thiopentone was used in most cases largely for historical reasons (37%), whilst other reasons for thiopentone use included reduction of awareness, the availability of a clear endpoint, dose predictability, cardiovascular stability, effects on the baby and drug licence concerns.[24]

The uses of propofol and thiopentone doses above 250 mg are not licenced for use in UK.[25] The FDA regulations specifically caution the use of propofol in obstetric practice.[26] Despite this, many anaesthetists employ them in off-label use.

Electroencephalographic patterns in women undergoing caesarean section suggest a light depth of anaesthesia with propofol between anaesthesia induction and delivery, confirmed by the presence of clinical signs of light anaesthesia in 50% of these patients.[27] In a study involving 82 patients undergoing caesarean section, patients receiving 2.5 mg/kg propofol had significantly reduced bispectral index during the point of uterine incision compared to patients receiving 5 mg/kg thiopentone.[28] Thus, this plane of anaesthesia that potentially risks awareness in propofol induction may deter users from using propofol as an induction agent.

As a potent arterial vasodilator, propofol may cause significant hypotension with bradycardia. However, as a single agent, it is the most effective at suppressing the hypertensive response to intubation, albeit not in a completely reliable fashion.[29,30] It does so by effectively blunting the airway and laryngeal reflexes and may be a suitable drug to improve laryngeal grade.[29,31–41] Nonetheless, this may be less useful where complete muscle paralysis is provided. It has been demonstrated that using thiopentone (5 mg/kg) as the induction agent leads to systolic blood pressure and heart rate rising following endotracheal intubation and skin incision, while that following propofol (2–4 mg/kg) induction may result in significant hypotension after induction.[27]

A randomised trial involving 100 ASA I-II women undergoing caesarean section found that if the induction-extraction interval was 10 min or less, both thiopentone (4 mg/kg) and propofol (2 mg/kg) given in a single dose for induction of general anaesthesia for caesarean section are equally safe for the infant.[42] Given the increasing difficulty of obtaining thiopentone, propofol may be a suitable alternative with more than half of anaesthetists at least willing to consider using propofol for induction of general anaesthesia for caesarean section (15% definitely and 44% probably).[24]

5. Succinylcholine or rocuronium

Succinylcholine is the conventional choice as a muscle relaxant for rapid sequence intubation. It possesses a rapid speed of onset and short duration of action, the latter of which is perceived to be sufficiently short enough to allow recovery before oxygen reserves are exhausted in an event of failure to intubate the patient. This is