If laughter is the best medicine...

Then it's time to utilize nitrous oxide as self-administered analgesia in childbirth

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Disclosure:

• I have no relevant financial or nonfinancial relationships to disclose pertaining to this topic

Behavioral Objectives~

The learner will be able to:

1. Define what element is combined with nitrous oxide and dosages for both when using for medical purposes.
2. List one historical fact about nitrous oxide.
3. Contrast an advantage/disadvantage between nitrous analgesia and one other labor medication.

Behavioral Objectives~

The learner will be able to:

4. Summarize knowledge about nitrous oxide anesthesia's effect on newborns.
5. Compose one client teaching point about nitrous analgesia and be able to apply this knowledge into clinical practice.
6. Formulate a justification for why nitrous analgesia should become mainstream in American maternity practices.

What is Nitrous Oxide/N2O?

• A colorless gas
• Slightly sweet odor and taste
• It is an oxide of nitrogen
Nitrous Oxide is also known as:

- DINITROGEN OXIDE OR DINITROGEN MONOXIDE

Nitrous Oxide is used for:

- Food processing propellant
- Semiconductor manufacturing
- Analytical chemistry
- Chemical manufacturing
- Auto racing engine injection

Nitrous Oxide is used for medical/dental anesthesia and analgesia...for our lecture the dosage is:

**N2O + O2**

50:50

Nitrous oxide + oxygen

NITROUS OXIDE AS SELF-ADMINISTERED ANALGESIA:

The most widely used pain relief during labor (outside of the USA)

Nitrous Oxide is also known as:

- “Laughing gas”
- “Nitrous”

Purpose of N2O + O2 for maternity:

- Provide another pain management option
- Satisfactory pain relief increases a positive birth experience
Why now?

- Consumers want safe & economical choices
- Escalating insurance premiums require creative solutions
- Third-party payers want financial stewardship

According to the World Health Organization (WHO, 2013)

Nitrous oxide is considered one of the most essential inhalation medications available...

Where in the world is N2O + O2 used in maternity?

- Australia
- Canada
- Denmark
- Finland
- Great Britain
- Iceland
- Ireland
- Israel
- New Zealand
- Norway
- Scotland
- Sri Lanka
- Sweden
- USA (still limited use)
- Wales

How common is Nitrous Oxide use in maternity elsewhere?

- >60% of birthing women in the UK
- 48% of birthing women in Finland
- 46% of birthing women in NSW, Australia
- 50% of birthing women in Canada

The availability? For example...

- 100% of birth centers and hospitals in UK, AU, NZ
- 85% of birth centers in Norway

In July 2010, only 4 US hospitals and no birth centers offered N2O for maternity ~

- UCSF Moffit Hospital-San Francisco, CA; used for > 10 years
- University of Washington Hospital-Seattle, WA; used for >30 years
- Okanogan Douglas-District Hospital-Brewster, WA; dates unknown
- St. Joseph Regional Medical Center-Lewiston, ID; dates unknown
Why so few US birthing facilities?

- Only used dental equipment was available in the USA until...
- January 2011: FDA approved a new nitrous oxide device
- 2012: N2O equipment available for purchase (now available to purchase from Canada)
- The FDA sanctioned equipment includes additional safety features

In USA: from January 2011 - December 2014, offerings grew at a tremendous rate

- 26 Hospitals
- 23 Free-standing Birth Centers

Nitrous Oxide in the Midwest as of today*

- 3 free-standing birth centers in Minnesota
- One hospital system in Minnesota
- One hospital system in Iowa
- One birth center & hospital system in Wisconsin
- Zero in North & South Dakota
- Many more facilities are in-process of offering this option

HISTORY ~

- Joseph Priestley
- British-born Chemist, Philosopher, Educator and Theologian
- First synthesized nitrous oxide in 1772

The process to make nitrous oxide:

- By allowing nitric oxide (NO) to stand in contact with iron filings
- Crystals heated to 240 degrees Celsius
- Decompresses to form the gas N2O

Even more relevant to our lives~

- O2
N2O History 1799 ~

- Humphry Davy, English chemist
- Remembered for his "heroic commitment to discovery"
- Later, President of the Royal Society, England’s Academy of Science

1799 Davy’s nitrous trials began with much enthusiasm

- Doctors and patients, chemists, playwrights, surgeons and poets – experimented on themselves and each other.
- Davy instituted a loose reporting protocol, asking every volunteer to produce a short written description of their experience.

"O, Excellent Air Bag"

- 1800 published a 580 page text on nitrous oxide
- Noting “nitrous was capable of destroying physical pain”
- He thought it “might be used during surgical operations”

Connecting the dots for pain control...

N2O History ~ Dentistry paves the way

Dr. Horace Wells

- Dentist
- “The Discoverer of Anaesthesia [sic], December 1844.”
History of N₂O+O₂ in maternity ~
- 1880, first physician to use nitrous oxide for labor
- Using an 80:20 mix
- Introduced 25 “subjects” to nitrous during childbirth

Stanislav Klikovich

Klikovich concluded:
- Harmless to mothers and babies
- Did produce pain relief
- Did not affect labor progress
- Did not require presence of M.D.
- Did not produce loss of consciousness

Dr. J. Whitridge Williams ~
- Physician in the US during the early 1900’s
- Head of OB at Johns Hopkins University
- Author of: Williams’ Obstetrics

Dr. Williams praised nitrous oxide ~
“because... it doesn’t diminish the force of contractions or have any other negative impacts on the physiology of labor”

Self-administration of Nitrous Oxide begins ~
- 1933, invented by James Minnitt, MD, with Charles King
- The first portable “Gas and Air” machine
- Used for pain relief in childbirth
- Managed by unsupervised midwives

Liverpool Maternity Hospital

Self-Administration of Nitrous Oxide ~
- Continued in the United Kingdom and many former colonies
- Available to maternity clients: homes, birth centers, hospitals

Machine from 1943-1960, in special Queen Charlotte carrying case
OBSTETRIC ANESTHESIA IN THE USA

- 1847: Ether introduced
- 1914: Twilight sleep introduced (scopolamine and morphine) and spinal anesthesia
- 1920: Sedation of women in labor began in earnest for hospitals
- Polypharmacy years included new blocks, inhalation agents ethylene, cyclopropane, and trichloroethlene, injectables and vaporizers…
- 1953: Virginia Apgar and introduction of “APGAR” scoring due to condition of babies born under anesthetic

Nitrous oxide is used in the USA ~

- Dentistry as a conscious sedation
- This form of nitrous use is “continuous”
- Pre-op for surgeries, especially pediatric
- Painful short-term procedures usually in pediatrics
- Locally, Children’s Hospitals & Clinics of Minnesota offering since 2004

Other medical uses for Nitrous Oxide ~

- By Emergency Medical Services (EMS) in many countries
- Including in some areas of the USA
- Provides fast onset pre-hospital pain-relief
- Rugby player on the field with broken ankle, Australia

Other N2O+O2 uses ~

- IV insertion
- During blood draw fear or history of fainting with procedure
- Perineal repair
- Manual removal of placenta
- IUD placement

Labor pain medication use in the USA ~

- 2013 ‘Listening to Mothers III Survey’ found that:
  - 83% of women reported at least one type of medication for pain relief in labor

N2O+O2 benefits for labor ~

- May manage pain well enough to avoid stronger medications
- Allows mother to change positions throughout labor
- Can continue to eat and drink
N2O+O2 continued benefits ~
- Woman controls frequency and dose
- Does not require continuous fetal monitoring
- Rapid onset of pain relief, within a minute
- Rapid offset if patient does not like it
- Non-invasive

N2O+O2 allied with epidurals ~
- Alleviate pain while waiting for MDA or epidural pre-procedures to be completed
- Can use nitrous while getting epidural placed (* not everywhere!)

N2O+O2 being used while on the birth ball or leaning over bed ~

N2O+O2 being used while in waterbirth tubs ~

Advantages of N2O+O2 ~
- Many years of safety under guidance of physicians, midwives & nurses worldwide
- Ease of use for staff and clients
- Inexpensive, after initial equipment purchase

Possible side effects of N2O+O2 ~
- Dizziness
- Dry mouth
- Earache
- Nausea
- Vomiting
- Mild hallucinations
- Sedation
Potential limitations of Nitrous Oxide use ~
- May not provide effective relief for duration of labor
- May not like the sensation of the gas
- May not like holding the mask against face or having mouthpiece in
- Mask may feel claustrophobic
- Her hand or arm may tire
- Inhalation requires coordination of breathing to get the full effect

How does N2O+O2 work?
- Not completely understood
- Alters nerve impulses to cerebral cortex
- Alters the interpretation of impulses
- Elevates the pain threshold and creates a feeling of relaxation and euphoria

Nitrous Oxide is also known for another important benefit ~

IT REDUCES ANXIETY

Some studies found N2O+O2 ~
- More effective than opioids
- N2O + O2 at 20%/80% is equal analgesic to 10-15 mg of morphine (in an adult)
- Non-allergenic & non-irritating
- Least toxic of inhalation agents
- May not show a difference in pain score, never the less client is “satisfied”

Actual pain scale:

“Nitrous Effect” pain scale:

As a pre-mixed medical gas it is 50% nitrous oxide and 50% oxygen mixture ~
- The U.S. Food and Drug Administration (FDA) prohibits single-cylinder nitrous oxide
- Requires N2O and O2 be in separate cylinders
As a medical gas delivery system

- Via a portable device mixer
- Obtained from a piped wall outlet
- In USA not likely to be dose adjustable

Nitronox equipment ~

Nitrous equipment & sample masks and tubing ~

Example of Pro-Nox system

Hey! What about babies?
No difference in APGAR scores, neonatal survival and neurobehavioral assessments when compared with newborns whose mothers were non-medicated.

All babies born to mothers who used “the gas” in NZ.

No effect on breastfeeding.

All babies born to mothers who used the “gas” in NZ.

Mark A. Rosen, MD ~

- Specialist in obstetric anesthesiology
- “We’ve never seen a groggy baby from inhalation of 50% nitrous oxide...it just doesn’t happen.”

More from Mark A. Rosen, MD ~

“When applied properly, it appears that nitrous oxide inhalation can provide significant pain relief...a conclusion reached 30 years ago.”

Getting started~

(Each facility will determine their own guidelines...)

Does client have any contraindications?
- First trimester of pregnancy (viable)
- Documented Vitamin B12 deficiency without treatment
- Recent surgery for obstruction of middle ear or sinus cavities
- Impaired level of consciousness
- Cannot hold her own face-mask or mouthpiece
Getting Started~
- Can the client follow simple instructions?
- Risks and benefits explained? Informed consent obtained?
- Is N2O prescribed for the client and it is documented in the chart?
  - Equipment check test to insure the cylinders have adequate gas
  - Connect the new face mask to tubing

Instructions for client and birth team:
- Client must self administer the gas (no one is to help)
- She must hold the mask over mouth and nose or insert the mouthpiece
- At the onset of contraction breathe in and out deeply and fairly rapidly into the mask or mouth-piece

Does client need ongoing monitoring by staff?
- After initial review that client knows how to use properly for best effect
- And to know that it is working
- Continuous direct observation not required
- Every 15-30 minutes IA per protocol, should be happening as well

Remember!
- Nitrous is an self-administered analgesic
- It is NOT dispensation of an anesthetic
- No different than nurses, midwives, physicians continuing to “monitor” women who receive opioids

Occupational safety considerations ~
- Staff could periodically wear dosimeter badges monitor exposure
- USA’s 25 ppm standard is the strictest in the world
- Most other countries have 100 ppm
  ▪ Recent studies have confirmed it is safe for pregnant workers to attend clients using self-administered N2O

N2O and Vitamin B12
- N2O affects B12 metabolism and can cause megaloblastic anemia, neutropenia
  ▪ A concern if more than a total of 24 hours consecutive (!)
  ▪ Or used more frequently than every 4 days (!)
Conclusion ~

- Maternity care in the USA needs to improve
- U.S. has the highest maternal death rate of any industrialized nation. Only three developed countries - Albania, Russia and Moldova are worse than the USA
- The c/section rate is 32.2%, more than double what the WHO recommends for best outcomes

Safest countries to have a baby ~
In order: Norway, Australia, Iceland, Sweden, Denmark, New Zealand and Finland®

- In appreciation to the mums and babies of Tuatapere Maternity/ Waiau Health Trust of New Zealand who introduced me to “the gas” as a midwife observer.
- Auckland University of Technology where I took my “Pharmacology for NZ Prescribers” course, which further informed me on this topic.
- Judith Bishop, CNM, MPH, and Judith Rooks, CNM, MPH both leader who passionately championed the nitrous oxide cause for many years through speaking and/or research.

WARNING
This video contains adult themes

Photo taken outside Tuatapere Maternity Home after 2 lovely births in a single day!