

Trends in Labor Anesthesia

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Objectives

1. Describe the indications and contraindications for nitrous oxide labor analgesia
2. Discuss the current clinical guidelines regarding food and drink during labor and for delivery
3. Describe the indications and contraindications for mobility with “Walking Epidurals”

Why Don't Women in the US have access to Nitrous-Oxide?

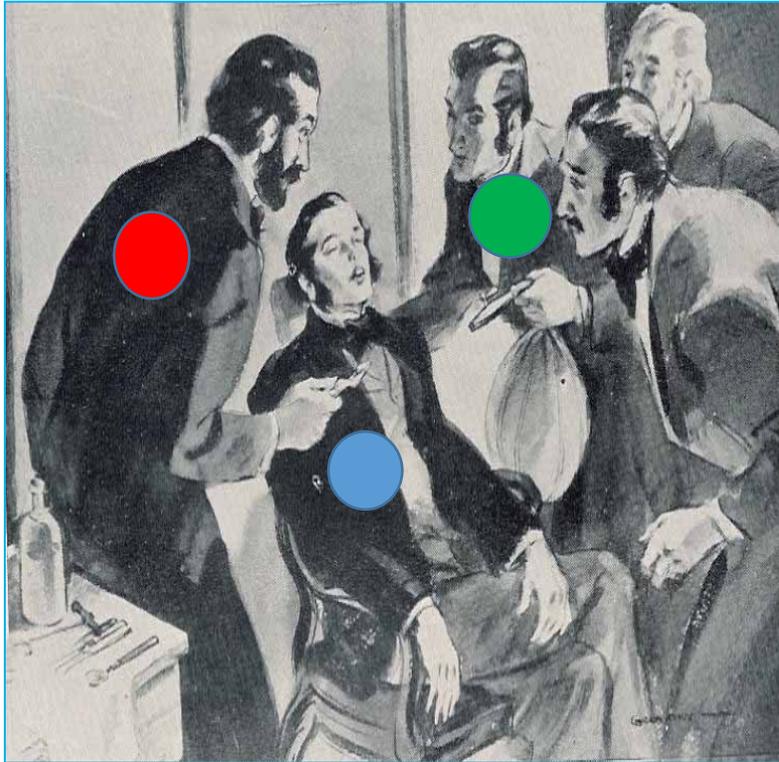
- Safe, inexpensive, fairly simple option for labor analgesia
- Offered and used widely to women in almost all other developed countries
 - Used by **75%** of laboring women in the UK, **60%** in Finland, and **widely used** in Canada



Why?

- “Simply Cultural”
- “Many women make decisions about childbirth based on what they learn from family and friends, and most have never heard of or used nitrous oxide for coping with labor pain”
- “In the UK, nitrous-oxide is just part of life; women expect they will have access to it....it’s in every birth room and every bathroom so women can use it and still be mobile”
- Holly Powell Kennedy, PhD – certified nurse midwife and professor of midwifery at Yale University
- Significant cost advantage - “It is much simpler and less expensive than epidural analgesia and does not result in complications that require more treatment and longer hospital stays” – Journal of Birth 2007

Horace Wells (Dentist) undergoes tooth extraction under nitrous oxide anesthesia. His partner John Riggs extracts the offending molar after Gardner Quincy Colton administers the nitrous oxide



1844



1845

FDA Approved For

- Administration of Analgesic – Sedation
- Alcohol Withdrawal Syndrome
- Prehospital Anesthesia (Ambulance)
- Anesthesia – Spinal Cord Injury
- Dental Procedure – Sedation
- General Anesthesia Adjunct
- Postoperative Hypertension
- Injection Site Pain
- Migraine
- Myocardial Infarction Pain
- Needle Phobia
- Obstetrical Pain (Labor Analgesia)
- Spasmodic Torticollis (Dystonic Movements)

ASA designates N₂O when used at < 50% as anxiolysis/analgesia minimal sedation

Mechanism of Action

- Produces both anxiolysis and analgesia
- Primary site of action is the **CNS** (cerebral cortex)
- **Modulates pain** stimuli by way of descending spinal cord nerve pathways
- Antagonism of **N-methyl-D-aspartate (NMDA)** receptor
- Has an effect at the **opioid receptor** (release of enkephalins and endorphins)
- Naloxone administration diminishes its effects
 - Naloxone (opioid reversal agent)

Uptake and Distribution

- Very distinct pharmacokinetics
- *Fast onset, quick recovery*, and ability to *rapidly titrate* levels of sedation
- Effect begins quickly (< 1 min) and peaks within *5 minutes*
- Recovery achieved within a few breaths of regular air (*< 5 minutes* of discontinuation)

Central Nervous System Pharmacology

- N₂O produces CNS depression
- Depresses all sensations including: pain, temperature, touch, proprioception, and auditory
- Sleepiness and mood alteration are the most noticeable effects
- Patient may experience euphoria (endorphin release)
- Mentation can be impaired
- Loss of tactile sensation in the perioral region, hands, and feet
- Dysphoria - an uncomfortable or uneasy feeling, may be seen in higher doses
- Inappropriate behavior, giddiness, laughing, or crying may be seen

Cardiac and Respiratory Pharmacology

- Cardiovascular System
 - Minimal effect
 - In the anxious patient, common to see ↓ in HR and BP
- Respiratory System
 - N₂O has negligible influence on respiration
 - Not an airway irritant, does not ↑ mucus production or bronchospasm

Patient Selection

- Failure with N₂O is typically associated with **Poor Patient Selection**
- It is a **weak** anesthetic agent; only offers **limited** anxiolysis and analgesia
- Along with **patient selection** comes **patient cooperation**
- Exchange of information is **critical** for patient comfort

Nitrous-Oxide Indications

- 3 generally accepted categories
 - **Analgesia** (pain threshold elevation)
 - **Alleviation** of mild to moderate fear and **anxiety**
 - **Stress reduction**

Pain Threshold Elevation

- N₂O does not prevent the transmission of pain stimulation
- N₂O does not replace adequate local or regional anesthesia
- N₂O can modify an inappropriate response to painful stimulus by producing dissociation from pain

Nitrous Oxide in L&D

- Since N₂O **produces dissociation** from pain
- **Pain relief** (in and of itself) is likely to be an **inadequate measure** of effectiveness for N₂O
 - It may be **counterproductive** to evaluate pain scores, which requires focusing on the **level of pain**
- **Satisfaction** may be a more relevant measure of effectiveness than assessment of pain because **N₂O is not intended to provide complete pain relief**
- Maternal satisfaction scores are comparable to labor analgesia (even in those who transition from N₂O to neuraxial analgesia)
- **Why Satisfaction?**- many women who have used it in the past choose to use it again in subsequent pregnancies

Nitrous Oxide in L&D

- At 50% concentration, N₂O **does not** appreciably affect the rates of maternal nausea or vomiting during labor
 - these symptoms are common during labor anyway, and it is difficult to distinguish the effects of nitrous oxide from the background incidence of these symptoms
- N₂O has shown **no adverse effects** on neonatal Apgar scores
- N₂O administration **does not affect uterine activity** and does not affect the course of **1st and 2nd stages of labor** and **rates of cesarean delivery**
- Currently **gaining resurgence in the United States** primarily from U.S. Food and Drug Administration (FDA) approval in **2012** a 50% N₂O with 50% oxygen N₂O machine for use in the United States

Contraindications:

Poor Patient Selection

- **Poor Choices for N₂O Use Are:**
 - Excessive fear and anxiety
 - Inability to communicate or reason
 - Upper respiratory tract infection – due to contamination of the hoses and equipment and subsequent infection of following patients

N₂O Use

- Epidural analgesia is widely acknowledged as the **gold-standard** for labor analgesia
- Epidural analgesia has a **5-15% failure rate**
- Many women are **not willing or able** to have the technique and opt instead for parental opioids



N2O Indications

- Laboring women
 - clear demonstrated value especially in **early labor**
- Women who are **very anxious** with IV initiation or epidural placement
- Women who need **forceps**-assisted or **vacuum**-assisted vaginal deliveries
- Women who need extensive laceration or **episiotomy repair**
- Women who require **manual removal of the placenta**, uterine exploration or bedside dilation and curettage



Use in Pregnancy

- **Safe** for the parturient, newborns, and healthcare workers in attendance
- **No effect** on uterine contractility
- N₂O does cross the placental barrier – has minimal effect
- Is **not teratogenic** in therapeutic concentrations for short periods
- **Good choice** because of rapid elimination and insignificant metabolism
- No effect on the fetus, no alteration in Apgar or neonatal neurobehavioral scores
- Safe for **breast-feeding**

Operating Procedures

- Important to ask the patients what they feel and make suggestions as to what they may be experiencing (pain is alleviated, not eliminated)
- The patients should feel relaxed, but must remain cooperative
- Patients that fail to achieve a relaxed state are not good N₂O candidates

Patient Monitoring

- Monitoring only requires observation and confirmation of 3 parameters:

Is the patient?

- Conscious
 - Comfortable
 - Cooperative
- Vascular access (IV), pulse oximetry, scavenging of exhaled gases

Patient Use

- Used intermittently, patient self administers
- Demand valve opens only when the patient applies negative pressure by inspiring through the mask – not FDA approved as of yet
- Entonox – no scavenging; Nitronox – does scavenge
- Time lag of ~ 1 min (50-60 seconds) before full analgesic effect
- Best to begin inhalation 30-50 seconds before contraction (patient must be cooperative)

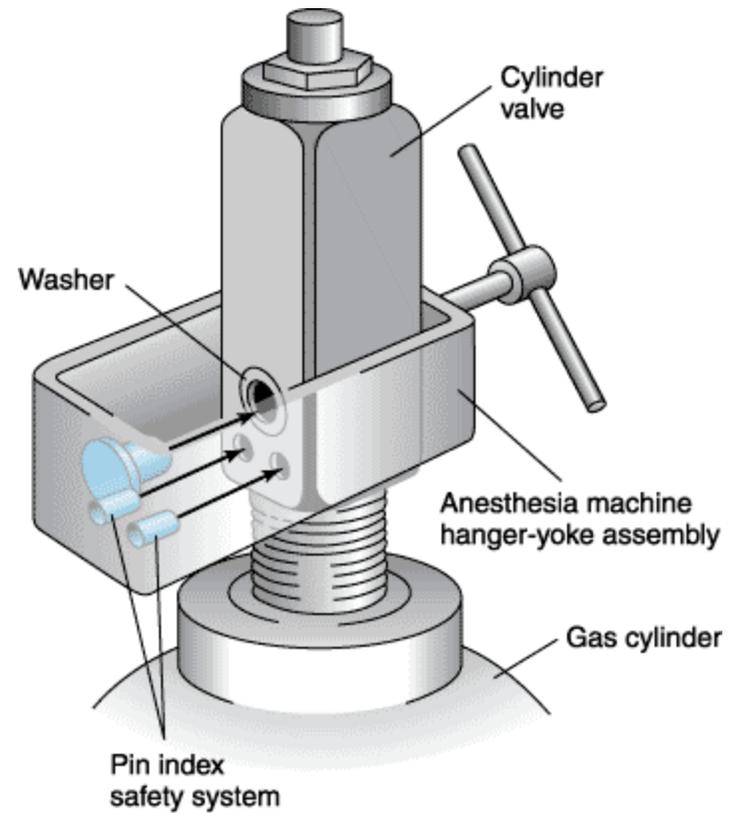
Patient Use

- Self-administration is critical!
- **Key safety feature** – if the woman becomes drowsy, her hand will fall away from her face, rendering the device non-functional, and forcing her to breathe room air again – **like a PCA**
- Instruct patient to take slow deep breaths
- Remove mask between contractions and breath normally
- **2nd stage** of labor – **2 to 3 deep breaths** before each push
- Consider pudendal block or local anesthesia infiltration for additional analgesia
- The **combination** of opioids and N₂O can more easily render a woman unconscious

Discharge Criteria

- Patient can be discharged within 5 minutes after discontinuation
- No escort needed for N₂O sedation only
- There must be no noticeable signs of impairment of coordination or responsiveness
- Usually patient will report feeling exactly the same as before the procedure

Pin Index Safety System



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E Cylinders



Oxygen – 2200 psi down to 0 psi
Nitrous – always 760 psi until empty
(must weigh tank)

Occupational Risks

- Occupational exposure limits (OELs): spread over an **8 hour period**
- NIOSH (National Institute of Occupational Safety and Health) recommends **less** than **25 parts per million** of nitrous in the ambient air
- European limit is **100 ppm**
- **Animal data** suggest that **exposure levels > 500 ppm** have been noted as a baseline to cause toxicity
- Several steps can be taken to reduce the escape of nitrous into the atmosphere:
 1. **Vent scavenged gases appropriately**
 2. **Routine equipment maintenance** – hoses, tanks, anesthesia department

Nurse and Advanced Practice Provision of N₂O

- Most nurse practice acts do not allow for a registered nurse to administer anesthetic gases
- In the case of N₂O, the registered nurse is not administering the N₂O; it is the woman who administers it to herself – like a PCA



Nitrous Conclusions

- The fact that scavenging systems have been shown to protect dental health care personnel from reduced fertility caused by nitrous oxide exposure is a convincing argument for its use in labor analgesia
- To date there is no evidence that a direct causal relationship exists between reproductive health and scavenged low levels of nitrous oxide



Food and Drink for Labor & Delivery



SNACK
IDEAS
FOR
labor

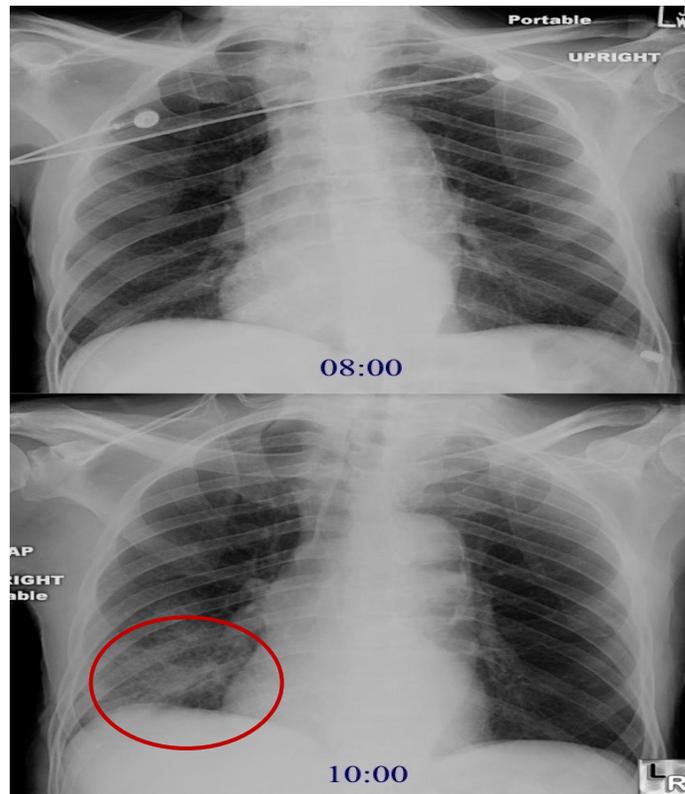
NPO in L&D: Introduction and Background

- Since the **1940's**, physicians have attempted to lower this risk by restricting the oral intake in laboring women to ice chips/water
 - Mendelson Syndrome
 - Typical diet during labor is NPO except for ice chips
- Actual **risk of aspiration** during labor is extremely low
 - **7 to 15 per 10,000**
 - Between 1979 and 1990 in the US, **7 in 10 million births**
 - **Improved** general anesthetic techniques over the decades have ↓ the incidence of aspiration in pregnancy



Mendelson's Syndrome

- Lung injury ↑ markedly when aspirate pH < 2.5 and volume > 25 mL



Curtis Lester MENDELSON

Le syndrome de Mendelson

Curtis Lester Mendelson : obstétricien et cardiologue, pionnier de la sécurité anesthésique

Jean-Pierre HABERER

L'expression « syndrome de Mendelson » est apparue dans la littérature médicale dans les années 1960, plus précisément d'ailleurs dans les traités et les manuels d'anesthésie [1,2,17]. Assez curieusement, dans la plupart des articles originaux traitant du sujet, l'expression utilisée est celle de « pneumopathie par inhalation du contenu gastrique ». La littérature anglaise fait la distinction entre *aspiration pneumonitis* et *aspiration pneumonia* [13].

Le syndrome de Mendelson *stricto sensu* désigne uniquement l'inhalation de liquide gastrique acide et stérile (*aspiration pneumonitis*) et c'est une atteinte chimique alors que l'inhalation de liquide gastrique de stase entraîne une pneumopathie d'inhalation (*aspiration pneumonia*) où le facteur infectieux est prépondérant. Il s'agit en principe de deux syndromes différents bien que le chevauchement soit fréquent comme le montre l'analyse de l'article *principis* de Mendelson. Dans la pratique clinique, et notamment en France, l'expression « syndrome de Mendelson » est souvent utilisée comme un terme général pour désigner l'ensemble des atteintes pulmonaires secondaires à l'inhalation bronchique du contenu gastrique.

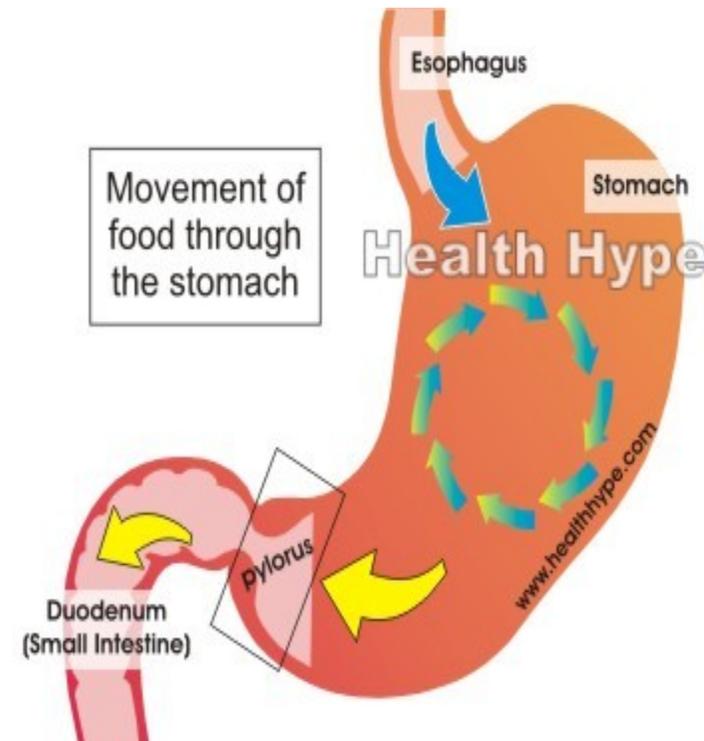
Curtis Lester Mendelson est né en 1913 à New York. Titulaire d'un diplôme de docteur en médecine en 1938 à l'Université Cornell (Ithaca, New York), il fut, après son internat, résident en gynécologie-obstétrique au *New York Lying-in Hospital* ; médecin dans ce service de 1945 à 1959, puis professeur à l'Université Cornell de 1950 à 1959 [11,12].

L'intérêt de Mendelson pour l'inhalation de liquide gastrique acide fut suscité par un cas clinique d'inhalation qui s'est présenté sous la forme d'une crise d'asthme et qui a culminé en un œdème pulmonaire aigu. Il a été mis sur la piste de l'étiologie du syndrome qui porte son nom après avoir lui-même inhalé accidentellement une faible quantité de liquide gastrique.

Curtis Lester Mendelson a présenté une étude rétrospective en décembre 1945 devant la *New York Obstetrical Society* [14].

NPO History

- Traditionally thought that gastric emptying in pregnancy is ↓ due to ↑ **abdominal pressure** on the gastrum, changes in **progesterone**, and **labor pain**
- **NPO restrictions** can be a leading cause of **patient dissatisfaction**, which can **negatively impact** the labor and delivery experience



The NPO Issue with Organized Groups

- NPO: ↑ incidence of **dehydration, hypoglycemia, dissatisfaction** and **anxiety**
- **Consumption** of a light diet during labor **does not** influence obstetric or neonatal outcome or ↑ emesis
 - **Light or BRAT diet (Bread, Rice, Applesauce, Toast)**
- **ASA** Task Force has stated that the **oral intake of clear liquids** during labor **improves** maternal comfort and satisfaction without increasing maternal complications
- Society of Obstetricians and Gynecologists of Canada (**SOGC**) and the World Health Organization of Europe (**WHO-Euro**) agree that women in active labor should be offered a **light or liquid diet** according to their preference
- Some European countries have more lenient policies on NPO status during labor
 - Netherlands
 - United Kingdom

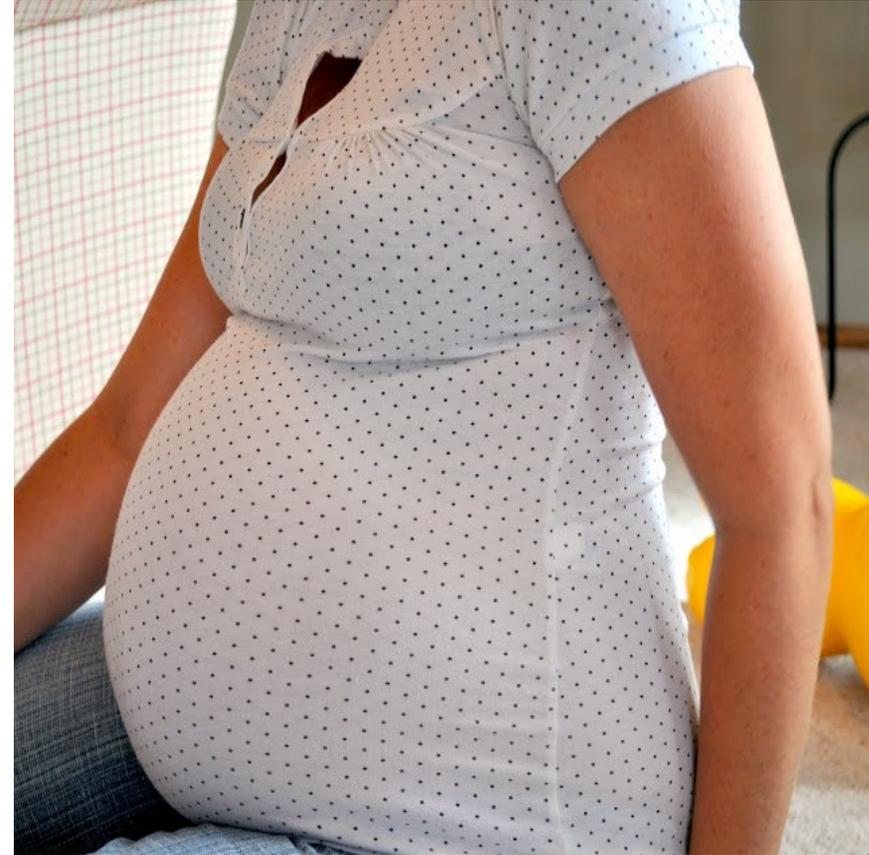


Oral Intake During Labor

- ASA consultants agree that maternal intake of **solids** during labor **↑ complications**
- **Solid foods** should be **avoided** in laboring patients
- Patients undergoing **elective C/S or tubal** should undergo a fasting period of **6-8 hr** depending on type of food ingested (fat content)
- There is insufficient evidence to draw conclusions about the relationship between fasting times for **clear liquids** and the risk of emesis, reflux, or both or pulmonary aspiration during labor
- Although there is some disagreement, most experts agree that oral intake of **clear liquids** during labor **does not ↑ maternal complications**
- **Oral intake** of modest amounts of clear liquids **may be allowed** for **patients with uncomplicated labor**
- Patients with **risk factors for aspiration** (e.g., morbid obesity, diabetes, and difficult airway), or patients at **↑ risk** for operative delivery **may require further restrictions** of oral intake, determined on a **case-by-case basis**

Our Institutional NPO Status

- As a result, all parturients beyond the 1st trimester are considered **“full stomachs”** and are at **risk** for aspiration
- **6-8 hours** prior to elective C/S or tubal
- **No solids** during labor
- **Clears o.k.** up to active pushing or 8 cm cervical dilation



General Anesthesia and Aspiration

- **Improved** general anesthetic techniques over the decades have ↓ the incidence of aspiration in pregnancy
- 1:10,000 → 1:10,000,000 (**1,000 fold ↓**)



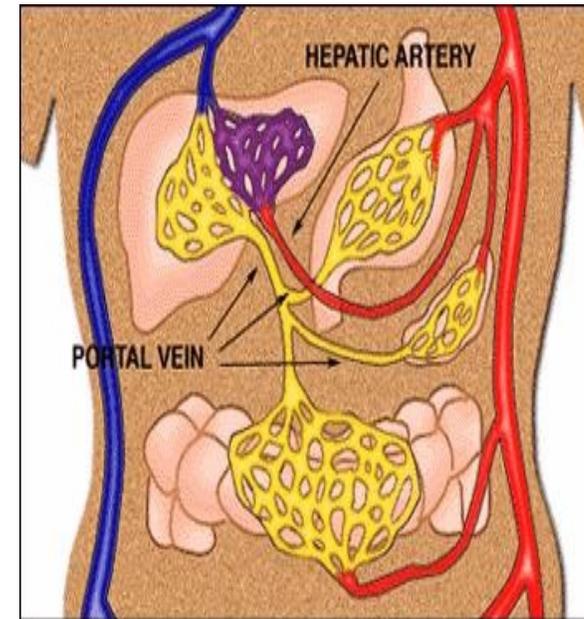
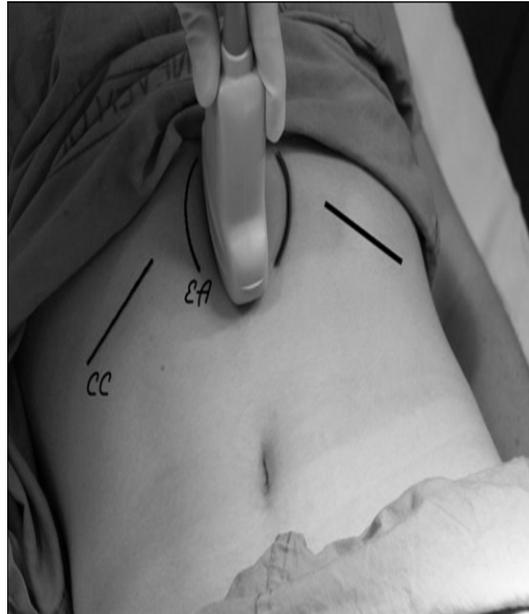
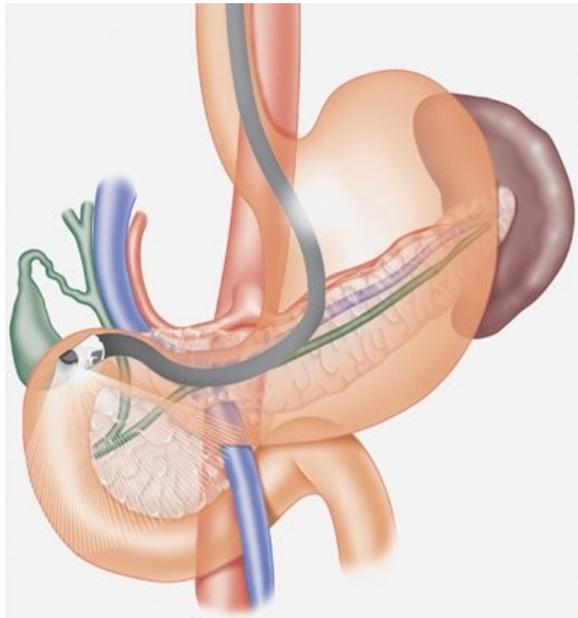
Possible Advantages of Oral Intake in Labor

- Labor can be compared with **continuous moderate aerobic exercise**
- Women who are in **control** of labor often report a **positive birthing experience**
- Offering an **option for sustenance** may provide women an **improved sense** of being in control



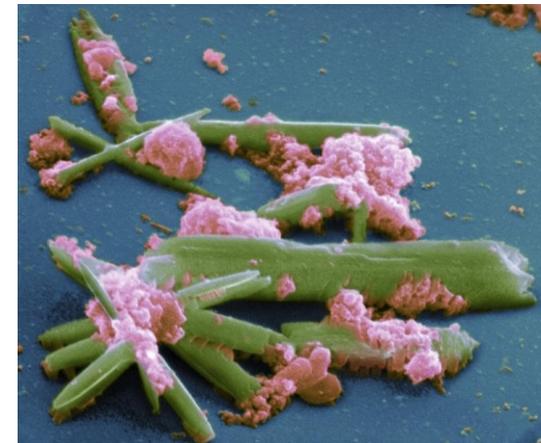
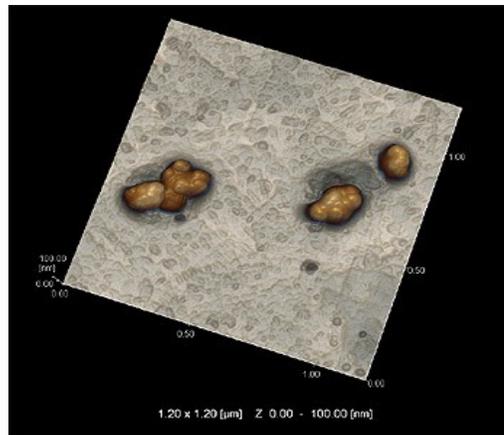
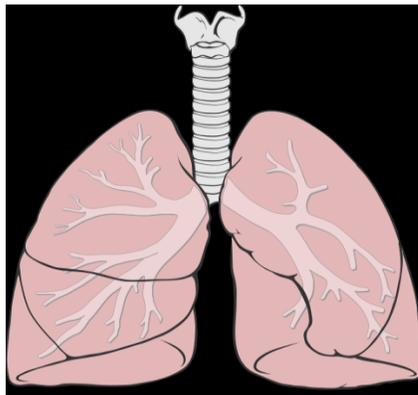
Gastric Ultrasound

- It has been shown with the use of US that **normal gastric emptying** occurs even in obese pregnant women who have reached term pregnancy
- **Opioids (narcotics) slow** gastric emptying



NPO Tips for your Clinical Practice: Key Points

- **Volume of liquid** is less important than the presence of **particulate matter** ingested
- **Solids foods** should be **avoided** in laboring patients
- **Oral intake** of clear liquids during labor **↑ patient satisfaction** and does not **↑** maternal complications
- **Complicated patients** (obesity, difficult airway, diabetes, etc.) should have **restricted** oral intake
- Patients undergoing **elective C/S** should **fast for 6-8 hr** depending on type of food ingested

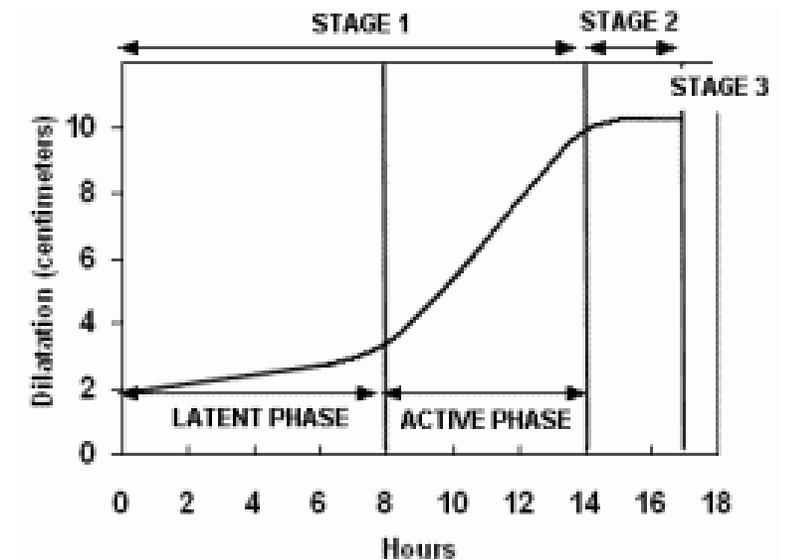


Walking Epidural Analgesia



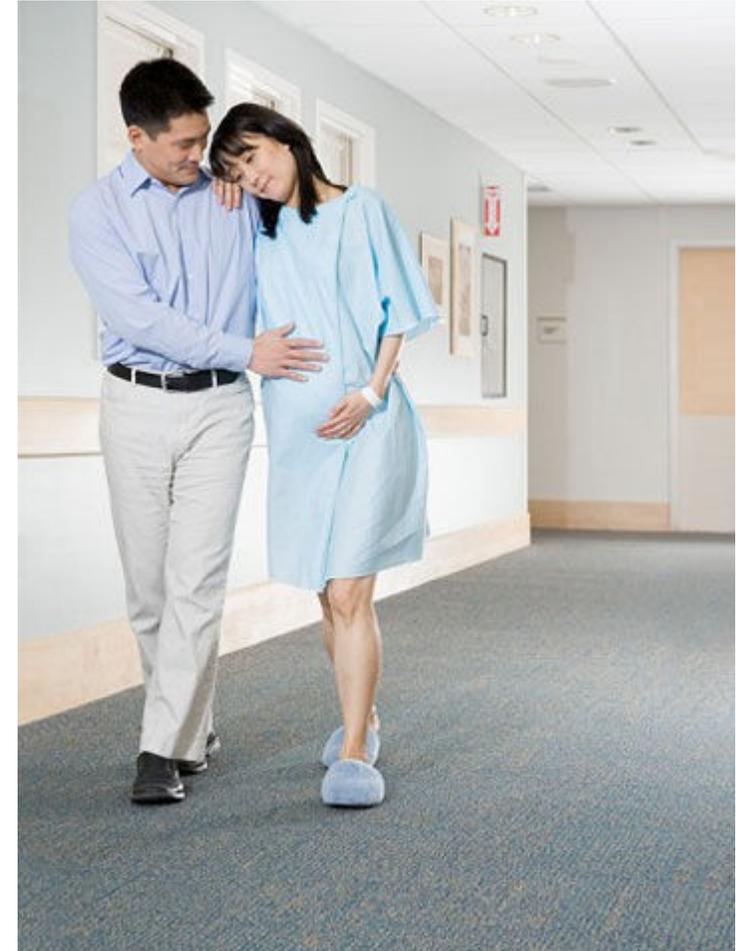
Labor Epidural Analgesia ACOG Committee Opinion

- Women in labor should **not** be required to reach **4–5 cm** of cervical dilatation before receiving epidural analgesia
- Epidural analgesia **prolongs labor ~ 40–90 minutes** with **~ 2x ↑ need for oxytocin augmentation**
- ↑ risk of a 2nd stage of labor > 2 hours in women with epidural analgesia => **contributes** to ↑ rates of operative vaginal delivery seen in most prospective studies
- **Association** with epidural analgesia is **not causation**



Ambulation Advantages

- ↓ pain
- ↑ maternal comfort
- ↑ uterine activity
- ↑ fetal head descent
- ↑ pelvic musculature relaxation
- ↓ labor duration
- ↓ operative delivery rate



Regional Advantages

- ↓ maternal hyperventilation \Rightarrow ↑ fetal acid-base status
- ↓ plasma catecholamines (↓ BP, ↓ HR)
- Optimizes uteroplacental circulation, oxygenation and function
- ↓ risk of aspiration and airway loss, ↓ blood loss
- Awake mother who can interact immediately with baby
- Most effective form of analgesia, “gold standard”

Walking Epidural Analgesia (WEA)

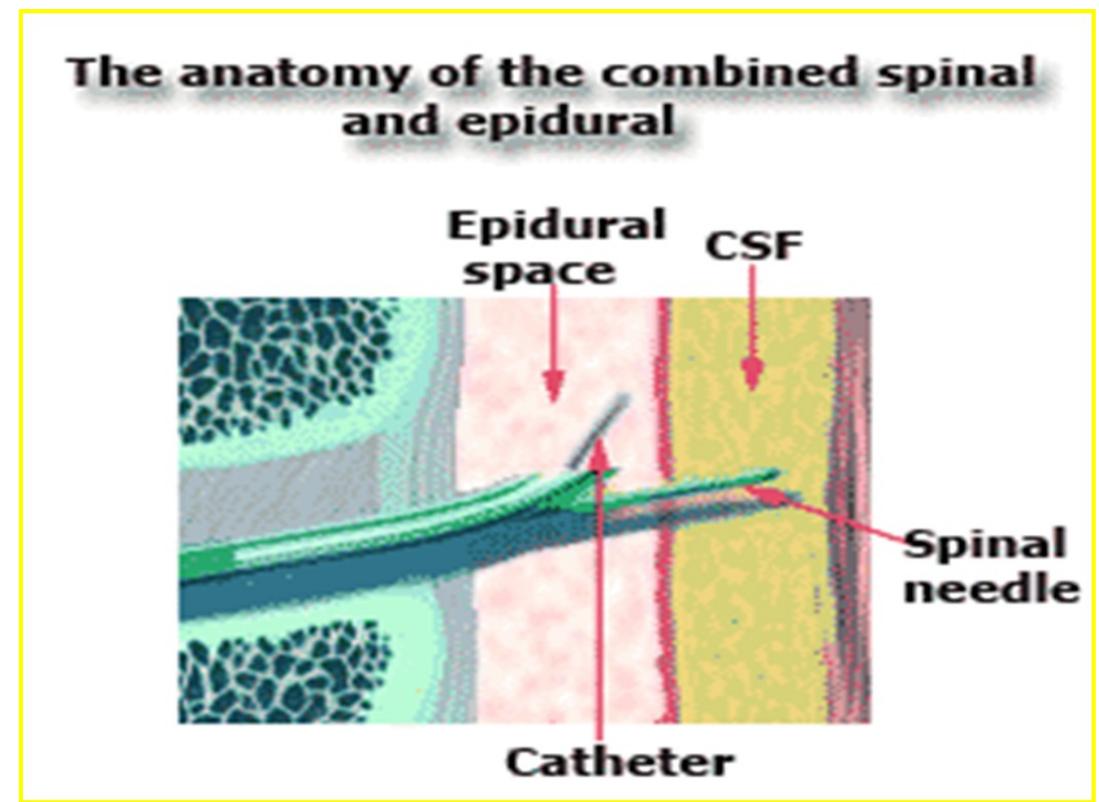
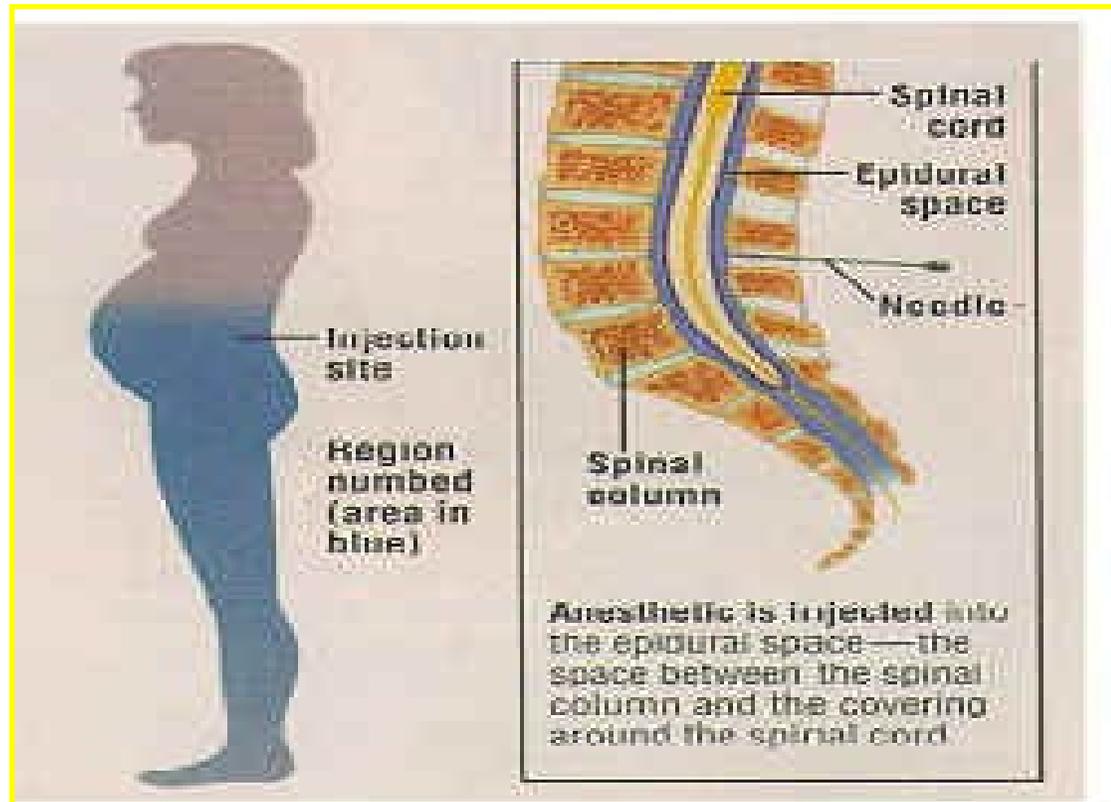
- Primary indication is for **analgesia** and the ability to **ambulate**
- WEA preparations combine a **low-dose local anesthetic** (bupivacaine, levobupivacaine, or ropivacaine) + **opioid** => ↓ motor blockade and ↑ spontaneous vaginal delivery rate



Single Shot Spinal and Combined Spinal Epidural (CSE)

- **Single-shot spinal** analgesia provides excellent pain relief for procedures of limited duration (i.e. cesarean delivery, 2nd stage of labor, rapidly progressing labor, and postpartum tubal ligation)
- Limited use for management of labor because of its **inability to extend the duration** of action
- **CSE** offers rapid onset of spinal analgesia + the ability to use the epidural catheter to prolong the duration of analgesia for labor, to convert to anesthesia for cesarean delivery, or to provide post cesarean delivery pain control

Labor Epidural and Combined Spinal Epidural



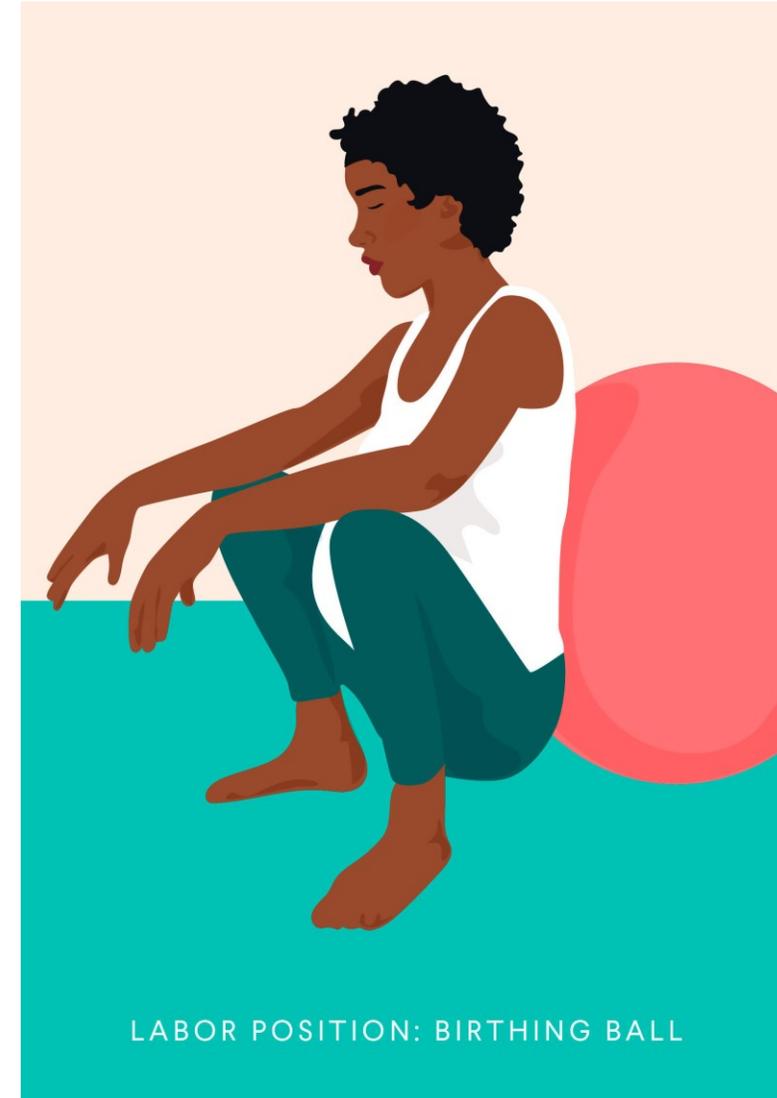
Walking Epidural Analgesia (WEA)

- Designed to provide enough pain relief that you are comfortable and yet still aware of the contractions
- Many women receiving WEA will not walk for the following reasons: woman refuses (15-25%), leg weakness (often described as not feeling normal), and maternal hypotension (low blood pressure)
- Walking ↑ risks for falling due to:
 - Need for FHR telemetry
 - IV pole
 - Loss of proprioception => fall risk
 - Ruptured membranes while walking => fall risk



Why Walking Epidural Analgesia

- Provides **satisfactory** analgesia
- May **↑ maternal comfort** and satisfaction
- **Does not prolong labor** and may shorten labor
- **Promotes contractions** and therefore labor
- **May ↓ use of forceps** and vacuum extraction => useful in the second stage of labor (pushing), where **adopting more upright** or squatting positions can help with delivery
- Allows the patient to **change positions in bed**, get into a chair, or walk to the bathroom
- **Psychological benefits** (more control, more autonomy, improved emotional and mental health)



Thank You!



Questions

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