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General Anesthesia for Cesarean Delivery

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What is general anesthesia?

- General anesthesia is a drug-induced state that allows surgery to proceed with physiologic stability and without significant memory of the operative events.

- Reasons to choose GA over regional include:
  a. lack of time to provide neuraxial - e.g. emergency situations
  b. patient inability to co-operate with positioning or refusal of neuraxial anesthesia
  c. hemodynamic instability - e.g. hemorrhage
  d. bleeding disorders/anticoagulation
  e. infection at site of placement

Anesthesia for Cesarean Delivery. Lawrence Tsen; Chestnut’s Obstetric Anesthesia: Principles and Practice. 5th edition
General anesthesia for cesarean

- From the viewpoint of tasks, a general anesthetic is conceptually divided into three sequential time domains:
  - induction
  - maintenance
  - emergence

- The patient's abdomen is usually prepared and draped prior to induction of anesthesia and intubation.

- Incision is made only after the airway is secured.

- This decreases the time between induction and delivery, and minimizes fetal exposure to anesthetics.
What about regional?

A central educational tenet in OB Anesthesia has been that regional anesthesia (ex. spinal or epidural) is safer than general anesthesia for cesarean delivery. However, safety comparisons via prospective, randomized studies are lacking. General anesthesia is typically utilized in patients with multiple medical comorbidities or emergencies making retrospective studies less accurate in determining risk.

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Physiologic changes in pregnancy

The physiologic changes of pregnancy have significant safety implications for portions of general anesthesia in pregnant women, particularly in reference to the upper airway, pulmonary, gastrointestinal and central nervous systems.
Upper Airway changes contributing to a difficult intubation during pregnancy

- ↑Mucosal blood supply & swelling
- Impede visualization during tracheal intubation
- Swelling in upper airway may increase during labor
- Oxytocin and Valsalva during second stage → ↑Edema & difficulty with intubation
- Mucosal swelling probably contributes to ↑snoring and post-extubation upper airway obstruction
- Rapid sequence induction followed by intubation is used

Pulmonary function changes

• Dominant safety issue for general anesthesia → ↓ in functional residual capacity (FRC), which is a measure of the "reservoir" of gas in the lungs for use during apnea.

• In most general anesthetics for cesarean delivery, there is a pause in delivery of new gases between the time of induction and the time of successful ventilation through the newly placed endotracheal tube. One strategy for improving safety in this situation is to increase the FiO$_2$ in the FRC reservoir before induction, by having the patient breathe 100% oxygen by mask just prior to the induction.
Pulmonary function changes (cont’d)

- This process is commonly called "pre-oxygenation" and typically increases the FiO₂ the FRC from 21% to approximately 80%.

- Unexpected difficulties with the process of endotracheal intubation can delay the delivery of new gases. In this situation, the survival of the patient may depend on the increased amount of oxygen in the FRC from pre-oxygenation.
GI changes

- The physiologic valve between the esophagus and the stomach, the lower-esophageal sphincter (LES), is a less effective barrier to gastro-esophageal reflux during pregnancy.
- During airway management for general anesthesia during pregnancy, decreased LES tone increases the risk of significant pulmonary aspiration of gastric contents.
- Depending on the volume, pH and particle-content, this maternal pulmonary aspiration may be life-threatening.
GI changes (cont’d)

• Maneuvers designed to minimize the pulmonary aspiration of gastric contents include cricoid pressure (debatable if this is helpful or potentially harmful) and minimal positive-pressure mask ventilation during induction of general anesthesia, and avoiding solid food intake during labor.

• Additionally, a non-particulate antacid may be given to neutralize acidity. Occasionally other medications such as famotidine may be administered though these do not work as rapidly.
Central nervous system changes

• Clinical observations suggest an increased vulnerability for intraoperative recall during general anesthesia for cesarean delivery.
  • Possible explanations include surgical incision for emergency cesarean delivery prior to the onset of maternal unconsciousness, and decreased dosing of anesthetic gases during maintenance to minimize post-delivery uterine atony.

• In contrast, data from clinical and laboratory research suggest that the potency of many inhaled anesthetic gases is increased during pregnancy. This apparent paradox is not entirely resolved.

• A central responsibility of the anesthesiologist during general anesthesia for any patient is to deliver an appropriate combination and dose of general anesthetic medications to avoid postoperative recall of intraoperative events, except in the rare instances when physiologic instability limit the safety of anesthetic medications (ex. trauma or massive hemorrhage).
Medications - Muscle relaxants

- Succinylcholine (a skeletal muscle relaxant) and all of the inhaled halogenated anesthetic gases are triggers for malignant hyperthermia, a rare but life-threatening hypermetabolic response by skeletal muscle.

- Succinylcholine is normally metabolized by plasma pseudocholinesterase. The clinical effect of succinylcholine can be prolonged in patients with genetic variants of plasma pseudocholinesterase.

- Patients receiving IV magnesium therapy (ex. preeclampsia or fetal neuroprotection) can have prolonged responses to non-depolarizing muscle relaxants, such as rocuronium.
Medications – Inhaled agents

- Inhaled halogenated anesthetic gases are dose-dependent relaxants of uterine smooth muscle, and can be associated with uterine atony during cesarean delivery.

- Inhaled nitrous oxide is neither a trigger for malignant hyperthermia nor a uterine muscle relaxant.
Medications – Placental transfer

- Most induction agents for general anesthesia get transferred to the fetus.
- Muscle relaxants are large molecules which do not cross the placental barrier.
- In most cases, all intravenous opiates and benzodiazepines are held until the fetus has been delivered and the umbilical cord is clamped. If these have been given prior to delivery, the fetus may develop respiratory depression and may need respiratory support.
- Patient safety concerns with general anesthesia include airway obstruction after extubation, and postoperative respiratory depression by analgesics and residual anesthetic medications.

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Post-operative analgesia options after general anesthesia for cesarean delivery

- Multi-modal analgesia regimen is preferred to minimize systemic opioids.

- Scheduled and staggered:
  - NSAIDs such as Ketorolac IV and Ibuprofen PO when appropriate.
  - IV Acetaminophen

- Low dose IV PCA with opioids is an option.

- Regional blocks such as Transversus Abdominus Plane (TAP) or quadratus lumborum (QL) blocks: either single shot or with indwelling catheters.

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Breastfeeding after general anesthesia for cesarean

- The patient can breast feed after a cesarean delivery under general anesthesia when she is awake enough to hold and support the baby independently without assistance and is not too sedated.
References

1. Anesthesia for Cesarean Delivery. Lawrence Tsen; Chestnut’s Obstetric Anesthesia: Principles and Practice. 5th edition