General Anesthesia for Cesarean Delivery

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**Indications**

- Fetal distress in the absence of preexisting epidural
- Acute maternal hypovolemia
- Significant coagulopathy
- Neurological or severe lumbar disc disease
- Infection
- Inadequate regional anesthesia
- Maternal refusal for regional anesthesia
Anesthetic Considerations

- Difficult airway
- Aspiration
- Rapid desaturation
- Aortocaval compression
- Uterine atony
- Awareness
Airway
Difficult Airway

- Mortality due to airway problems 49% (USA)
- Failed intubation rate 8 X general surgical population
- In 50% cases Mallampati scores increase to class 3/4 at the end of labor

Kodali, Anesthesiology 2008
Difficult Airway

- Airway edema
- Capillary engorgement
- Tissue friability
- Tongue enlargement
- Distortion of anatomy of larynx
- Decreased size of laryngeal opening
- Enlarged breasts
Difficult Airway

- Prepare a small size endotracheal tube # 6.5
- Short handle laryngoscope
- LMA/ Difficult airway cart
- Suction
Aspiration
Factors responsible for aspiration pneumonia

- Chemical nature of aspirate  
  - pH < 2.5

- Physical nature of aspirate  
  - Particulate

- Volume of aspirate  
  - Large Vol > 0.8-1ml/kg

Awe WC, Surgery 1966
Aspiration Prophylaxis

ASA Practice guidelines: Consider timely administration of

- **Sodium Citrate** 0.3M, 15-30ml PO-less than 30 min before induction
- **Ranitidine** 50mg IV (H2 antagonists)-more than 30 min before induction
- **Metoclopramide** 10 mg IV-more than 30 min before induction

Also effective for prevention of aspiration during extubation and PONV
Cricoid Pressure

- MRI of healthy, non-pregnant volunteers (n=22)
- Esophagus lateral to cricoid in 53%, after cricoid pressure 91%
- Cricoid pressure displaces airway from midline in 67%

Smith KJ. Anesthesiology 2003
Rapid desaturation
Rapid desaturation

Critical hemoglobin desaturation will occur before return to an unparalyzed state following succinylcholine 1 mg/kg IV

Benumof, Anesthesiology 1997
Preoxygenation

- $O_2$ consumption ↑ by 20%
- FRC ↓ by 20%

- Administration of 100% $O_2$
  - 3-5 min using tight fitting mask at $FiO_2 \, 1$
  - 4 VC breaths/ 30 sec – more rapid desaturation
  - 8 VC breaths/ 60 sec – hypocapnia
Primary Goals

- Adequate maternal and fetal oxygenation
- Appropriate depth of anesthesia
- Adequate hemodynamics
- Minimize effects on uterine tone after delivery
- Minimize adverse effects on neonate
Oxygenation:  $\text{FiO}_2$ 0.3-1

Ventilation:  $\text{PaCO}_2$ 30-32 mmHg

- Hypocapnia - Uteroplacental vasoconstriction
  - Lt shift of $O_2\text{Hb}$ dissociation curve

- Hypercapnia - Maternal tachycardia
Aortocaval compression

Hypotension
- Left uterine displacement
- Hydration 10 – 15 ml/kg RL
- Vasopressors Phenylephrine 0.05 - 0.1 mg
  Ephedrine 5 - 10 mg
**Requirement of anesthetic agents**

- **Induction agents:** Increased dose  
  (increased Vd, Increased CO)

- **Inhalational agents:** decreased MAC  
  (decreased FRC, increased MV)

- **Opioids:** Increased dose  
  (Progesterone – endogeneous opioid effect)
Induction agents

- **Thiopental** 5-7 mg/kg
- **Propofol** 2-3 mg/kg
- **Ketamine** 1-1.5 mg/kg
- **Etomidate** 0.3 mg/kg
Muscle Relaxants

- Succinylcholine 1.5 - 2 mg/kg
- Defasciculating/priming dose of NDMR not reqd
  - Risk of partial paralysis in awake patient
  - Prolongs onset and ↓ duration/intensity of sux block
  - Pregnant women do not have intense fasciculations or post-sux ms pain (progesterone)
  - Less rise in intragastric pressure (less abd tone)
  - MgSO₄ effect
Uterine atony
Effects of Desflurane and Sevoflurane on oxytocin-induced myometrial contractions

**Volatile Agents**

- Requirement ↓ by 25-40%
- Dose - dependent ↓ in Uterine tone
- Up to 1 MAC does not alter uterine responsiveness to oxytocin
- Awareness < 0.7 – 1 MAC > Atony

**Nitrous oxide**

- Allows reduction in concentration of volatile agent
- Does not cause uterine relaxation

*Chin KJ. Anesth Analg 2004; Robins K. Anesth Analg 2009*
Uterotonic Agents

- **Oxytocin**
  - 20 IU/L infusion 25ml (elective) to 150 ml (labor arrest)
  - rapid bolus
  - Maintenance 40-80mU/min

- **Ergot**
  - Methylergonovine/ Ergonovine 0.2mg IM/slow IV

- **Prostaglandin**
  - Hemabate/Carboprost 0.25mg IM/ IMM
  - Misoprostol  800 - 1000 μg PR
Oxytocin at Cesarean delivery: Hemodynamic consequences
5 IU Bolus vs. Infusion (5 min)

Awareness
Awareness

Incidence: 12-26%

Factors:
- Avoidance of sedative premedications
- Deliberate use of low conc of volatile agents
- Reduction in the dose of anesthetics during hypotension and hemorrhage
- Assumption that high baseline tone is responsible for intraop tachycardia
- Use of muscle relaxants
Preparation

1. Discuss the operative plan with the multidisciplinary team
2. Perform pre-anesthetic assessment (medications, allergies, medical/OB history, A/W assessment)
3. Prepare necessary medications and equipment
4. Place patient supine with left uterine displacement
5. Secure 16- or 18-G IV access, Send blood work
6. Give Aspiration Prophylaxis
7. Administer antibiotic prophylaxis (Cefazoline 2 g)
8. Initiate monitoring BP, SpO₂, EKG, nerve stimulator ± BIS
9. Perform a team “time-out”
Induction

1. Preoxygenate with 100% Oxygen

2. After the abdomen has been prepared and operative drapes are in place, verify that the surgeon and assistant are ready to begin surgery.

3. Initiate rapid-sequence induction:
   a. Cricoid pressure 10 N while awake; increase to 30 N after loss of consciousness.
   b. Thiopental 5-7 mg/kg or Propofol 2-3 mg/kg and succinylcholine 1.5 -2 mg/kg; wait 30 to 40 seconds.

Maintenance

Before delivery
1. Use sevoflurane or desflurane (1 MAC) in O₂ with N₂O 33-50%
2. Treat hypotension

After delivery
1. Begin oxytocin infusion; consider other uterotonic agents if inadequate uterine tone. Monitor blood loss and respond
2. Administer Volatile agent (0.7 - 1 MAC), N₂O 66% in O₂
3. Give attention to risk of awareness, supplement anesthesia with:
   - fentanyl (up to 250 mcg) and morphine (up to 15 mcg)
   - IV hypnotic (Midazolam, Propofol infusion), if needed
   - Ms relaxant (Sux/NDMR) titrate as per the response of nerve stimulator
4. Evaluate postoperative issues (e.g., pain, nausea)
5. Extubate when NM blockade is fully reversed and the patient is awake and responds to commands