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	Owner:	<i>Leslie Bagley: Clinical Nurse Spec</i>
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	Applicability:	<i>AK - Providence Alaska MC & affiliates</i>

Nitrous Oxide Administration

Historical Number:

POLICY - PAMC/MS - NEW 11/2017

PURPOSE/SCOPE

The purpose of this policy is to provide for safe and effective administration of nitrous oxide to pediatric patients in order to relieve anxiety and prevent or decrease pain associated with painful procedures. Reduction of full procedural sedation and needed recovery time improves overall patient safety. The scope of this policy is for pediatric patients between 6 months and 18 years of age of ASA physical status 1 or 2.

POLICY

In keeping with the philosophy and mission of the Providence Health & Services nitrous oxide administration is titrated to keep a child at a level of anxiolysis; therefore, current hospital policy regarding patients receiving minimal sedation will apply. If the delivered nitrous oxide concentration is > 50% or if nitrous oxide is delivered in conjunction with another sedative or analgesic, it is considered moderate sedation.¹⁵ See Moderate Sedation Policy.

DEFINITIONS

American Society of Anesthesiologists (ASA 1): Physical status classification of a normal healthy patient.

American Society of Anesthesiologists (ASA 2): Physical status classification of a patient with mild systemic disease.

American Society of Anesthesiologists (ASA 3): Physical status classification of a patient with severe systemic disease

American Society of Anesthesiologists (ASA 4): Physical status classification of a patient with severe systemic disease that is a constant threat to life

Experienced RN Mentor: A nitrous oxide/oxygen trained RN who has successfully performed and documented 25 cases.

Fail safe equipment: built in mechanism of the nitrous oxide delivery unit that automatically prevents the flow of nitrous oxide if oxygen flow is terminated, thus ensuring oxygen delivery at a minimum of 30% at all times to patients receiving nitrous oxide oxygen sedation. A valve on the nitrous unit's flowmeter opens to allow nitrous flow only when there is flow of oxygen to the system. Anytime the oxygen flow is less than 30%, nitrous stops flowing. This feature prevents the potential delivery of 100% nitrous oxide.

Minimal sedation (anxiolysis): A drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. This is the target sedation level.

Moderate sedation: A drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. Note, reflex withdrawal from a painful stimulus is not considered a purposeful response. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is maintained.

Modified Aldrete score: Is a commonly use scoring tool used for determining when patients can be safely discharged post-anesthesia.

Nitrous oxide/oxygen (N₂O/O₂): An inorganic compound that is a combination of nitrous oxide and oxygen gases. It has a sweetish smell and is capable of inducing the first and second stages of anesthesia when inhaled.

Nitrous oxide/oxygen Provider (N₂O/O₂ Provider): A provider who has completed appropriate instructional training, has ongoing competency on file with the Medical Staff office, and also has nitrous sedation privileges. This provider may prescribe/order N₂O/O₂ and oversee its administration by a trained RN.

Nitrous oxide/oxygen trained RN: A registered nurse who has satisfactorily completed an instructional program and has documented initial and ongoing clinical competency for administration of nitrous oxygen within the registered nurse scope of practice per the Alaska Board of Nursing (**see related Advisory Opinion**).

r-FLACC: The Face, Legs, Activity, Cry, Consolability scale is a measurement used to assess pain for children between the ages of 2 months and 7 years or individuals that are unable to communicate their pain. The scale is scored in a range of 0-10 with 0 representing no pain.

Ramsey Score: A type of sedation scale utilized to establish the desired level of sedation in a quick, safe manner.

SPECIAL CONSIDERATIONS

This policy does not include pregnant patients of any age, including those pediatric patients up to 18 years of age.

Nitrous oxide should not be administered in the same room as or by a pregnant individual due to a possible increased incidence of spontaneous abortion and/or teratogenicity following procedure.¹³

Due to occupational exposure risk, RNs may refuse participation.^{BON}

REQUIREMENTS

- A. Only N₂O/O₂ providers may order nitrous oxide.
- B. Only N₂O/O₂ providers and nitrous oxide/oxygen trained RNs may administer nitrous oxide.
- C. A providers' s order for nitrous oxide sedation must be obtained prior to nursing nitrous oxide administration.
- D. A N₂O/O₂ privileged provider is readily available in the facility during nitrous/oxygen administration by a trained RN.¹¹
- E. N₂O/O₂ privileged provider is physically present if the age of the patient is less than 2 years.², **BON Advisory Opinion**
- F. RNs administering nitrous oxide/oxygen have current basic life support (BLS) and advanced life support (e.g. PALS, ACLS).
- G. The RN or provider administering nitrous oxide is primarily responsible for the safety of the sedated patient and may not leave the patient unattended or engage in other tasks that could compromise continuous monitoring of patient, airway, and/or level of consciousness.² Another provider is required to perform any associated procedure(s).

- H. RNs complete a minimum of six hours of didactic training specific to nitrous oxide, completion of a written exam, and successful completion of three nitrous oxide administrations with an experienced mentor. ², **BON Advisory Opinion**
- I. Continuing nursing competency is maintained by annual policy review and must have performed a minimum of 5 nurse administered nitrous oxide cases every 12 months otherwise re-certified by successful completion of three nitrous oxide administrations with an experienced mentor.
- J. RNs and providers trained in nitrous oxide administration evaluate the patient for cooperativeness, health status, and the presence of contraindications. RNs may choose not to administer nitrous oxide to any patient based on their pre-assessment. The provider is then notified.
- K. For all staff who administer nitrous oxide via a portable nitrous oxide machine (e.g. Sentry Sedate), dosimeter monitoring is executed per manufacturer's recommendations as follows:
1. Each staff member new to nitrous oxide administration must undergo initial monitoring immediately upon achievement of competency status (e.g. after check offs, training complete).
 2. Each staff member wears a dosimeter badge at least twice annually.
 3. Each staff member wears a dosimeter badge whenever new nitrous oxide equipment is introduced.
 4. After return or evaluation of the portable nitrous oxide machine by the Clinical Engineering Department, the next 5 users will wear a dosimeter badge as described in this section
 5. Each badge is worn by a single staff member for only one period of time or "occurrence".
 6. Each occurrence includes a minimum vapor exposure time of 15 minutes and is worn for a maximum of 8 hours.
(Example: If staff have multiple cases, the dosimeter badge is worn for their entire shift, up to a maximum of 8 hours.)
 7. Dosimetry is available by request for other participating staff members.
- L. The departmental sedation leader works in conjunction with nursing leadership and the Sedation Committee chair to define and implement nitrous oxide quality improvement initiatives.

PROCEDURE

- A. Indications - nitrous oxide is considered for procedures which would likely cause mild-moderate pain and/or produce anxiety and distress, including but not limited to:
1. Urinary catheterization
 2. Intravenous access
 3. Wound care, suturing
 4. Lumbar puncture
 5. Laceration repair
 6. Fracture reduction
 7. Nasogastric (NG) tube placement
 8. Joint aspiration or injection
 9. Vaccine administration
 10. Dressing changes
 11. Non-invasive procedures (e.g. MRI, CT)
 12. Abscess incision and drainage

13. Foreign body removal
14. Vaginal exam/abuse exam
15. Splint/traction placement

B. Contraindications

1. Absolute contraindications

- a. Sensitivity to nitrous oxide
- b. Pneumothorax
- c. Cystic fibrosis
- d. Significant bowel obstruction
- e. Pregnancy
- f. Air embolism
- g. Severe bullous emphysema
- h. Chronic obstructive pulmonary disease
- i. Congenital pulmonary airway malformation
- j. Patient in shock, increased ICP, semi-conscious or with serious head/facial injuries with potential for trapped air
- k. Congenital cystic adenomatoid malformation
- l. Cases of suspected pneumocephalus
- m. Decompression sickness (consider exclusion if diving in last 24 hours)
- n. Methylenetetrahydrofolate Reductase Deficiency (homocystinemia/vitamin B12 pathway)
- o. Suspected/known pernicious anemia or vitamin B12 deficiency
- p. Treatment with bleomycin sulfate
- q. Psychological impairment
- r. Current psychotropic drug use
- s. Current or recovering drug or alcohol addiction

2. Relative contraindications (discuss with care team):

- a. Patient's inability to participate
- b. Treatment with pain and/or sedation medication within past 2 hours
- c. Middle ear occlusion (e.g. ear ache) or other disturbances (e.g. grafting, surgery)
- d. Current upper respiratory tract infection
- e. Intraocular surgery (involving injected gas in last 10 weeks)
- f. Maxillofacial injuries (may prevent proper seal with mask)

3. RNs administer nitrous oxide as a single-sedative agent.²

- a. Use of nitrous oxide/oxygen combined with other sedatives falls into the category of moderate sedation. Additional monitoring and LIP presence requirements are found in the Moderate Sedation policy.

4. NPO considerations - There are no fasting requirements for mild sedation/ anxiolytic sedation.

- a. For moderate sedation cases, follow NPO guidelines outlined in the Moderate Sedation policy.

C. Equipment

1. Use fail-safe nitrous oxide/oxygen delivery equipment which is incapable of delivering less than 30% oxygen/maximum of 70% nitrous oxide.^{1,2}
2. A scavenging system must be used (i.e., wall suction but not portable suction).
3. Use disposable nose or face mask with sedation circuit.
4. Wall suction and equipment; separate suction for patient and scavenging.

D. Pre-Administration

1. Patient is assessed by nitrous oxide privileged provider prior to administration.
2. RN verifies provider orders.
3. Minimal sedation is covered under the general hospital consent for treatment and no additional written consent for nitrous oxide as a single agent is required. When advanced to moderate sedation, consent is required per Moderate Sedation policy.
4. RN/provider initiates teaching. Educates patient and family about the expected sedative effects and potential side effects including risks, benefits, and alternatives.
 - a. Utilizes Child Life if available for teaching/preparation (e.g. familiarize patient with mask and practice breathing with mask)
 - b. Provides a copy of the information guide to parent/patient.
5. RN or provider verbally consents patient or family member as appropriate and documents.
6. RN assures negative pregnancy test on all female patients of childbearing age (9 years old or has started menses) prior to procedure with the following exceptions: currently pregnant, history of hysterectomy, tubal ligation, or menopause (12 months without menses).
7. Checks equipment. Checks connection of hoses, tank pounds per square inch (PSI), operational scavenging system, and fail-safe mechanism.
8. Standard procedural sedation equipment is available and functioning properly (e.g. bag-valve-mask, suction, code cart)
9. Sign for nitrous oxide use is displayed and visible.
10. Performs time out and documents in the sedation flowsheet.
11. Allows child to choose flavor for mask.
12. A low stimulus environment (e.g. low lights, limited talking, soft voices) is provided to optimize effects and minimize amount of N₂O/O₂ required.

E. Administration for Anxiolysis (Nurse Administered Nitrous Oxide)

1. Nitrous oxide/oxygen is administered as a single agent.
2. Select flavored mask or nosepiece per patient preference and/or situation.
3. Place face mask on patient to obtain good seal.
4. Engage Child Life to assist with distraction, imagery, etc., as adjuncts complement nitrous oxide effect.⁶
5. Place child on SpO₂ monitor with alarm set and audible at 90%; obtain and document room air SpO₂.
6. Begin administration of 100% oxygen with appropriate volume to inflate and collapse bag with each breath.
7. Begin administration of nitrous oxide at 40-50% with oxygen as the remaining gas.¹¹
8. Titrate nitrous oxide by 10% increments to keep the child at a level of anxiolysis and able to respond to verbal commands.

9. Allow patient to inhale gas for 3-5 minutes before beginning any procedure.²
10. Avoid unnecessary conversation with patient to limit breaking seal and exhalation of nitrous oxide into the room. Use imagery and distraction techniques to enhance/compliment administration.
11. To avoid environmental exposure, do not manually collapse the bag or remove the mask during administration to achieve desired levels of anxiolysis.
12. Best results using nitrous is to complete procedure within 30 minutes. Additional administration increases risk of side effects.
13. Place patient on 100% oxygen for 5 minutes after the procedure is complete.
14. If the patient does not achieve the desired level of sedation (higher or lower) discontinue nitrous administration, place patient on 100% oxygen and call the ordering physician. If the patient has achieved a higher than intended level of sedation the physician should immediately come to the room . If nitrous oxide use is to be continued, guidelines for moderate sedation are followed.

F. Administration for Moderate Sedation (Physician monitored)

1. Follow guidelines as outlined in E above for administration of nitrous oxide.
2. Pre-sedation documentation and consent as stated in Moderate Sedation policy.
3. Place patient on monitors as stated in Moderate Sedation policy.
4. Administer additional single medication as ordered by provider. The following are the only approved medications to be administered with nitrous oxide for the purpose of moderate sedation:
 - a. benzodiazepines or
 - b. opioids or
 - c. dexmedetomidine
5. No additional medications for sedation should be administered for 5 minutes after nitrous oxide has been discontinued.
6. If sedation continues without the use of nitrous oxide, the patient should remain on oxygen until the procedure is complete and the patient returns to baseline.

G. Ongoing monitoring, assessment, and documentation

1. Continually assess by direct observation for signs of:
 - a. Adequate sedation as observed by the following:
 - i. Tingling sensation of hands and feet
 - ii. Warmth over chest, cheeks or face
 - iii. Feeling of floating
 - b. Oversedation - signs include:
 - i. Agitation (excessive movement)
 - ii. Diaphoresis
 - iii. Nausea, vomiting
 - iv. Asleep/unable to respond to verbal commands
 - c. Undersedation which includes:
 - i. Crying, combative, tense
 - ii. FLACC-r score greater than 5

d. Serious adverse events of sedation (0-0.5% of patients)

- i. SpO₂ less than 90%
- ii. Bradycardia
- iii. Apnea, stridor
- iv. Pulmonary aspiration, edema
- v. Laryngospasm, bronchospasm
- vi. Cardiovascular instability
- vii. Unplanned admission to PICU
- viii. Unplanned admission of outpatient

e. Minor adverse events of sedation (8% of patients)

- i. Headache
- ii. Nausea, vomiting
- iii. Diaphoresis, pallor
- iv. Crying or agitation
- v. Dizziness, hallucinations, hiccups

f. Sedation failure

- i. If rescue from an unintended level of sedation or any other adverse event occurred, submit an Unusual Occurrence Report (UOR) detailing the events

2. Discontinue and notify provider if pain relief has not been achieved and/or other side effects occur (nausea, light-headedness, etc.).
3. If the child becomes over-sedated or experiences adverse events of sedation, administer 100% oxygen until recovery, no less than 5 minutes. Notify the provider.
4. Monitor continuous pulse oximetry throughout procedure and document saturation, heart rate and sedation score every 5 minutes until the patient returns to pre-sedation level of alertness.¹²
5. Monitor patient and document response to procedure, pain, and indications of side effects.
6. Monitor and document vital signs (temperature, blood pressure, heart rate, respiratory rate) and Modified Aldrete score pre- and post-procedure per department standard and patient condition.
7. Record nitrous oxide concentration, pulse oximetry, and level of sedation at the onset of administration, and with any change in nitrous concentration throughout administration and recovery on the Nitrous Oxide flowsheet in the electronic health record (EHR).

H. Recovery

1. Discontinue nitrous oxide and provide 100% oxygen for 5 minutes following procedure.
 - a. If there is any indication that patient does not feel normal, assume that recovery is not complete. Additional post-procedural oxygen time is required and continued until Modified Aldrete scores are at baseline and indicative of normal feelings. Continue 100% oxygen as long as necessary.³
2. Key nitrous tank off immediately following procedure.

I. Additional RN documentation to be charted in EHR:

1. Location of procedure
2. Type of procedure

3. ASA status
 4. Name of person doing procedure
 5. Record concentration of nitrous oxide administered and pulse oximetry and level of sedation with any change in concentration.
 6. Maximum oxygen flow rate
 7. Start and stop times for nitrous oxide administration
 8. Response to treatment
 9. Recovery time with 100% oxygen
 10. Adverse events of sedation
 11. Sedation failure
 12. Patient education
- J. Equipment care and storage
1. Disposes of masks and breathing circuits after procedure. These items are for one time use.
 2. Sentry Sedate is cleaned per manufacturer's instructions with panels, gauges, and "T" piece (gray balloon) being cleaned with alcohol and remainder of machine cleaned with hospital approved disinfectant wipe after each patient use.
 3. Sedation masks and breathing circuits are securely stored and monitored to facilitate tracking and documentation of use in each area that nitrous is used.
 4. Nitrous tanks are secured to the locked mobile stand in a restricted, locked storage room when not in use. ⁶
 5. Full nitrous tanks are stored in the "Medical Gas" room in locked cage behind badge access door in PAMC basement per PAMC policies and regulations.
 - a. The key for the locked cage is signed in/out at the Control Room.
 6. A minimum of two nitrous tanks are available at all times (within Sentry Sedate) - one in use and one full sealed tank. Empty tanks are returned and replaced immediately following a procedure.
 7. Empty nitrous tanks are returned to the Waste Handling Room in PAMC basement per policy.
 8. Identified staff are trained in general tank safety as well as how to change tanks.
 9. Keys to the nitrous delivery device are kept in the Pyxis. Staff are required to sign keys out and keys are returned between each user. An audit of keys is performed and documented every shift.

ATTACHMENTS

Attachment A – Sentry Sedate Quick Set-Up Guide

Attachment B - Nitrous Oxide in Use Sign

Attachment C – Nitrous Oxide Administration Competency Checkoff

Attachment D - Clinical Pathway

Attachment E - Parent Information Guide

Attachment F - ASA Physical Status Classification System with Examples

REFERENCES

A. Regulatory and / or Accreditation

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2. Alaska Board of Nursing (BON) Advisory Opinion: Use in the Pediatric Population, https://www.commerce.alaska.gov/web/Portals/5/pub/NUR_AOnitrousPedPopulation.pdf
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B. Policy / Competency

1. Moderate Sedation
2. Nitrous Administration Competency
3. Procurement-Distribution Of Medicinal Gases

C. Other

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KEY INDEX WORDS

None

End of Policy

HISTORY: This policy replaces this/these previous policy/policies: NEW POLICY 11/2017

Attachments:

[Attachment A - Sentry Sedate Quick Set-Up Guide](#)
[Attachment B - Nitrous Oxide in Use Sign](#)
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Approval Signatures

Approver	Date
James Reineke: Reg Chief Nursing Officer AK	11/2019
Governing Board Committee [SJ]	07/2019
General Staff Review: (30 days) [NH]	06/2019
Medical Executive Committee: MEC [NH]	05/2019
ByLaws Committee [NH]	05/2019
Policy Triage [TP]	05/2019
GPP Committee: Guidelines, Policies and Protocols [TP]	05/2019
Sheri Kelly [NH]	05/2019
Theresa Posini: Coord Reg Compliance Admin [NH]	05/2019
Leslie Bagley: title	04/2019
Leslie Bagley: Clinical Nurse Specialist	04/2019

Applicability

AK - Providence Alaska MC & affiliates