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4

The ongoing challenges of regional and general anaesthesia in obstetrics

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The increasing trend of caesarean section in the setting of increasing maternal age, obesity and other concomitant diseases will continue to challenge the obstetric anaesthetist in his/her task of providing regional and general anaesthesia. The challenges of providing anaesthesia for an emergency caesarean section, particularly the risks of general anaesthesia, will be debated. The need for involvement of a multidisciplinary team, good communication and challenges surrounding the provision of anaesthesia to such patients are discussed.

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Obstetric anaesthetists have constantly striven to make childbirth, including caesarean delivery, a safer and less painful process. Good teamwork and communication among caregivers in the perinatal period are crucial to a good outcome. General anaesthesia remains a significant risk to women undergoing caesarean section, owing notably to the increased difficulties in airway management, which can be life-threatening. Hence, it is prudent to avoid general anaesthesia, especially in the emergency situation, if possible. The modern-day obstetric anaesthetist has to also grapple with issues related to changing population characteristics, including maternal obesity, advanced maternal age and an increased complexity of medical diseases (including cardiac diseases), which may afflict women with reproductive potential today. It behooves the obstetric anaesthetist to accord due consideration to these factors to optimise outcome of mother and child.

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Anaesthesia for 'stat' caesarean sections

One of the greatest challenges for the obstetric anaesthetist is to be called upon to provide support for an immediate caesarean delivery, typically in the situation of impending maternal–foetal demise. The potential problems here are legion; the unprepared anaesthetist may be compelled to administer general anaesthesia under less than ideal conditions to an unfasted patient. Indeed, data from the United Kingdom demonstrate that the rate of caesarean section for the indication of 'foetal distress' has escalated dramatically over the past 2 decades, from 6.4% in 1980 to 13% in 1999,¹ and up to 24% in 2001.² This could have been attributed in part to the greater ability to diagnose intra-partum foetal compromise rendered by the enhanced sophistication of modern peri-partum monitoring. The current obstetric practice, when taking the medico-legal environment into account, may preclude a more conservative approach in the management of pregnancies with potential maternal–foetal complications. Regardless of cause, the urgency of which the situation is undertaken will undoubtedly have repercussions on the practice of anaesthesia; some degree of pressure to speedily, or worse, hastily administer general anaesthesia may be inevitable.³ This predicament can often be avoided if anaesthetists are informed earlier about the existence of such 'high-risk' cases before the rapid deterioration of the maternal–foetal clinical state and the decision for caesarean section is finally made. This would serve to enhance the preparedness of the anaesthetist and operating theatre staff in the eventuality of caesarean section.

Admittedly, some 'stat' caesarean sections may not be easily predicted and may present suddenly, such as a collapsed pregnant patient who requires a peri-mortem caesarean delivery when time is of the greatest essence.⁴ In this respect, previous audits have revealed that the longest delay in the decision-to-delivery interval is the time taken to transfer the patient to the operating theatre and the timely assembly of staff.⁵ This will continue to be a challenge but the principles of good clinical practice, including good teamwork, presence of well-trained staff and the implementation of a well-drilled system could potentially enhance the outcome of mother and baby. Our institution uses a public announcement system, a 'stat' caesarean section code activated only in the most desperate situation when an emergent caesarean section is required.⁶ This allows us to immediately mobilise the team members (comprising obstetricians, anaesthetists, neonatologists, nurses and health attendants) plus equipment for the processes of preparing and proceeding with surgery. Logistics aside, with the application of such a system, made possible only with appropriate training and drills, a remarkably short decision-to-delivery time could be potentially achieved.⁷

In many other situations, such as the condition of a 'non-reassuring foetal status', it may be unnecessary, indeed undesirable, to rush the patient to an abdominal delivery. It is imperative for caregivers to recognise the urgency for a caesarean section, stratify risks accordingly and weigh the risk–benefit ratio before proceeding to deliver the baby without undue delay. Attempts have been made in the United Kingdom (UK) to classify the urgency of caesarean sections into 4 grades — (i) immediate threat to life of woman or foetus; (ii) maternal or foetal compromise which is not immediately life-threatening; (iii) needing early delivery but no maternal or foetal compromise; (iv) at a time to suite the patient and maternity team.⁸ This was found to be well accepted by both obstetricians and anaesthesiologists, thus enhancing multidisciplinary teamwork. However, the pathogenesis of intra-partum hypoxia, a common cause for making the call for a caesarean section in this case, is not yet fully understood and methods for its diagnosis are not without their limitations. Ironically, continuous intra-partum cardiotocographic monitoring could lead to an increase in caesarean sections and instrumental deliveries without apparent benefit in long-term neonatal outcomes.⁹ A maximum decision-to-delivery interval of 30 min for urgent caesarean sections has been adopted in the UK² and North America¹⁰ as the minimum acceptable standard of care, although it is not apparent that neonates delivered beyond this time limit are always associated with a poorer outcome.¹¹ However, conditions such as placental abruption or uterine rupture would necessitate an immediate delivery of the neonate, as any delay would, intuitively, result in a poor outcome for the baby. In other situations, the severity and gravity of the extent of maternal foetal insult may not be so apparent; hence, the need for good communication among caregivers is ever more vital to ensure patient-centric decision making and timely delivery. Active measures, such as positioning the mother in full left lateral position, giving oxygen, intravenous fluids and stopping the syntocinon infusion, might ameliorate foetal compromise, perhaps even avert a caesarean section.¹²

In short, preparing a woman for emergency caesarean section is a multi-disciplinary task involving multiple steps and processes, including the timely assembly of staff. Good communication among obstetricians, midwives and anaesthetists, and early involvement of senior staff for high-risk cases may prevent a 'crash' caesarean section.¹³ In the most recent report on the confidential enquiry in maternal and child health (CEMACH), general anaesthesia for caesarean section in the emergency setting constituted the major direct cause of maternal death due to anaesthesia. We could infer that it is desirable to avoid a 'stat' caesarean section if possible. Rushing the process of performing a caesarean section may unduly place the mother and the foetus under unnecessary risks; particularly, it might pressurise the anaesthetist to be inclined to administering a hurried general anaesthetic against his/her better judgement of providing a regional technique instead. Ideally, anaesthetists should be informed *early* if there are problems such as high-risk pregnancies, patients with co-existing morbidities or a poor cardiocotographic trace so that anaesthetic management plans can be made in advance, or a functioning epidural catheter inserted early in labour. Though it is important to audit performance indicators such as decision-to-delivery times, it might be more useful to look for ways and means to constantly improve upon the process and pathway of care in urgent caesarean sections.

General anaesthesia for emergency caesarean section—a vanishing art?

In spite of the increasing popularity of regional anaesthesia, general anaesthesia for an emergency caesarean section continues to be an important, direct cause of maternal mortality and morbidity. Since 1979, results from CEMACH reports for direct maternal deaths show a greater risk from general anaesthesia than from regional anaesthesia.¹⁴ Hawkins and colleagues also report these findings in North America.¹⁵ The American Society of Anesthesiology (ASA) Closed Claims Study has attributed many of these deaths to the inability to establish or maintain a patent airway during general anaesthesia.¹⁶ Maternal death in this instance is commonly attributed to the high incidence of difficult airway and aspiration pneumonitis. It is still mandatory for one to perform tracheal intubation when administering general anaesthesia to 'protect' the airway; tracheal intubation in these patients can be a very daunting task for anaesthetist. Soft-tissue oedema and the accumulation of adipose tissue around the airway in pregnancy may render the visualisation of the larynx very challenging during laryngoscopy.¹⁷ Mask ventilation is difficult,¹⁸ and the pregnant patient, particularly if obese, is very prone to rapid oxygen desaturations on induction of general anaesthesia. Even though the difficult airway can often be anticipated by clinical features such as a large neck circumference, thyromental distance and a high Mallampati score,¹⁹ none of these is completely reliable. Caregivers of the parturient (e.g., midwives, obstetricians and anaesthetic personnel) could be trained to be alert and recognise the presence of risk factors that place the parturients at increased risk for complications from general anaesthesia, and alert the anaesthetist when identified.¹⁷ Hence, it is important for institutions that provide obstetric anaesthesia to have appropriate 'unanticipated difficult airway' and 'failed intubation' protocols.²⁰ One could potentially decrease maternal morbidity and mortality associated with the provision of general anaesthesia for caesarean section by calling for organised drills and mock airway codes specific for the obstetric population to enable caregivers to function as a team.²¹

The issue of difficult airway during general anaesthesia has largely been circumvented by the increasing use of regional anaesthesia. Even though trainees may be very proficient in the conduct of spinal or epidural anaesthesia, they are usually not as familiar with handling a real-life difficult airway for caesarean section. Many anaesthetists may encounter a difficult airway for the first time when called upon to anaesthetise such a patient in an emergency. The challenge is in the difficulty to ramp up one's capability to handle these cases when the exposure to general anaesthesia is limited in the normal situation. There is a constant struggle to maintain safety of general anaesthesia with the lack of experienced anaesthetists to undertake the task, especially in remote areas and developing countries where the overall numbers of trained anaesthetists are few, and regional techniques are widely used as it is deemed safer and cheaper for the parturient.²² The safety of anaesthesia will certainly be enhanced with the more widespread availability of critical monitoring tools, such as pulse oximetry, and the training of their usage in developing countries.

Indeed, there are some positive signs on the horizon. For example, the recent ASA closed claims analysis found that there were no fatalities due to failed intubation since 1999.¹⁶ This state of affairs

could be attributed to an increased awareness of potential airway catastrophes at the time of general anaesthesia, more frequent usage of regional anaesthesia, improvements in the difficult airway algorithm and of the use of the laryngeal mask airway (LMA) as a 'rescue' airway in the event of a failed intubation. The usefulness of the LMA in this situation is generally very well accepted and has been incorporated into the ASA difficult airway protocol.²³ The LMA has also been used selectively for elective caesarean section²⁴ even though there is no evidence to support its routine use at this point in time. Although the LMA is easy to insert, there are potential issues with its use in obstetric anaesthesia, principally related to the potential risk of regurgitation and aspiration of gastric content. The LMA ProSeal™, which has a port that allows drainage of gastric contents apart from affording a better oropharyngeal seal, has been shown to be effective as a temporary airway for post-partum patients.²⁵ There have also been several reports of the successful use of the ProSeal™ as the rescue airway for failed intubation during general anaesthesia for caesarean section,^{26–28} even though there are no reports of properly performed randomised controlled trials to examine its safety in this context. Nevertheless, it is important to include tools such as the LMA and ProSeal™ (among others such as intubating fibre-optic bronchoscope, gum elastic bougie and cricothyroidotomy set) in the 'difficult airway' trolley, in the event of unexpected difficult intubation. Novel video-laryngoscopic devices have also been shown to either shorten the time to tracheal intubation²⁹ or improve the quality of oxygenation³⁰ when compared with the traditional direct laryngoscope, although that there is a significant learning curve involved and experience is limited in maternity patients.

Moreover, the incidence of maternal mortality due to aspiration during delivery is now rare; this could be attributable to a heightened awareness of the increased risk, enforcement of fasting guidelines, institution of aspiration prophylaxis and the increasing trend for use of regional anaesthesia for caesarean section delivery. Even though there has been a drastic reduction in maternal deaths from aspiration over the past few decades (from 1:42000 births in the USA in the 1950s, to only two closed claims in the ASA database since the 1990s), it is still a potential risk that the obstetric anaesthetist should not dismiss.¹⁶

Central neuraxial anaesthesia in the pregnant patient

Spinal anaesthesia

In the vast majority of cases, a central neuraxial block would be desirable for a caesarean section. A single-shot spinal anaesthesia (subarachnoid block) provides fast and reliable anaesthesia, apart from allowing the anaesthetist to co-administer agents (including intrathecal morphine) to provide effective postoperative analgesia. However, spinal anaesthesia is not without its own challenges, including the high incidence of arterial hypotension and its potential repercussions. The higher incidence of foetal acidosis, which has been attributed to hypotension or the effect of the overzealous administration of ephedrine to remedy hypotension, has led to considerable debate with regard to the utility of spinal anaesthesia for caesarean section.³¹ While intravenous fluid 'preloading' has not been found to be efficacious in many instances, fluid 'co-loading', that is, the administration of intravenous fluid at the injection of spinal anaesthetic instead of before, has been found to be more useful for this purpose.³²

The choice of vasopressors as the treatment for hypotension after spinal anaesthesia has also been a topic of some debate until recently; phenylephrine is currently the treatment of choice in this context in many instances even though its role in the compromised foetus warrants further investigation.^{33,34} The use of ephedrine has been found to be less efficacious in managing post-spinal anaesthesia hypotension, resulting in a higher incidence of maternal nausea and vomiting as well as foetal acidosis.³⁵ To keep patients' blood pressure tightly within the normal pre-block values and to ensure the best outcome for the mother and foetus, a multimodal therapy comprising fluid co-loading and prophylactic phenylephrine infusion has been suggested.³⁶

However, the rapidity of onset of spinal anaesthesia may be advantageous in situations when the foetus needs to be delivered urgently. Although not evaluated in clinical trials, in skilled hands, spinal anaesthesia for urgent caesarean section could possibly be achieved just as quickly as general anaesthesia, without the attendant problems of the latter (*vide ante*).³⁷

One of the drawbacks of a single-shot spinal anaesthesia is the inability to extend the block when anaesthesia is inadequate. Pain during surgery has been one of the most important causes of medico-

legal actions against the obstetric anaesthetist.¹⁶ In this regard, the testing of the adequacy of block prior to surgery is challenging; the test of loss of sensation to touch up to and including the fifth thoracic dermatomal level bilaterally has been recommended.³⁸ The increasing trend in the rate of caesarean section worldwide implies that many abdominal deliveries are repeat surgeries; these may be associated with potentially greater surgical difficulty, such as the increased risk of placenta praevia, and a more prolonged surgical time,³⁹ thus the use of an extensible block is advisable. In this respect, the use of the combined spinal epidural technique (CSE) has gained much popularity. It potentially allows the anaesthetist to moderate the dose of spinal anaesthetics⁴⁰ or to apply techniques such as epidural volume extension (EVE) to enhance the level of block without necessarily exposing the patient to large doses of anaesthetics.⁴¹ Indeed, modifications to spinal anaesthetic dosing may be a consideration; a similar dose of spinal anaesthetic has been found to result in a more profound block in CSE than in a single-shot spinal technique even though this finding has been recently challenged.^{42,43} The extension of block intra-operatively by using the epidural catheter should be undertaken with the consideration of possible direct migration of local anaesthetics through the dural rent, as studies have shown a greater spread of block when local anaesthetics were injected into the epidural space instead of normal saline.⁴⁴ The presence of the epidural catheter could also provide an avenue for effectively controlling post-operative pain after caesarean section, notably by the patient-controlled epidural technique.⁴⁵

As the result, CSE has gained wide acceptance; indeed, detracting arguments and fears related to the status of unproven functionality of the epidural catheter at induction of spinal anaesthesia have not been consistently supported. Reliability of the epidural catheter in providing anaesthesia for caesarean section after CSE induction for labour analgesia has been shown to be greater than an epidural catheter which was inserted without the initial breach of dura.^{46,47} The use of continuous spinal anaesthesia (CSA) could potentially incorporate the reliability of subarachnoid anaesthesia and the flexibility of block extension, if necessary. Indeed, there have been reports on the reliability of a carefully titrated CSA in high-risk cardiac patients undergoing caesarean section.⁴⁸ Even though the risks of neurological sequelae and post-dural puncture headache have not been found to be higher in CSA than in CSE in a recent publication, the role of CSA in obstetric anaesthesia at large is, to date, highly debatable.⁴⁹

Central neuraxial anaesthesia in the pregnant patient-

Augmentation of existing labour epidural analgesia for intra-partum caesarean delivery

With the growing popularity of subarachnoid block, the role of *de novo* epidural anaesthesia for caesarean section has diminished. By contrast, the use of epidural analgesia has gained considerable popularity due to its safety and efficacy for the management of labour and intra-partum pain. A well-functioning epidural catheter can be quickly extended to provide anaesthesia for caesarean section by administering a 'top-up' dose of local anaesthetic. In this event, studies have shown that the decision-to-delivery time is as fast for a 'top-up' technique as for general anaesthesia.⁵⁰ As a corollary, high-risk parturients with twin pregnancies, pre-eclampsia, anticipated difficult airways or obesity should have a functioning catheter inserted early in labour in anticipation of a possible urgent caesarean section.⁵¹ Although the decision-to-delivery time may not be different from general anaesthesia, it still takes time for an epidural top-up to work. To overcome this challenge, the use of 2-chloroprocaine, an ester local anaesthetic, has been found to have a very rapid onset time, although its duration of action is correspondingly short; the experience with its use may be limited outside North America.⁵²

However, even though the role of a formal 'epidural test dose' is now questioned,⁵³ confirming that no blood is aspirated from the epidural catheter before an epidural top-up, ensuring the proper monitoring of mother and foetus, and verifying the appropriate functioning of the epidural catheter are some of the imperatives.^{46,54,55} When augmenting an epidural block for caesarean section, a seemingly functioning epidural catheter in the delivery suite may rarely result in an excessive block when a large top-up volume is injected⁵⁶; hence it is prudent to constantly monitor the patient when augmentation of labour epidural analgesia for intra-partum caesarean delivery is performed. By contrast, an inadequately functioning epidural catheter that requires multiple supplementations during the intra-partum period is strongly and independently associated with an increased possibility of caesarean section.⁵⁷ The higher incidence of this 'breakthrough' pain has also been found to be associated with

a higher failure of augmentation of labour epidural analgesia for intra-partum caesarean delivery.⁴⁷ Anaesthetists may opt to re-insert the epidural catheter and to re-establish an adequate function of the epidural block early as these patients are at a higher risk for general anaesthesia, should they need one for caesarean section. Alternatively, instead of augmenting the 'questionable' epidural catheter for intra-partum caesarean delivery, other techniques such as spinal anaesthesia could be explored. However, it is prudent to modulate the dose of spinal anaesthetics in the presence of a partially effective epidural anaesthesia⁵⁸ as failure to do so could lead to excessively high block cases, which could result in cardio-respiratory compromise.⁵⁹

Changing population characteristics-the obese parturient

Weight gain occurs as part of the physiological changes of pregnancy, and there is a lack of clarity in the definition of obesity according to body mass index (BMI) *during* pregnancy. In the World Health Organization (WHO) guidelines, the categorisation of obesity follows pre-pregnancy BMI; as such, a parturient is obese when the pre-pregnant BMI is greater than 30 kg/m².⁶⁰

The last two CEMACH reports have identified obesity as an independent risk factor for maternal mortality. More than half of the women who died were either overweight or obese.⁶¹ Maternal obesity increases the risk of pregnancy-induced hypertension, venous thrombo-embolism, gestational diabetes and wound infection and peri-partum cardiomyopathy.^{62,63} The obese parturient is also at a higher risk of developing complications during labour; these include foetal distress, meconium aspiration, failure to progress in labour and shoulder dystocia. These factors are in turn highly predictive of the need for instrumental and abdominal deliveries.⁶⁴ Indeed, obesity and caesarean section are independent risk factors for maternal morbidity and mortality.⁶⁵

The increased incidence of difficult airway resulting in increased risks of difficult or failed intubation makes the obese patient a particularly poor candidate for general anaesthesia.¹⁸ In addition, the physiological changes in the respiratory system due to pregnancy are further compounded by obesity. Functional residual capacity (FRC), which determines the amount oxygen reserve, is decreased in pregnancy. The FRC will fall even further, below the closing capacity of the dependent alveoli, when the obese patient is supine, particularly if general anaesthesia is induced. The resultant atelectasis and intra-pulmonary shunting, coupled with the increase in oxygen consumption, would make them very prone to rapid hypoxaemia in the supine position.⁶⁶ This situation can be exacerbated by cephalad retraction of the panniculus due to obesity. These respiratory problems can often be compounded by obstructive sleep apnoea (OSA) and its corresponding complications such as pulmonary hypertension and right heart failure.⁶⁷

Importantly, obesity is clearly linked to co-morbidities such as diabetes mellitus, hypertension, coronary artery disease, cerebrovascular disease and pregnancy-related complications. Morbidly obese mothers should be referred for an early anaesthetic consultation. Engagement of the obstetric anaesthetist in the management of this group of high-risk patient should be done, preferably, antenatally so that an appropriate management strategy could be planned in advance to prevent an adverse outcome. Again, good communication between the obstetrician and the anaesthetist during the antenatal period is essential. For instance, with the increased risk of operative procedures in the obese parturient and the hazards of general anaesthesia, the obese patient in labour should be encouraged to have a functioning epidural catheter placement early. Apart from providing efficacious analgesia and alleviating further physiological derangements due to labour, the presence of a functioning epidural catheter can also be used to induce anaesthesia quickly in the event of an emergency caesarean section.⁶⁸

Other practical issues such as the co-ordination of postoperative care, the need for intensive care monitoring and the patient's functional state (including the ability of the patient to lie flat) should be discussed in antenatal multidisciplinary meetings involving all caregivers for the patient. Preparations to ensure an adequate number of personnel, and sometimes lifting equipment, will be necessary for safe transfer (both for the staff and patient) of the super-morbidly obese parturient. Hospital equipment such as surgical instruments to facilitate surgery must be available; trolleys, delivery beds and operating tables must be able to withstand the weight of the patient. Extra long needles may be rarely required to make performing a spinal or epidural technically possible. The institution of standard

operating procedures and establishment of a 'high-risk' team to routinely provide leadership in the management of these patients may be desirable if resources permit.

There is also a host of technical and procedural problems that will challenge the obstetric anaesthetist who is called upon to anaesthetise the obese patient. Peripheral venous access can be very difficult. Occasionally, central venous catheterisation for venous access may have to be resorted to.⁶⁹ Physiologic monitoring of these patients is also difficult; non-invasive blood pressure cuffs may be too small, difficult to apply and may not provide reliable readings. Unfortunately, the ability to accurately monitor blood pressure is critical, especially during neuraxial blocks, as greater fluctuations than in non-obese patients may be anticipated.⁷⁰ In addition, if inappropriately positioned, the obese patient is more prone to developing aorto-caval compression, which is exacerbated by the large fat panniculus apart from the gravid uterus. This could result in severely reduced cardiac output and placental perfusion.⁷¹ Therefore, the need for an intra-arterial, invasive blood pressure monitoring may be desirable if not inevitable.

Similarly, although regional anaesthesia is highly recommended for this group of patients for caesarean delivery, this is not without its own difficulties (*vide infra*). Locating the midline can often be a challenge; the identification of the inter-vertebral space for potential needle entry may be near impossible due to the obliteration of the usually palpable bony anatomical landmarks such as spinous processes of vertebrae by the large amount of adipose tissue, requiring repeated attempts at needle placement.⁷² Even though the use of ultrasonography as a clinical adjunct to locating landmarks and structures has been proven to be very effective, its role may be limited in the obese patient, as clear images of the vertebral columns may not be produced owing to fat tissue.^{73–75}

In spite of its popularity, the suitability of single-shot spinal anaesthesia in the obese patient is arguable as exaggerated spread of local anaesthetics, resulting in an unpredictable level of block has been previously reported.⁷⁶ This was purportedly due to lower cerebrospinal fluid volume caused by increased abdominal pressures and engorgement of the epidural venous plexus due to increased pressure of the epidural space secondary to compression of the inferior vena cava in obese subjects.^{77,78} The importance of avoiding an excessively high block in the obese patient, who has multiple medical problems, including a potentially difficult airway cannot be overemphasised. By contrast, the lack of ability to extend a single-shot spinal anaesthesia, which has a finite duration of action, is a distinct disadvantage in this context because surgery in these patients can often be prolonged. In this situation, the use of a technique that offers the flexibility to extend the duration of analgesia, via a functioning epidural catheter, for instance, would be desirable. However, the placement of an epidural catheter in this group of patients has been found to be associated with a higher risk of complications such as accidental dural puncture⁷² and venous cannulation of the epidural veins.⁷⁹

In short, obesity has become an emerging threat to the health of pregnant women apart from being a multifaceted preoperative and intra-operative problem that the obstetric anaesthetist has to grapple with. Furthermore, its association with postoperative complications such as venous thromboembolism and wound infections⁷² necessitates a comprehensive strategy that encompasses a multi-disciplinary and holistic approach in management.

Changing population characteristics

The ageing parturient

As there is a steady worldwide trend in delaying childbearing, especially in developed countries, the obstetric anaesthetist would increasingly face a parturient with increasing age.⁸⁰ Increasing maternal age is positively correlated with maternal morbidities, including gestational diabetes, pre-eclampsia, placental abruption and caesarean delivery.⁸¹ Advanced age is also associated with a higher incidence of pre-existing medical conditions such as hypertension, ischaemic heart disease, obesity and diabetes mellitus. An emerging challenge would be caring for pregnant women with ischaemic heart disease. Maternal deaths from acute coronary syndromes (ACS) had risen fourfold in the triennium from 2000–02 to 2003–05.^{61,82}

As such, the care of the elderly parturient is the care of a high-risk pregnancy; the engagement of the anaesthetist is vital in the antenatal and postnatal management of these patients. The obstetric

anaesthetist will be increasingly challenged to stay engaged and to spend more time in the antenatal clinics and postoperative care to optimise outcome for this group of patients. The worldwide trend of increasing caesarean section rates, in tandem with issue of advanced maternal age, will add further pressure on the commitment of obstetric anaesthetists.

In summary, the increasing trend of caesarean sections (in the setting of increasing maternal age, obesity and other concomitant diseases) will continue to challenge the obstetric anaesthetist in his/her task of providing regional and general anaesthesia. Owing to the potentially greater risk of general anaesthesia, particularly in the emergency situation, a regional anaesthetic technique is commonly preferred. The infrequency of administering general anaesthesia and the resultant lack of experience may in turn compound the problems of general anaesthesia. The importance of training for preparedness and drills to tackle potential problems related to general anaesthesia, such as a difficult tracheal intubation, should not be underestimated. Similarly, the co-ordination of care among personnel is pivotal in improving the outcome of high-risk patients. The best management of a 'stat' caesarean section is to avoid one but having a good system that incorporates training and mock codes may enhance preparedness and avoid an adverse outcome in this eventuality. Good and timely communication among caregivers is imperative; adopting a multi-disciplinary, holistic approach is the key to overcoming many of the challenges in providing general and regional anaesthesia in obstetrics.

Practice points

- The key to successful management of an emergency caesarean section is communication and teamwork between the caregivers.
- Obstetricians should inform the anaesthetists early if there are anticipated problems such as high-risk pregnancies, patients with co-existing morbidities or a poor cardiotocographic trace so that anaesthetic management plans can be made in advance, or a functioning epidural catheter inserted early in labour.
- The obstetric anaesthetist must be involved as early as possible in the anaesthetic screening and management of morbidly obese patients.
- Elective epidural placement may be preferred for obese parturients in labour, which can be extended if necessary for operative delivery.
- Anaesthetists can contribute by organising practice drills for teaching airway skills and recognising of potential difficult airway in obese parturients.

Research Agenda

- Health Services Research on the use of simulators and drills in enhancing outcome in obstetric anaesthesia.
- The use supraglottic airway in general anaesthesia for caesarean section.
- The comparative maternal and neonatal outcomes of general versus regional anaesthesia for caesarean section.
- The relevance of rapid sequence induction in general anaesthesia for caesarean section.

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