

GENERAL ANAESTHESIA FOR CAESAREAN SECTION

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Introduction

Caesarean section is a surgical procedure commonly performed in rural hospitals in developing countries. Those responsible for providing anaesthesia for such surgery must be fully aware of the basic principles involved.

Caesarean sections can be performed under general anaesthesia, regional anaesthesia or local infiltration. This article will consider only general anaesthesia: regional and local techniques will be described in a subsequent article.

When selecting the type of anaesthetic to be used, the anaesthetist must take into consideration his or her own experience and that of the surgeon, the condition of the patient, the degree of urgency and the availability of equipment and drugs. General anaesthesia has the advantage of speed, but introduces the risk of airway complications including aspiration of gastric contents or failed intubation. Regional anaesthesia, such as spinal or epidural block, avoids these risks, but takes longer to perform, and may cause undesirable hypotension secondary to peripheral vasodilation.

Physiological changes in late pregnancy

In the later stages of pregnancy some substantial physiological changes occur. The most important ones and their significance to the anaesthetist are:

1. When the patient lies on her back the pregnant uterus compresses the vena cava and the aorta and obstructs blood flow. Compression of the former leads to a diminished venous return and a fall in maternal cardiac output, and this together with the compression of the aorta will reduce the blood flow to the uterus, with undesirable effects on the fetus. In some women this "aorto-caval" compression may lead to hypotension (supine hypotensive syndrome).

The conscious patient can respond by improving her position, but under general anaesthesia this is impossible. Spinal or epidural anaesthesia considerably worsens the problem due to the sympathetic blockade produced.

By tilting the patient to the left by about 15 degrees the pressure from the uterus on the vena cava is reduced. This can be achieved by tilting the operating table or by placing a wedge under the patient's right buttock (figure 1).

2. There is diminished tone in the lower oesophageal sphincter and in later pregnancy the raised intra-abdominal pressure and altered gastro-oesophageal angle make gastric reflux more likely. In labour the administration of opioids markedly slows gastric emptying.

During induction of anaesthesia passive regurgitation of stomach contents into the pharynx may occur, and lead to aspiration pneumonia. This is likely if the pH of the stomach contents is less than 3 (very acidic) and more than 30 mls of fluid is aspirated. The mother may be protected from this complication by using local anaesthesia instead of general anaesthesia when possible, by reducing food intake in labour to minimise stomach contents and by a careful rapid sequence induction of anaesthesia using cricoid pressure (see figs 2 & 3). The stomach acid should also be neutralised if a Caesarean section is planned. An intravenous H₂ blocker such as ranitidine or cimetidine is effective but takes an hour to work. An antacid such as 30mls of 0.3 Molar sodium citrate is reliable if given immediately before induction of anaesthesia and will last about 1 hour. A combination of both methods will protect for several hours.

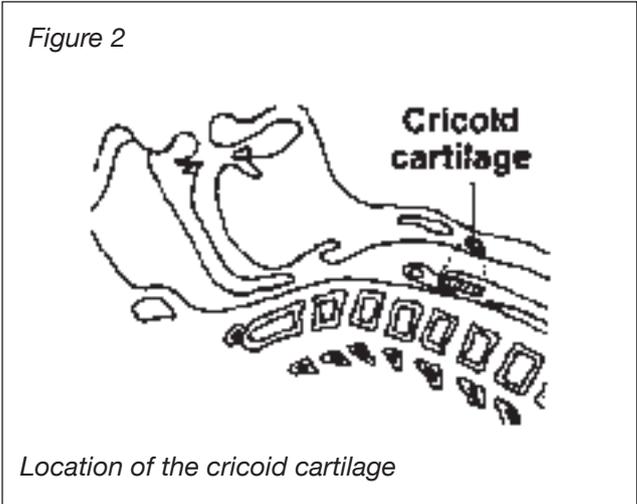
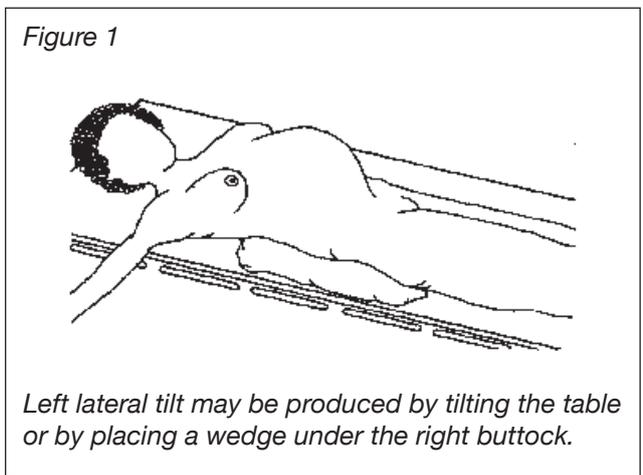


Figure 3



Applying pressure to the cricoid cartilage

Some anaesthetists pass stomach tubes prior to induction of anaesthesia to empty the stomach. Although this may remove some fluid it is rare for them to empty the stomach effectively, as solid material cannot generally be removed.

3. There is a greater increase in plasma volume than red cell mass causing dilutional anaemia. Cardiac output is increased. Patients with cardiac disease (either congenital or valvular) are at particular danger during pregnancy, due to their inability to adapt to these changes.

4. There is a decrease in the resting lung volume caused by pressure from the enlarged uterus, and there is an increase in the basal metabolic rate. Oxygen reserves are therefore diminished and hypoxia develops rapidly if airway problems occur.

5. Many drugs used in anaesthesia cross the placental barrier and may affect the fetus, particularly opioids such as morphine and sedatives such as diazepam. During anaesthesia these drugs should be avoided until the umbilical cord has been clamped.

Although this article is concerned with anaesthesia for Caesarean section, the general principles discussed are applicable to other operations in the pregnant patient.

Preparation. Caesarean sections are frequently performed as emergencies in unprepared patients. The procedure may be complicated by an unfasted patient, fetal distress, severe haemorrhage, pre-eclampsia etc. Prepare and check equipment for obstetric anaesthesia in advance, so that your apparatus and drugs are immediately to hand. This saves valuable time in an urgent case. Particular attention should be paid to the function of the laryngoscopes, the endotracheal tube and cuff, and the suction apparatus. As intubation may be difficult, it is a wise precaution to have an introducer and a smaller size of endotracheal tube ready. A trained assistant must be available at induction.

A relevant anaesthetic history is obtained from the patient and clinical examination carried out paying particular attention to the cardiovascular and respiratory systems. Any likely intubation problems should be identified. The blood pressure is measured and the haemoglobin result checked. It should be confirmed that blood has been sent for crossmatch and will be available for emergency transfusion if required.

The patient is positioned with the table tilted or with a wedge under the right hip. This should produce a lateral tilt of at least 15 degrees which helps to prevent aorto-caval compression. This position must be maintained until delivery. A large intravenous cannula is inserted and a reliable infusion established. An adequate supply of intravenous fluids should be available in case they are required at short notice. If there is clinical evidence of hypovolaemia (low blood pressure, rapid thready pulse, cold peripheries) this should be corrected with intravenous fluids prior to induction. Patients with Pregnancy Induced Hypertension (PIH) or eclampsia may require treatment for their high blood pressure prior to induction. Increments of hydralazine 5mg or labetalol 5-10mg intravenously may be given at 5 minute intervals until the diastolic pressure has been reduced to around 90-100mmHg. It should be remembered that beta blockers are contra-indicated in asthma.

Induction of general anaesthesia

The patient should be pre-oxygenated with 100% oxygen via a close fitting face mask for 3 minutes before induction. Thiopentone 3-5mg/kg or ketamine 2mg/kg is then injected, followed by suxamethonium 1.5mg/kg. Cricoid pressure is applied by the assistant as consciousness is lost and must be maintained until the anaesthetist is satisfied that the airway is secure. When the patient is fully relaxed intubation is performed. The lungs are not normally inflated by face mask prior to intubation as this may force gas into the stomach, raise the intragastric pressure and promote regurgitation. Only when the anaesthetist has confirmed the placement of the endotracheal tube and the cuff has been inflated is cricoid pressure released. If intubation cannot be performed, however, facemask ventilation will be necessary to maintain oxygenation. This situation is termed "failed intubation". Always have a plan available in case this happens -a suitable plan is discussed at the end of this article.

Maintenance of anaesthesia

Anaesthesia can be maintained with a 50% mixture of nitrous oxide and oxygen, supplemented with a low concentration of a volatile agent in order to avoid the possibility of awareness. Halothane 0.5% is suitable. High concentrations of volatile agents should be avoided as they may decrease uterine tone increasing bleeding at operation and they may depress the neonate.

Further relaxation can be achieved by increments of suxamethonium (remember to give atropine before a second dose of suxamethonium) or the use of a non-depolarising relaxant. Most non-depolarising relaxants do not cross the placenta to any great extent, except gallamine which should be avoided until after the cord is clamped. After delivery oxytocin 10 units or ergometrine 500 micrograms is injected intravenously to contract the uterus. Ergometrine should be avoided in the presence of hypertension as it causes a rise in blood pressure. Once the umbilical cord is clamped an opioid such as morphine (5-15mg) can safely be given slowly intravenously. At this point the inspired oxygen concentration can be reduced to 30-35%.

In situations where no nitrous oxide is available an increased concentration of halothane (around 1%) should be given in oxygen until delivery. After the cord has been clamped an intravenous opioid should be administered and the concentration of halothane reduced to minimise relaxation of the uterus.

In many places diethyl ether is the main anaesthetic agent available, and it is also suitable for caesarean section. The patient may be paralysed and ventilated with a mixture of air, oxygen and 2-3% ether. Where muscle relaxants are in short supply many anaesthetists allow the patient to breathe air, oxygen and ether spontaneously following intubation. 4-6% ether is required for this purpose, although a higher concentration is needed initially until the patient is settled. If a spontaneously breathing technique is used it is wise to assist ventilation to improve the efficiency of respiration.

At the conclusion of surgery muscle relaxation is reversed, (or in the case of suxamethonium allowed to wear off), and the patient turned on to her left side in the head down position. The endotracheal tube is removed only when laryngeal reflexes have returned and spontaneous respiration has resumed. Oxygen is administered by face mask for at least 30 minutes following surgery, during which time the patient should remain on her side. The intravenous infusion is continued into the post-operative period to ensure adequate hydration and to retain venous access. Analgesia is prescribed, usually in the form of an opiate such as morphine or pethidine.

In extremely difficult circumstances

In some countries there are many anaesthetists working without oxygen or endotracheal tubes. However they are still faced with the challenge of providing anaesthesia for caesarean sections. People

working in these difficult environments recommend the use of local infiltration anaesthesia or regional block (both of which will be covered in a future edition). Some anaesthetists attest to the use of ketamine by intravenous bolus injections, and others administer ether via a facemask. It is likely that techniques using local anaesthesia are the safest, providing proper precautions are taken, and the anaesthetists and surgeons are skilled in their use. Although several of these techniques are unconventional, careful attention to basic anaesthetic principles, such as airway care, monitoring of the colour and circulation, will ensure the safest anaesthetic available under the circumstances.

Failed intubation drill

A clear plan must be available in the event of failed intubation. There is a serious risk of hypoxia if the situation is mishandled. An appropriate course of action is as follows:

Maintain cricoid pressure

Oxygenate using the facemask

Turn the patient on to the left side into a head down position and allow her to wake up. Proceed with local anaesthetic block when the patient has regained consciousness.

If the operation is needed very urgently (eg for fetal distress or an antepartum haemorrhage), re-establish spontaneous respiration after the suxamethonium has worn off, and continue the anaesthetic under a facemask using nitrous oxide, oxygen and halothane or an ether based technique. If possible maintain cricoid pressure during the anaesthetic. If problems are encountered with the airway, it may be necessary to wake the patient up and use a regional technique.

At all times ensure that the patient is well oxygenated.

Other measures

If available a laryngeal mask may be useful for maintaining the airway in the event of a failed intubation. If severe airway obstruction develops during a failed intubation and none of the usual airway manoeuvres regains the airway, a cricothyroidotomy should be performed using a large intravenous cannula (at least 16 gauge). This should be connected to the anaesthetic circuit (use a Portex 3.5mm connector or other similar connector) and 100% oxygen delivered directly into the trachea, until the patient wakes up. This equipment should always be available for this event.