

Anaesthesia for urgent (grade 1) caesarean section

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Purpose of review

We describe the different possible anaesthetic techniques for an emergency caesarean section. To choose the right method of anaesthesia may have major implications for mother, child and all involved personnel. The major controversy is whether one have other or better alternatives or both than general anaesthesia, with a rapid sequence induction technique, when the foetus is compromised.

Recent findings

Recently published studies indicate that a top-up of a well functioning labour epidural is as fast as general anaesthesia, and that the top-up can be performed during preparation and transport. Spinal anaesthesia, when performed by skilled anaesthetists, is as fast or almost as fast as general anaesthesia with a very low failure rate. Combined spinal/epidural may have advantages, especially in high-risk cardiac patients, but is too time-consuming. General anaesthesia still seems to be the method of choice for most anaesthetists in extremely urgent settings. The major disadvantage with general anaesthesia is the risk of failure and the dramatic consequences of a 'cannot intubate, cannot ventilate' situation. Awareness is another concern, and the incidence varies from 0.26 to 1% in recent literature.

Summary

Regional anaesthesia techniques such as a single-shot spinal or a top-up of a well functioning labour epidural analgesia are good alternatives to general anaesthesia in an emergency caesarean setting.

Keywords

caesarean, emergency, general anaesthesia, regional anaesthesia

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Introduction

Due to differences in tradition and resources, the rate of caesarean sections varies widely from country to country. In Norway, with almost 60 000 deliveries yearly, the caesarean rate was 16.4% in 2007. More than 60% of these were unplanned [1]. Caesarean deliveries have increased by 4% during the last decade, and the rate of planned deliveries remains the same. Clearly, there seem to be more sections performed due to unforeseen complications during delivery than before. Why is that? Obviously, both more extensive peripartum monitoring and a lower threshold for surgical intervention can explain some of the changes. For example, the results from the United Kingdom (West Sussex) show a tremendous increase in 'foetal distress' caesareans from 6.4% in 1980 to 13% in 1999 [2]. Could it be, similar to what Yentis [3] proposes, that the surgeons are getting more and more distressed? Obstetricians' distress has implications for the anaesthetist and may lead to a decision to use general anaesthesia in many cases when a regional technique may have sufficed.

How do we define an urgent (grade 1) caesarean section? The definition of an urgent or grade 1 caesarean section

should imply that the section should be performed as quickly as possible. The Royal College of Obstetricians and Gynaecologists published the 'organisational standards for maternity service' in 1995 in which they proposed that there should be a maximum decision-to-delivery time of 30 min for urgent caesarean sections. The 30 min rule has also been acknowledged by the anaesthetic community in the UK [4]. Although this rather pragmatic standard has been challenged [5], it still seems to be the standard of practice in most western countries [6].

Anaesthesia techniques

The best way of treating an urgent (grade 1) caesarean is, of course, to avoid it. A good multidisciplinary communication between obstetrician, midwife and anaesthetist can predict and to a large extent prevent grade 1 caesarean sections [7]. Parturients at risk should receive an epidural or spinal catheter as early as possible, and it should be ensured that it is well functioning in order to use it for top-up in case of urgent caesarean section. Recommendation from the American Society of Anaesthesiologists (ASA) task force on obstetric anaesthesia

even recommends the insertion of a spinal or epidural catheter before labour or parturients' request in high-risk parturients such as twin gestation, preeclampsia, anticipated difficult airways or obesity or all [8^{••},9[•]].

Top-up of a well functioning epidural

Several studies have shown that the decision-to-delivery time is as fast for a top-up technique as for general anaesthesia. Lim *et al.* [10] in Singapore found the same decision-to-delivery time between general anaesthesia and top-up of epidurals, an impressive 7.7 ± 3.0 min. In an audit from Australia encompassing 444 code green (grade 1 emergency) caesareans, mean decision-to-delivery time was 17 ± 6 min for general anaesthesia, 19 ± 9 min for epidural extensions and 26 ± 9 min for spinal anaesthesia [11[•]]. Clearly, the speed of onset is important, and the choice of local anaesthetic, as well as possible adjuvants such as opioids, epinephrine and bicarbonate has major influence. The more recent amid derivatives of local anaesthesia seem to have advantage compared with bupivacaine. Extending low-dose epidural analgesia for emergency caesarean section using 0.75% ropivacaine resulted in less need for analgesic supplementation compared with 0.5% bupivacaine with similar time to reach satisfactory level of anaesthesia [12]. A comparison between 2% lignocaine with fentanyl, 0.5% levobupivacaine and 0.75% ropivacaine showed no significant difference in time to surgical readiness, defined as loss of sensation to cold at T4 between the three, but not surprisingly a longer duration of sensory block with levobupivacaine and ropivacaine [13[•]]. Malhotra and Yentis [14] have examined the addition of 75 µg fentanyl to 0.5% levobupivacaine (20 ml) and did not find any benefits compared with parturients getting only 0.5% levobupivacaine.

Still, mixtures containing lidocaine or chloroprocaine with or without additives are the most frequently used solutions for epidural top-ups. In a prospective, double-blinded trial comparing a mixture of lidocaine, bicarbonate and epinephrine, Allam *et al.* [15[•]] demonstrated that a mixture of 1.8% lidocaine, 0.76% bicarbonate and 1:200 000 epinephrine resulted in surgical readiness in half the time compared with 0.5% levobupivacaine, with a median time to reach a block to T5 of about 7 min for the lidocaine–bicarbonate–epinephrine group. Although lidocaine may result in a slight increase in maternal sedation, it still seems to be a good alternative when time is utterly important [15[•]]. Bjornestad *et al.* [16] have shown in a controlled randomized trial that 2-chloroprocaine (30 mg/ml) without preservatives or additives provides loss of cold sensation at T5 as fast as lidocaine (20 mg/ml) and epinephrine 5 µg/ml. Epidural top-up with 2-chloroprocaine is rapid and easy because the solution needs no additives, and errors during preparation of the top-up medication can be minimized [16].

The onset time for 2-chloroprocaine is short. In a study of Gaiser *et al.* [17], the injection-to-incision time was about 9 min (SD: ± 4.7 min). Bjornestad *et al.* [16] demonstrated loss of cold sensation at T5 after 8 min (4–13 min).

It is important to inject the epidural top-up solution as early as possible after the need for emergency caesarean section has been decided. Regan and O'Sullivan [18^{••}] conducted a survey of current UK practice for extension of epidural blockade. They demonstrated that most of the obstetric anaesthetists inject the top-up solution in the delivery room. The time it takes to provide anaesthesia up to T5 can be used to transport the parturient to the operating theatre and prepare the patient for operation. Monitoring of the parturient during the transport is often insufficient during this period, and this risk must be balanced against desired rapid onset of surgery [18^{••},19–21].

Spinal anaesthesia after epidural analgesia

One major problem with the top-up technique is the possibility of a poorly functioning epidural, resulting in a nonsatisfactory anaesthesia for an emergency caesarean section. The rate of failure to achieve a pain-free operation was 24% with epidural top-up and 18% with the combined spinal/epidural (CSE) technique in a prospective audit performed over a 5-year period in Bristol, UK [22^{••}]. Many of these failures will result in pain, discomfort and often a conversion to general anaesthesia. If the epidural analgesia during labour is poor or uncertain in efficacy, a conversion to spinal anaesthesia may be a logical option. However, there have been many case-reports of unpredictable high-spinal blocks, and by some, it is considered to be a relative contraindication to give spinal anaesthesia following epidural analgesia in labour [23].

The recommendations for a spinal block after a failed epidural are to decrease the dose of local anaesthesia by 20–30% and use addition of opioids. With no documented block, and more than 30 min passed since the last dose of epidural, a normal dose of local anaesthesia can be used [24]. In a retrospective audit published in *International Journal of Obstetric Anaesthesia* in 2004 encompassing 115 women with inadequate epidural labour analgesia, a reduced dose of hyperbaric bupivacaine (average 9.38 mg) with 10–15 µg fentanyl resulted in satisfactory conditions for surgery with no high blocks [25].

Spinal anaesthesia

Spinal anaesthesia for emergency caesarean section is a widely used technique. In skilled hands, it is as fast or almost as fast as general anaesthesia [10,11[•]]. The failure rate is low. In an audit from the United States published in 2005 with 15 000 spinals, 15 000 epidurals and more than 4000 CSEs, the failure rate of spinal anaesthesia was

2.1%, postdural puncture headache occurred in 0.5%, the need for a bloodpatch was 0.2% and the frequency of high spinal was 0.06% [26]. The drug of choice still seems to be bupivacaine, either isobaric or hyperbaric, although the newer local anaesthetics levobupivacaine and ropivacaine may have some advantages such as less motor blockade and toxicity [27,28]. The addition of a lipophilic opioid such as fentanyl or sufentanil will further reduce the needed dose of local anaesthesia and shorten the time to readiness for surgery [29].

A recent study conducted by Khaw *et al.* [30[•]] showed that supplementary oxygen (60%) during emergency caesarean section in regional anaesthesia could be beneficial by increasing oxygen content in umbilical blood without increasing lipid peroxidation in the mother or foetus.

Combined spinal/epidural

The CSE method is widely used for caesarean sections. There are various techniques in which volume of either 0.9% NaCl or local anaesthesia in the epidural space is used to extend the low-dose spinal. In this way, it is possible to adjust the level of anaesthesia very accurately and reduce the incidences of cardiovascular instability. Epidural volume expansion (EVE) has been shown to reduce the dose requirement of intrathecal local anaesthesia substantially [31]. The use of low-dose sequential CSE with EVE is especially useful in high-risk cardiac patients. Although sequential CSE has many advantages, it may take 20–40 min to reach a satisfactory block when a low-spinal dose is used initially. The rate of failure to achieve a pain-free operation is also reported to be as high as 18% [22^{••}]. For emergency situations such as grade 1 caesarean sections, a sequential CSE technique is not recommended due to the extra time consumption.

General anaesthesia

Although caesarean sections can be done under regional anaesthesia, general anaesthesia sometimes will be the best solution. The frequency of general anaesthesia for emergency caesarean section will probably always remain high, as it is slightly faster than alternative regional anaesthesia methods [5,6,10]. In extremely urgent settings, as many as 90% of the caesareans seem to be performed under general anaesthesia [10]. In addition to the time factor, there may also be other possible advantages; when a compromised newborn is anticipated, a sleeping mother and a nonpresent father may offer a less stressful situation for a neonatal resuscitation. Studies have shown that the umbilical artery pH on neonates is about the same when the caesarean is performed under general anaesthesia, but umbilical arterial cord base excess has been shown to be less negative when regional anaesthesia has been used [32].

The major disadvantage of general anaesthesia is the risk of failure and the dramatic consequences of a potential 'cannot intubate, cannot ventilate' situation. The risk of failed intubation is at least eight times higher in the obstetric population [33]. The great effort during the last 30 years to change the practice from general to regional anaesthesia has substantially reduced the maternal mortality during caesarean sections [34]. This fact is still obvious in less-developed countries. In a newly published article [35] from Bangladesh, the number of deaths during caesarean sections was 17 times higher with general anaesthesia than with regional anaesthesia, although it cannot be ruled out that the general anaesthesia cases were more urgent and thus carried a higher risk.

Tracheal intubation after rapid sequence induction remains the approach to airway management during general anaesthesia. The incidence of failed intubation seems to be consistent. Publication from the Australian and New Zealand ANZCA trial group, including 1095 women receiving general anaesthesia, showed an incidence of difficult intubation of 3.3%, four failed intubations, of which three were successfully managed with a laryngeal mask airway. Antacid prophylaxis was used only in 64% of the emergency cases, and eight cases of regurgitation of gastric content were noted, but there were no cases of serious airway morbidity [36^{••}].

Induction and intubation invariabilities lead to haemodynamic instability. Remifentanyl may offer a new and promising way to maintain cardiovascular stability with little effect on the neonate, although two out of 40 neonates still required naloxone in a study comparing standard induction with thiopental/succinylcholine with thiopental/succinylcholine and remifentanyl 1 µg/kg [37].

Another concern with general anaesthesia is the incidence of awareness. In a prospective study from Spain, including 4001 patients receiving general anaesthesia, the incidence of awareness was 1%, and caesarean section was an independent risk factor. The use of halogenated inhalation agents and use of neuromonitoring during maintenance would reduce the risk [38[•]]. As a part of the ANZCA study group project, a prospective study of awareness from Australia was conducted during 2005 and 2006 in 13 maternity units dealing with almost 50 000 deliveries annually. The frequency of recall of intra-operative events was recorded for those who underwent general anaesthesia. This included 1095 women undergoing general anaesthesia, in which 47% were being performed for urgent foetal delivery. Thiopental was used as induction in 83% of the cases, with sevoflurane for maintenance in 63%. Only two cases were deemed to be consistent with awareness (incidence 0.26% or one in 382) and three cases of possible awareness [39^{••}].

Conclusion

Emergency caesarean section still remains a challenge for the anaesthetist. The choice of anaesthesia technique will depend on multiple factors. The 30 min standard is often unnecessary, and there will be time to perform a regional anaesthesia more often than not. A careful evaluation of the patients at the labour ward and a multidisciplinary approach with good communication between the obstetrician, the midwife and the anaesthetist will enable an early detection of a compromised foetus or mother. An early placement of an epidural or spinal catheter in high-risk parturients will reduce the need for general anaesthesia. Top-up of a well functioning epidural is almost as fast as general anaesthesia, as is a single-shot spinal. Rapid sequence induction with thiopental and succinylcholine and maintenance with halogenated drugs is still the choice for most anaesthetists when general anaesthesia has to be performed in the most urgent situations.

References and recommended reading

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Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 448–449).

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