



ANESTHESIA for Labor and Delivery

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History

James Young Simpson

- first administered obstetric anesthesia on January 17, 1847
- used ether and chloroform for pain relief
- “This is certainly the greatest blessing of this age”

John Snow

- anesthetized obstetric patients with chloroform
- Most famous patient was Queen Victoria for the births of Prince Leopold and Princess Beatrice
- Father of Modern Anesthesiology

Physiologic Changes with Pregnancy

Factors that bring about change:

- **Rising hormonal levels**
(progesterone, estrogen, chorionic, gonadotropin, etc)
- **The enlarging uterus**

Physiologic Changes with Pregnancy

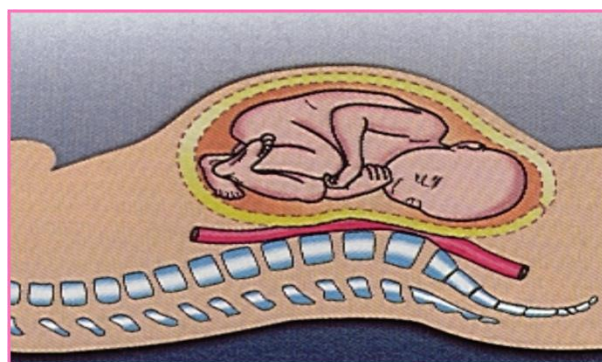
- Cardiovascular
- Respiratory
- Neurologic
- Hematologic
- Renal
- Gastrointestinal

Cardiovascular Changes with Pregnancy

1. Increase in intravascular fluid volume
2. Increase in cardiac output
3. Decrease in systemic vascular resistance

	Value Near Term
Intravascular Fluid volume	35% ↑
Plasma volume	45% ↑
Erythrocyte volume	20% ↑
Cardiac Output	40–50% ↑
Stroke volume	30% ↑
Heart rate	15–25% ↑
Peripheral Circulation	
Mean arterial blood pressure	15 mmHg ↓
Systolic BP	15 mmHg ↓
Diastolic BP	10–20% ↓
Systemic vascular resistance	20% ↓
Pulmonary vascular resistance	35% ↓
Central venous pressure	No change
Femoral venous pressure	15% ↑

- At term, maternal blood volume increased by 1000 - 1500 ml
- Increase in CO is due to ↑ HR and stroke volume
- Greatest increase in CO are seen during labor and immediately after delivery
- Aortocaval compression is an important but preventable cause of fetal distress
- Up to 20% of women develop Supine Hypotension Syndrome (hypotension, pallor, sweating, nausea and vomiting)



Supine Hypotension Syndrome

Risks of Aortocaval Compression

- Decreased uterine and placental blood flow
- Venous blood diversion

Clinical Significance

- To prevent aortocaval compression, parturients should never be allowed to rest in the supine position.
- Sympathetic blockade due to spinal or epidural anesthesia interferes with the compensatory

- vasoconstrictor reflex---- profound hypotension
- engorgement of the epidural vasculature makes puncture of an epidural vein more likely
- decrease in epidural space by the engorged vessels leads to decreased drug requirement
- Healthy parturient will tolerate a 1 to 1.5L of blood loss (hemorrhage at delivery remains an important risk)
- Cardiac output remains high in first few hours post-partum. Women with cardiac/ pulmonary disease remain at risk after delivery

CNS Changes with Pregnancy

- MAC decreases by 40%
- Increased epidural blood volume
- Progesterone - ↑ 20X normal at term pregnancy
- ↑ β endorphin levels
- Obstruction of inferior vena cava by enlarging uterus → epidural venous plexus distention → ↑ epidural blood volume
 - ↓ CSF volume
 - ↓ volume of epidural space
 - ↑ epidural (space) pressure

Respiratory Changes with Pregnancy

Significant changes in the pulmonary system during pregnancy:

- Upper airway
- Minute ventilation
- Lung volumes
- Arterial oxygenation

Upper Airway

- Capillary engorgement of the mucosal lining of the upper respiratory tract
- Short neck

	Value Near Term
Minute Ventilation	50% ↑
Tidal volume	40% ↑
Breathing frequency	15% ↑
Lung Volume	
Expiratory reserve volume	20% ↓
Residual volume	20% ↓
Functional residual capacity	20% ↓
Vital capacity	No change
Total lung capacity	5% ↓
Arterial Blood gases and pH	
PaO ₂	Normal or slightly ↓
PaCO ₂	10 mmHg ↓
pH	No change
Oxygen Consumption	20% ↑

Diaphragm

- Upward displacement due to upward pressure exerted by growing uterus → decreased FRC
- Elevation of the diaphragm is compensated by ↑ AP diameter of chest – thoracic breathing favored
- ↓ FRC and ↑ O₂ consumption leads to rapid desaturation during periods of apnea

Clinical Significance

- **Decreased FRC**
 - more susceptible to hypoxia and hypercarbia during apnea while pushing
 - supine and lithotomy positions aggravate the onset of hypoxia
- ↓ FRC + ↑ Min Ventilation = Increased Anesthetic Uptake
- Capillary engorgement of mucosa →
- trauma, bleeding, airway obstruction
- Severe hyperventilation during pain leads to hypocarbia, causing uterine artery vasoconstriction
- Administration of supplemental 100% oxygen is mandatory during fetal distress

Anesthetic Significance

Airway Management is more challenging because of:

Alterations	Anesthetic Implications
Weight gain/breast engorgement	Hinders laryngoscopy
Swollen mucosa	• Easy bleeding with manipulation • Upper airway obstruction • Use of smaller caliber endotracheal tubes

Modified responses to anesthetics

Alterations	Anesthetic Implications
MAC decreased	Overdosage hazard
Decreased FRC	Faster induction with insoluble agents
Increased VE	Speeds induction with soluble agents

Greater risk of Hypoxemia

Alterations	Anesthetic Implications
Decreased FRC	Less O ₂ reserve
Increased O ₂ consumption	
Mucosal engorgement of the Respiratory Tract	Rapid airway obstruction

Hematologic Changes with Pregnancy

- Clotting factors rise by 50-250%
- Hemoglobin decreases by 20%
- Platelet count lowered by 20%
- Iron and folate anemias

- Dilutional anemia
- Platelet count – 20% ↓
- The following factors are increased:
 - Fibrinogen (Factor I)
 - Factor VII
 - Factor VIII
 - Factor X

Renal Changes with Pregnancy

- Plasma flow and GFR increases by 50%
- Decreased threshold for glucose and amino acids

Gastrointestinal Changes with Pregnancy

- Elevated progesterone levels
 - decreased gastric motility
 - decreased food absorption
 - lower esophageal sphincter tone at term

- Placental secretion of gastrin
 - higher gastric acidity (Gastric pH $\leq$ 2.5)
 - increased gastric acid volume

- Enlarged uterus
 - increased intragastric pressure
 - gastroesophageal angle flattens

Clinical Significance

- Increased danger of vomiting and aspiration
- Acid Aspiration Pneumonia (Mendelson's Syndrome)
- All parturients are considered to have a full stomach regardless of the number of hours after last food intake
- No solid food should be given to parturients and that liquids be restricted to a small amount of ice chips

Medical Measures for a Full Stomach

- Histamine₂-blocking agents
 - (cimetidine, ranitidine, famotidine) decrease acidity and volume
- Metoclopramide
 - increases gastric motility and lower esophageal sphincter tone, and has central antiemetic effects

ANATOMY OF LABOR PAIN

Pain Pathways During Labor

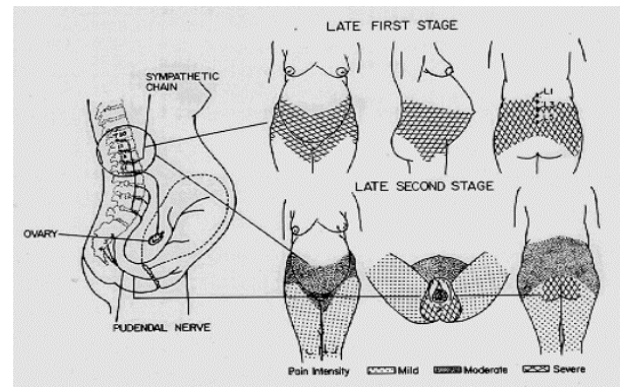
Pain in the 1st stage of labor

- from uterine contractions and cervical dilatation
- Visceral pain – dull, diffuse, periodic
- Pain intensity is related to the strength of uterine contraction

T11 – T12
(latent phase)

T10 – L1
(active phase)

T10 – S4
(second stage)



Factors that may influence the perception of labor pain

- duration of labor
- maternal pelvic anatomy and fetal size
- use of oxytocin
- parity
- participation in childbirth preparation classes
- fear and anxiety about childbirth
- attitudes and experiences of pain
- coping mechanisms

Anesthesia Goals

- Satisfactory pain relief
- Non-interference with labor
- Minimal risk to either mother or fetus
- Provision of satisfactory conditions for delivery
- Early interaction between mother and newborn

Anesthesia for Labor and Vaginal Delivery

- Psychologic and Non-pharmacologic techniques
- Parenteral agents
- Inhalational
- Regional anesthetic techniques

Non-Pharmacologic Techniques

- Lamaze
- Hypnosis
- Biofeedback
- Muscle therapy
- TENS
- Sterile water blocks
- Acupuncture
- Therapeutic touch
- Massage therapy
- Muscle tension release
- Reflexology

2nd stage – somatic pain

- well-localized, sharp, constant
- Pain results from distention of birth canal, vulva and perineum by the fetal head
- Pain is mediated by the Posterior roots of S2 – S4 nerves

Anesthetic Implications

- Effectiveness of Pudendal Nerve
- Epidural coverage of S2-S4

Pain Pathways

Stage	Description	Spinal Dermatomes
Stage I	Onset of labor to 10 cm cervical dilation	T10 – L1 (Sympathetic fibers)
Stage II	10 cm cervical dilatation to the birth of the baby	S2- S4 (Pudendal nerves, somatic)
Stage III	Delivery of the Placenta	T10 – L1 (Sympathetic fibers)

Labor Analgesia

- Accupressure
- Hydrotherapy
- Herbal cocktails
- Aromatherapy

Parenteral Agents

- **Opioids**
 - Meperidine (Demerol)
 - Fentanyl
 - Morphine
 - Nalbuphine
- **Sedatives / Tranquilizers**
 - Phenothiazines
 - Benzodiazepines
 - Dissociative medications (Ketamine)
- **Intravenous Anesthetics**
 - Barbiturates
 - Propofol

Inhalational Analgesia

Fetal Effects

- Low concentrations over a short period of time cause neonatal sedation
- Higher concentrations and prolonged administration result in neonatal apnea and hypotension

Peripheral Nerve Blocks

- Perineal infiltration
- Pudendal block
- Paracervical block

Perineal Infiltration

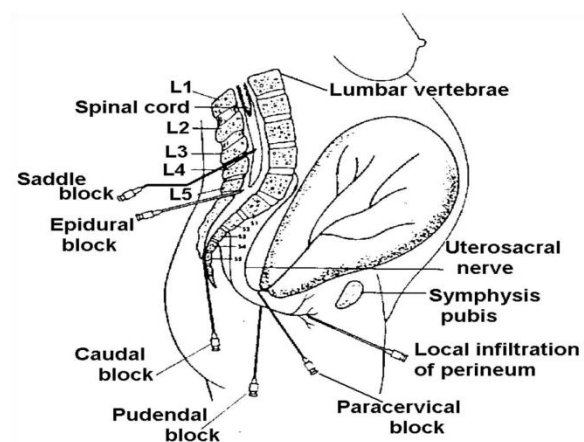
- Most common local anesthetic technique for vaginal delivery
- Local anesthetic is injected into the posterior fourchette
- Supplement unsatisfactory epidural and pudendal blocks

Pudendal Block

- Provides adequate analgesia for spontaneous delivery and outlet forceps delivery
- injection of local anesthetic on both sides of the vagina.
- Reference point: Ischial spines
- administered prior to delivery
- numbs the perineal area, vulva, and the vagina
- used frequently in labor and delivery in combination with local anesthesia

Paracervical block

- injection of local anesthetic into the paracervical nerve endings through the vagina
- Aim: block Frankenhauser's ganglion
- Reference point – 3 & 9 o' clock positions
- Only provides pain relief in the 1st stage of labor
- Pain relief in 5 minutes and lasts for 45 – 60 min
- Associated with a high rate of fetal bradycardia and CNS medullary depression (vascular collapse and apnea)



Neuraxial Blocks

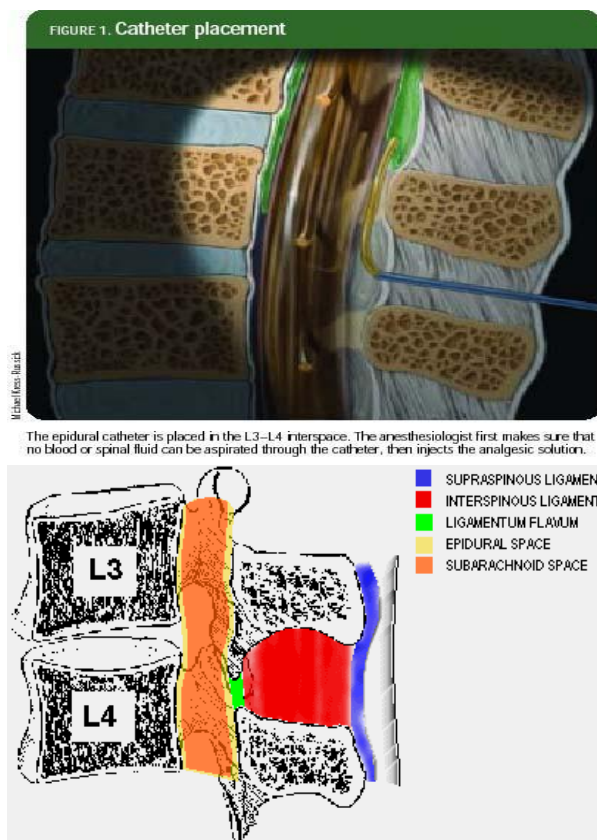
- Epidural analgesia
- Sub-arachnoid block (spinal)
- Combined spinal-epidural (CSE)
- Saddle block
- Caudal block

Epidural Anesthesia

- Continuous lumbar epidural is the most versatile and commonly employed technique
- Administered when labor is well established
- Should be administered when labor is progressing well
- Standard for vaginal delivery
- Given at 6-7 cm cervical dilation (primigravida), 4-5 cm (multipara)
- Inserted at L2-L3 or L3-L4
-

Criteria for Epidural Anesthesia for Labor & Delivery

- No fetal distress
- Good regular uterine contractions
- Adequate cervical dilatation
- Engagement of the fetal head



Complications:

- Hypotension
 - Most common
- Intravascular injection
- Intrathecal injection (1.5ml of LA per segment)
 - Post-dural puncture headache
- Backache

Spinal Anesthesia (SAB)

- Injection of local anesthetics into the subarachnoid space

True Saddle Block (L5 to S5)

- Puncture at L4-L5 or L5-S1

• Modified Saddle Block (T10-S5)

- Puncture L3-L4

Advantages

- Rapid onset
- Reliable anesthesia
- Small amount of anesthetic is used

Disadvantages

- Unpredictable sensory level
- Hypotension
- Headache

Regional Anesthesia

Anesthetic Significance:

- Epidural block reduces cardiac work during labor; beneficial in some cardiac disease states
- Hypotension with regional block may be associated with decreased uterine blood flow
- Reduction of local anesthetic requirement for spinal/ epidural block

Reduced local anesthetic requirement may be explained by:

- Swelling of the epidural veins
- Labor-induced increases in CSF pressure
- Increased neurosensitivity to local anesthetics
- Increased lumbar lordosis of pregnancy may enhance cephalad spread of LA solutions in the CSF

Anesthesia for Cesarean Section

A. Regional Anesthesia

- Spinal
- Epidural
- Combined spinal & epidural anesthesia

B. General Anesthesia

Placental Transfer of Anesthetic Drugs

- Molecular weight – (<500 daltons)
- Protein binding

- Degree of lipid solubility
- Maternal drug concentration
- Maternal and Fetal pH
- Ionization of the drug

Advantages

- rapid onset
- small amounts of drugs

Disadvantage

- hypotension in 50-80% of cases even if with adequate fluid preload

General Anesthesia for Caesarian Section

Indications

- rapid induction of anesthesia:
 - fetal distress
 - bleeding placenta previa
 - placental abruption
 - uterine rupture
 - delivery of the second entrapped twin

Obstetric Anesthesia

- All patients are considered to have full stomach
- Prophylactic antacids or Metoclopramide
- Supine position should be avoided

Main Anesthesia Concerns

- Maternal Safety
- Fetal Safety

PLEASE NOTE: For additional side notes, please refer to JAX notes. (they were not discussed by Doc Mike). They were not included here to avoid redundancy. Also, damo ginskip sa lecture.

REVIEW QUESTIONS

1. The father of anesthesia:
 - John Snow
2. The ff. increases during hormonal pregnancy, except:
 - A. Plasma volume
 - B. Stroke volume
 - C. Heart rate
 - D. Blood pressure***

3. Greatest increase in cardiac output occurs during:
 - Labor
4. The following factors are increased except:
 - Factor 2
5. True regarding gastrointestinal changes in pregnancy, except:
 - A. Decreased gastric motility
 - B. Lower esophageal sphincter tone
 - C. Higher gastric pH***
 - D. Higher gastric acid volume
6. True of cervical block, except:
 - A. For first stage labor
 - B. Targets frankenhauser's ganglion
 - C. Offers pain relief for 2nd stage labor***
 - D. Cause fetal bradycardia and cns depression
7. MAC increase:
 - 40%
8. Which dermatomes are affected in the first stage of labor?
 - T10- L1
9. The ff are true of second stage of labor, except:
 - A. Pain is localized, sharp
 - B. Pain results from distention of birth canal
 - C. Pain mediated by S2-S4 nerves
 - D. Visceral pain***
10. The most common side effect of spinal anesthesia:
 - Hypotension

Notes by: Lumasag J, Iwag M, Sameon N

THAT AWKWARD MOMENT:
 when you're about to study
 and your laptop walks in with
 no bra and panties on and
 seduces you