Nitrous Oxide for Labor: A Resident and SRNA In-Service
What is Nitrous Oxide for Labor?

- 50% nitrous/50% oxygen
- Inhaled during contractions
- Self-administered
- Analgesia not anesthesia
- Awake, responsive
- Laryngeal reflexes intact

Rosen, 2002
Indications

- Women in painful labor
- Extensive perineal repair (local anesthesia may not be enough)
- Painful post-partum procedures (manual removal of the placenta and dilation/curettage)
- Used with IV narcotics for conscious sedation/MAC
N2O for labor around the World

- United Kingdom
- Canada
- Australia
- Norway
- Finland
- New Zealand
Nitrous Oxide for labor in the United States

• UCSF (San Francisco)
• University of Washington (Seattle)
• Vanderbilt UMC
Why should we offer this?

- Patients want effective alternatives to epidurals!!!
- Birth experience often better for many women with less invasive methods
- Many patients from different cultures desire non-regional analgesia
- Non-Invasive, “simpler”
- When regional contraindicated
2002-2010 UCSF Statistics

• Eight years of data
• 65% used epidurals
• 10% used nitrous
• 50% (half) of patients opting for nitrous went on to get an epidural
# Vanderbilt Statistics

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<tbody>
<tr>
<td><strong>Women using N2O</strong></td>
<td>35</td>
<td>35</td>
<td>39</td>
<td>43</td>
<td>57</td>
<td>209</td>
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<tr>
<td><strong>Sole Analgesic</strong></td>
<td>22 (63%)</td>
<td>19 (64%)</td>
<td>16 (41%)</td>
<td>23 (53%)</td>
<td>23 (41%)</td>
<td>103 (49%)</td>
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<tr>
<td><strong>Converted to LEP</strong></td>
<td>13 (37%)</td>
<td>16 (36%)</td>
<td>20 (59%)</td>
<td>20 (47%)</td>
<td>34 (59%)</td>
<td>106 (51%)</td>
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Vanderbilt now offers laughing gas to women in labor - WKRN, Nashville, Tennessee News, Weather and.
www.wkrn.com

The gas can be administered quickly, is widely known to rapidly ease pain, and has been proven safe for both mothers and their babies.
Converting to Epidural

- UCSF: 50% conversion rate overall
- Vanderbilt data: May 30 to October 31, 2011 cumulative (209 pts)
- Vandy: 49% (103/209) delivered without an epidural
- KEY POINT: We expect that patients using nitrous for their labor will deliver without an epidural about 50% of the time
Proportion of Laboring Women Opting for Nitrous

- **UCSF:** 11-14% rate for nitrous use after CNM administered starting 2007 (prior to was 6-8%)
- **Vandy:** 13.8% (43/311) of patients presenting for intended vaginal delivery chose nitrous in Sept 2011
- 19.1% (57/298) chose nitrous in Oct 2011
A Very Brief History

- **1772**: N2O first synthesized (Joseph Priestly)
- **1846**: EtherDome “invention” of anesthesia (William Morton)
- **1847**: Chloroform first used in Obstetrics (James Simpson)
- **1895**: N2O first used in Obstetrics (Stanilov Klikovich)
- **1933**: Minnitt Apparatus (RJ Minnitt) gas and air
- **1961**: Entonox (Michael Tunstall and the BOC)
Medical Uses

- Operating Rooms
- Emergency Medicine
- Burn units
Use in Dentistry

• Estimated 35-50% of American dentists
• Most common clinical application in this country
Industrial Uses

- Rocket fuel
- Racing and retrofit cars
- Whipped cream
Mechanisms

- Release of endogenous endorphins
- GABA
- NMDA
- Complex action
Physiology

- Inhalation
- Onset 30-50 sec
- Eliminated by exhalation
- Metabolism 0.004%
- Onset dose dependent
Research/Studies

- Long history of clinical use
- Most studies older/twilight
- Sedative polypharmacy not consistent with modern medical practice
- AHRQ review currently being performed
Maternal Oxygen Saturation

- Desaturations occur in all laboring patients
- Saturations comparable to control used as sole agent
- Diffusion hypoxia not demonstrated at 50%
Nitrous Oxide and Narcotics

- N2O/narcotics may affect O2 sats and be sedative
- Clinical significance not established but does point to increased monitoring vigilance
- The two are routinely combined in clinical use
- Vandy Policy: wait 2 hours before nitrous oxide analgesia
- May be started sooner at discretion of attending anesthesiologist
Progress of labor

- Older studies of epidurals suggested increased rate of cesarean section
- Current research suggests no increased risk
- ACOG and early epidural placement
Nitrous Oxide

• No impact on C/S rate
• No impact on second stage of labor
• Instrumental delivery rate same as control
• No effect on first stage of labor based upon limited studies

Epidural

• No impact on C/S rate
• Prolonged second stage of labor
• Increased instrumental delivery rate
• Variable effect upon first stage of labor (Wong et al)
Neonatal Outcomes

- APGARs
- Cord blood gasses
- Neurobehavioral testing
- Outcomes comparable
Apoptosis

- Animal models
- All anesthetic agents
- Apoptosis not shown at clinically relevant doses
- FDA Advisory 2007
- No change in clinical practice
Nausea

- Occurs in all laboring patients
- N2O more common than epidural
- Comparable to narcotics/other inhaled agents
- Approximately 10%
- Consider pretreatment
Dizziness

- Appx 20% of women
- Wide variation in rates reported
- Comparable to other inhaled agents
- Most common side effect
- Usually well tolerated and transient
Efficacy/Satisfaction

- VAS reduction less compared to epidural
- Comparable to other inhaled agents
- Higher satisfaction compared to demerol
- Remifentanil may provide greater pain reduction but is difficult to administer
- Anxiolysis effect
Other Outcomes

- Amnesia not reported with nitrous as sole agent
- Unconsciousness not associated with use as sole agent
- Studies stratified to two groups: older studies not consistent with modern medical practice
- Nitrous crosses the placenta and is rapidly eliminated after delivery
- Decease in Homocysteine/B12 proportional to duration of use
Studies Overview

• No demonstrated maternal or neonatal adverse effects
• Maternal side effects usually well tolerated
• Variable reduction in pain relief
• Labor Course unaffected
Environmental Safety

- NIOSH exposure limit 25ppm/8hr TWA
- European/UK limit 100ppm
- US v European delivery systems
- Ventilation/Scavenging
- Demand Valve
- UCSF data 2010 all samples <2ppm
Abuse Potential

- Reasonable measures to prevent diversion
- Machines stored in locked room in common area
- Patient teaching
- UCSF: no incidences of abuse in 30 years of clinical use
Contraindications

• Acute Intoxication
• Pneumothorax/air in closed spaces
• Documented B12 deficiency
• No nitrous while using tub
Patient Assessment

- H&P-same as for epidural
- Consent for nitrous and LEP/GA
- Confirm no narcotics in last 2 hours
- Consider Zofran prophylactic
Patient Counseling: “What can I expect?”

- Less pain
- More relaxed
- “I don’t care” effect
- 80%: No side effects
- Nausea - 1 in 10
- Dizziness - 1 in 5
- About ½ of women deliver with nitrous only
Monitoring

• Pulse Ox/BP/HR recorded at start of Gaschart case
• Standard L and D Monitoring thereafter
• IV is not required
• Fetal Monitoring is per OB provider
All Patients getting Nitrous must have a GasChart!!!!

- Record 2-3 sets of vitals at start of case
- N2O 50% and O2 50% under gasses given
- Schedule title of case as N2O
- Document IV if present and other monitors
- Anesthesia end time 30 min after placenta delivery
- Conversion to Epidural: change Title to N2O/LEP
Changing Title of the Case

• If LEP: Change from N2O to N2O/LEP
• If no LEP, change title to N2O only
• “N2O” must remain in title for all cases
Sample GasChart narrative:

Consulted to provide nitrous oxide therapy to patient. History and physical performed, Risks/benefits of therapy discussed, questions answered and she states she wishes to proceed with nitrous therapy at this time. Patient counseled not to ambulate without assistance. Most recent cervical check is ___cm on exam at ___am/pm. Current level of pain is ___/10. Machine in room and connected to wall suction in on position.

Patient teaching performed and therapy initiated. I remained in room for ten minutes and provided guidance of proper timing of breaths. Patient using therapy and reports improvement in her pain and coping. Level of pain while using nitrous oxide is ___/10 ten minutes after initiation of therapy.
Machine Basics

- Free-Standing Blender Device
- Delivers set 50/50 mix
- Tank supply N2O
- Wall supply O2
- Scavenging system/wall suction
- Anesthesia provider operates/troubleshoots
Where is the machine located?

- Medication room off the nurses station
- Combo 2/4 together, then 3
- Anesthesia provider returns/cleans machine at end of use
- L and D nurse will call when patient delivers
The mask and demand valve

- Patient’s breath opens valve
- 10cm water pressure
- No flow between breaths
Place Sticker on Patient Log

- Patient Sticker
- Place on log
- Clipboard located on each machine
- Patient use tracking
Machine Operation

• Turn key- about ¼ turn
• Nitrous is now on
• Confirm tank pressure
• 700-800psi
Connecting the oxygen supply

- Flowmeter protects machine from high O2 pressure
- Close before connecting
- Gradually open
- Ball will not float

OFF position prior to connecting!
Checking the Pressure lines

- Most important check
- Check that all Pressures are in wide green range
  - 40-65 psi
- Nitrous on left
- Oxygen on right
- Mixture pressure on top
The Scavenging System

• Exhaled breath enters circuit
• Reservoir to prevent system overflow
• Suction tubing
• Wall suction
Connecting the scavenger

- Connect to wall suction port
- Full/High setting
- Valve in on position
- Air will flow continuously through mask
At the end of use...

- Labor nurse will call anesthesia to pick up machine
- Check nitrous tank pressure
- Turn off nitrous with key
- Close O2 valve and disconnect from wall
- Disconnect suction/coil tubing
- Return to storage room
- New Mask/ Sanitize
Sanitize Equipment

• Wipe down Demand valve
• Wipe Circuit Tubing and housing
• New Mask on circuit
Preventing Tank Depletion: A Team Effort

- O2 can still flow if N2O tank is empty!
- Instruct support person and midwife/doula to watch tank pressure intermittently
- Pressure gauge location
- Call anesthesia if gauge reads 500 (line marked on gauge)
Changing the Nitrous Tank

- N2O liquid at room temp
- Pressure stable at 700-800 until all liquid is gone
- If pressure reads <700psi tank is almost empty
- Rapid depletion follows
Where do I get another tank?

The Anesthesia Supply Room
(Paul’s Office)
First turn off the machine!!!

- Turn off the gas supply with the black key
- Changing tank with tank supply open is dangerous
What’s next?

• Slide foot under the tank
• Tip up on your heel to touch tank
• Your foot supports the tank as it lowers down off the pins
Remove empty tank

- Loosen the tank by unscrewing on the side of the yoke block as shown
- Carefully pull the tank away and lower
Check Gasket Connection

- Gasket located at tank attachment
- Gasket on new tank
- Inspect connection
Hang/Secure new tank

- Raise tank in place with foot
- Slide tank unto the pins
- Secure by hand first
- Tighten seal with scissors to avoid leak
Patient Teaching Points

- Patient holds own mask
- Wrist straps limit hand fatigue
- Tilt the mask for good fit
- BP cuff on arm not holding mask
- Remain in room 10-15 minutes to aid in teaching/assessment
Timing of breathing

- 3-5 breaths before start of contraction
- Anticipate very start of contraction
- Can help to start breathing when “it's been a while since the last one”
- She can try breathing continuously through a few contraction cycles

The Relationship between the contraction and the blood level of Nitrous Oxide. Note the 'lag' or delay if breathing the gas is started at the time of the contraction.
“Baby Straps” reduce hand fatigue
Getting out of Bed

• Assistant must be at patient side when standing or transferring
• Have her sit on edge of bed and assess prior to standing for the first time.
<table>
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<th>Nitrous Oxide</th>
<th>Epidural</th>
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<tbody>
<tr>
<td>• Pain reduced but still</td>
<td>• Dense pain relief often</td>
</tr>
<tr>
<td>present</td>
<td>complete</td>
</tr>
<tr>
<td>• Reduction in anxiety</td>
<td>• No effect on anxiety</td>
</tr>
<tr>
<td>• Non-invasive</td>
<td>• Invasive</td>
</tr>
<tr>
<td>• No serious side effects or</td>
<td>• Serious side effects</td>
</tr>
<tr>
<td>risks as used for labor</td>
<td>uncommon/rare</td>
</tr>
<tr>
<td>• Patient can move about</td>
<td>• Patient bed bound</td>
</tr>
<tr>
<td>• IV/Catheter not required</td>
<td>• Need for IV and catheter</td>
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Nitrous Oxide

- Variable amount pain relief
- Significant Anxiolysis
- Pain perception alteration “I don’t care” effect
- Nausea comparable
- Dizziness more common
- No effect Apgars

IV/IV Narcotics

- Variable amount pain relief
- No anxiolysis
- Pain perception unchanged relative to analgesia
- Nausea comparable
- Dizziness less common
- Can effect Apgars (sleepy baby)
Offering meaningful alternatives for birth

- Put yourself in her shoes
- Birth is a very important life event!
- Provide safe and effective choices
- Allow women to decide what is best for them
In Conclusion...

- Simple/Non invasive
- Good safety profile mom/baby
- Side effects mild
- Pain relief/anxiety reduction
- Effective alternative to an epidural for about 50% of women
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