Nitrous Oxide for Labor
Expanding Options for Women in the
United States

Judith Bishop CNM MPH
AIM
June 10, 2011

Disclosure

Options for labor pain in USA

- [It is a] fact that US women have fewer options in the management of pain in childbirth than, for example, women in Canada, France, the Netherlands, and the United Kingdom.”

“Labor pain management in the United States: understanding patterns and the issue of choice”

Listening to Mothers II

- Report of the 2nd national U.S. survey of women’s childbearing experiences
- 1,573 singleton hospital deliveries 2005

Declercq et al 2006
Effectiveness of pain relief options


<table>
<thead>
<tr>
<th>Method</th>
<th>Overall</th>
<th>Very helpful</th>
<th>Somewhat helpful</th>
<th>Not very helpful</th>
<th>Not helpful at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural or spinal analgesia</td>
<td>76%</td>
<td>81%</td>
<td>10%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Immersion in tub or pool</td>
<td>6%</td>
<td>48%</td>
<td>43%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Hands on techniques (eg massage)</td>
<td>20%</td>
<td>42%</td>
<td>51%</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Narcotics</td>
<td>22%</td>
<td>45%</td>
<td>35%</td>
<td>15%</td>
<td>11%</td>
</tr>
<tr>
<td>Birthing ball</td>
<td>7%</td>
<td>34%</td>
<td>33%</td>
<td>21%</td>
<td>12%</td>
</tr>
<tr>
<td>Shower</td>
<td>4%</td>
<td>33%</td>
<td>40%</td>
<td>7%</td>
<td>12%</td>
</tr>
<tr>
<td>Application of hot or cold</td>
<td>5%</td>
<td>31%</td>
<td>50%</td>
<td>13%</td>
<td>4%</td>
</tr>
<tr>
<td>Mental strategies (eg relaxation)</td>
<td>25%</td>
<td>23%</td>
<td>48%</td>
<td>15%</td>
<td>8%</td>
</tr>
<tr>
<td>Position changes</td>
<td>42%</td>
<td>23%</td>
<td>54%</td>
<td>17%</td>
<td>7%</td>
</tr>
<tr>
<td>Changes to environment (eg music)</td>
<td>4%</td>
<td>21%</td>
<td>55%</td>
<td>20%</td>
<td>2%</td>
</tr>
<tr>
<td>Breathing techniques</td>
<td>49%</td>
<td>21%</td>
<td>56%</td>
<td>17%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Epidural or spinal analgesia: 91%
Immersion in tub or pool: 92%
Narcotics: 77%
Mental strategies: 77%

History of N₂O

1808

Enter Nitrous!

- History
- Use in Ob
- Advantages
- Limitations
- UCSF experience/stats
- FAQ’s (cost, billing, staff safety, abuse)
- What’s happening/the future
History of N₂O use in OB

- 1880 Stanislav Casimirovic Klikovicz studied the use of N₂O for labor pain
- 25 “subjects”
- Conclusions:
  - Harmless to mother and fetus
  - Did not affect labor progress
  - Did not produce loss of consciousness
  - Did produce pain relief
  - Did not require presence of M.D.

Current use of N₂O

- Despite introduction of other more potent anesthetics (some of which have come and gone), nitrous oxide survives and
  - Continues to be the most used gaseous anesthetic in the world
  - Continues to be widely used for labor analgesia

Current use of N₂O

- LABOR ANALGESIA
- Used “commonly” in:
  - UK
  - Canada
  - Australia
  - Scandinavia

N₂O use for labor analgesia in USA

- University of California, San Francisco
- University of Washington, Seattle
- A hospital in Lewiston, Idaho
N\textsubscript{2}O for labor

It’s about:

- N\textsubscript{2}O for analgesia (not anesthesia)
- Intermittent use
- Fixed 50% nitrous 50% oxygen blend
  - Has been “Nitronox” in U.S.A.
  - “Entonox”, Kalinox, Midogas elsewhere

N\textsubscript{2}O for labor

Some of the advantages

- Extensive experience of safe use “administered” and supervised by midwives and nurses
- “Easy” to use
- Relatively inexpensive
- Self administered by woman in labor
  - Empowering to women to determine own usage
  - Ensures safety, prevents overuse

N\textsubscript{2}O for labor

Some of the advantages

- Rapid onset (≤ a minute)
  - Some degree of relief quickly
- Rapid offset
  - Doesn’t build up in mother or fetus
  - Can be used through second stage

N\textsubscript{2}O for labor

Some of the advantages

- Does not seem to affect contractions, progression of labor/ability to push
- No evidence of effects on newborn or on breastfeeding
- May allow postponement or avoidance of use of narcotics or epidural anesthesia and hence their adverse effects
N₂O for labor

Some of the advantages

- Additional “low tech” option for women desiring unanesthetized birth
  - Shouldn’t require IV site, pulse oximetry or continuous monitoring
- Additional option for women who would like an epidural but cannot have one
  - Arrive “too late”
  - Low platelets or other contraindication
  - Anesthesiologist unavailable

Some of the limitations

- Not all women find it helpful/effective
- Some women experience unpleasant side effects
  - Dizziness, drowsiness
  - Nausea
- Woman may have to stay near source of N₂O, which may limit where she can be

UCSF

Available to our laboring women for > 30 years

- Courtesy of Sol Shnider, M.D., Ob anesthesiologist (from Canada) and his successor Mark Rosen M.D.
- We are building it in to new hospital at Mission Bay as well
**N₂O for labor**  
**The equipment**

- Mask or mouthpiece
- Flow initiated by negative pressure opening demand valve
- Same valve prevents further flow when inhalation ceases

**At UCSF**

- Holding tanks of N₂O and oxygen piped into labor rooms
- Portable “blender”, regulator apparatus with demand valve
- Hooked up to wall when needed

**“Nitronox”**  
**UCSF wall connection**

**N₂O in use**
**N₂O in use**

- Informing of possible side effects
- Only laboring woman can hold mask
- Placement of mask to create seal
- Timing of breathing for maximum analgesic effect
- Exhaling back into mask

---

**N₂O for labor**

**Instructions for use**

**N₂O for labor**

**Timing of breathing**

**UCSF Statistics**

- 2002-2010
  - 65% used epidurals
  - 10% used nitrous oxide
  - 5% (half) of those went on to epidurals
N\textsubscript{2}O for labor

**UCSF**
- These numbers do not include multiple other uses of nitrous oxide on our unit:
  - Laceration repair
  - Retained placenta
  - Foley balloon placement/vag exam
  - Blood draw/IV placement

---

N\textsubscript{2}O for labor - UCSF
Access through midwives

- In 2007, administration of nitrous oxide was added to “privileges” of CNM’s
- Up to that time, the anesthesia resident had to be called to come and start administration

---

N\textsubscript{2}O for labor - UCSF
Access through midwives

**Effects of Increased Access:**
- In the 3 years before midwifery “privileges” to administer:
  - 6-8% use of nitrous
- In the 4 years since:
  - 11-12% use of nitrous
  - close to 50% increase

---

“Midogas” – Australia

[Image of a midwifery machine and a birthing pool]
**Entonox – Great Britain**

- Laboring woman administers the nitrous

- Initiation of nitrous could be done by anesthesiologist, FP/OB M.D., midwife, nurse anesthetist, a nurse with order*

  *This option would give greatest access in U.S.

---

**N₂O for labor Regulations**

- Nitrous anlagesia for labor essentially does not exist in USA - So really no regulation per se/ none specific to this use

- Regulations DO exist for use of nitrous oxide for >"moderate sedation"

- Moderate in terms of nitrous is defined as greater than or above 50% N₂O

---

**N₂O for labor Regulations**

- American Society of Anesthesiologists (ASA) document is the main source of policy

  “Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists”

  Anesthesiology, V 96, No 4 Apr 2002
**N₂O for labor Regulations**

- ASA guidelines “specifically exclude” minimal sedation because
  - It “entails minimal risk”
  - Ventilatory & cardiovascular functions are unaffected
  - Adverse effects are negligible

---

**N₂O for labor Protocol - UCSF**

- Appears in full in JMWH 2007;52:308-9
- Title: “Administration of Nitrous Oxide in Labor: Expanding the Options for Women”

---

**N₂O for labor Knowledge and Competency**

- For institutions new to nitrous a more formal education approach may be required initially
  - Equipment providers plan educational component (DVD?)
  - Private companies/continuing education organizations/courses = another option

---

**N₂O for labor Safety for staff**

- No implications of harm with analgesic levels, used intermittently and with
  - Use of scavenging equipment
  - Use of demand valve
  - Proper instruction to, and use by, user

All of which limits exposure of others in the room
N\textsubscript{2}O for labor

Monitoring exposure for staff

Occupational exposure guidelines

- NIOSH set standard exposure limit = <25 ppm 8 hr time-weighted average (TWA)
- UK, Finland, Germany, Sweden limit = < 100 ppm

N\textsubscript{2}O

Monitoring exposure - UCSF

UCSF Office of Environmental Health and Safety

- Conducts workplace hazard evaluations
- Chemical exposure monitoring is one component
  - Nitrous oxide falls under this component

N\textsubscript{2}O

UCSF Exposure Monitoring

- Yearly evaluation, last results 2010
- Dosimeter badges worn by 3 nurses
- Advanced Chemical Sensors Co, Boca Raton, FL (AIHA accredited) analyzed badges

Dosimeter badge

- Cost between $40 - $75
- Includes badge and evaluation
- All done by mail
N₂O Exposure Monitoring

Results for 2010:
1. ppm < 1.0
2. ppm < 2.0
3. ppm < 2.0

Remember NIOSH exposure limit = 25 ppm

N₂O Equipment cost

- Two portable tanks (N₂O and O₂)
- Blender
- Demand valve
- Trolley

N₂O Equipment cost

- Blender, demand valve, trolley

- Nitronox was = $5,000

- New equipment – "not more than that"

N₂O for labor Cost

The cost of nitrous oxide and oxygen is comparatively low.

- But cost depends on distance from distributors and can increase considerably (up to factor of 7x)
In dentistry, nitrous oxide administration is touted as having “economic benefit” for a practice.

- Fees of $50-$150 added to bill for nitrous administration
- Dental (ADA) code=D9230
  - Anxiolysis, analgesia, inhalation of N2O

There are no CPT/ICD-9 codes specifically for inhalation of nitrous for analgesia.

“Billing” issues too different in other countries (e.g. with National Healthcare!) to be useful.

Matrx extolled “low abuse potential” of Nitronox equipment.

- Removable demand valve
- Lock away the blender
- 50/50 N2O/O2 can never be lethal

In actual practice, not a problem we have seen or been concerned about.
What’s happening

- Lots of interest from the media!
  - Associated Press
  - ABC news
  - Slate
  - Wall St. Journal
  - Nightline
  - Etc!

No laughing matter: Vanderbilt Medical to offer nitrous oxide during childbirth

Academic interest
- Vanderbilt as part of Agency for Healthcare Research and Quality (AHRQ) producing thorough review
- Dartmouth – NNEPQIN 2011 winter mtg
- Cochrane Review coming
**N₂O**

**What’s happening**

- Countless inquiries and many talks around the USA
- All impeded by lack of equipment
- Except for Vanderbilt who purchased previously owned equipment and has just started using it!

**N₂O analgesia for labor**

**Conclusions**

- Self-administered, intermittent N₂O is:
  - Simple
  - Safe and effective
  - Inexpensive
  - Does not require M.D. supervision
  - Popular with many laboring women
  - Should be available as an option here!

**N₂O**

**For more information**

Join the listserv:

N2Oduringlabor.subscribe@yahoogroups.com

**Thank You**