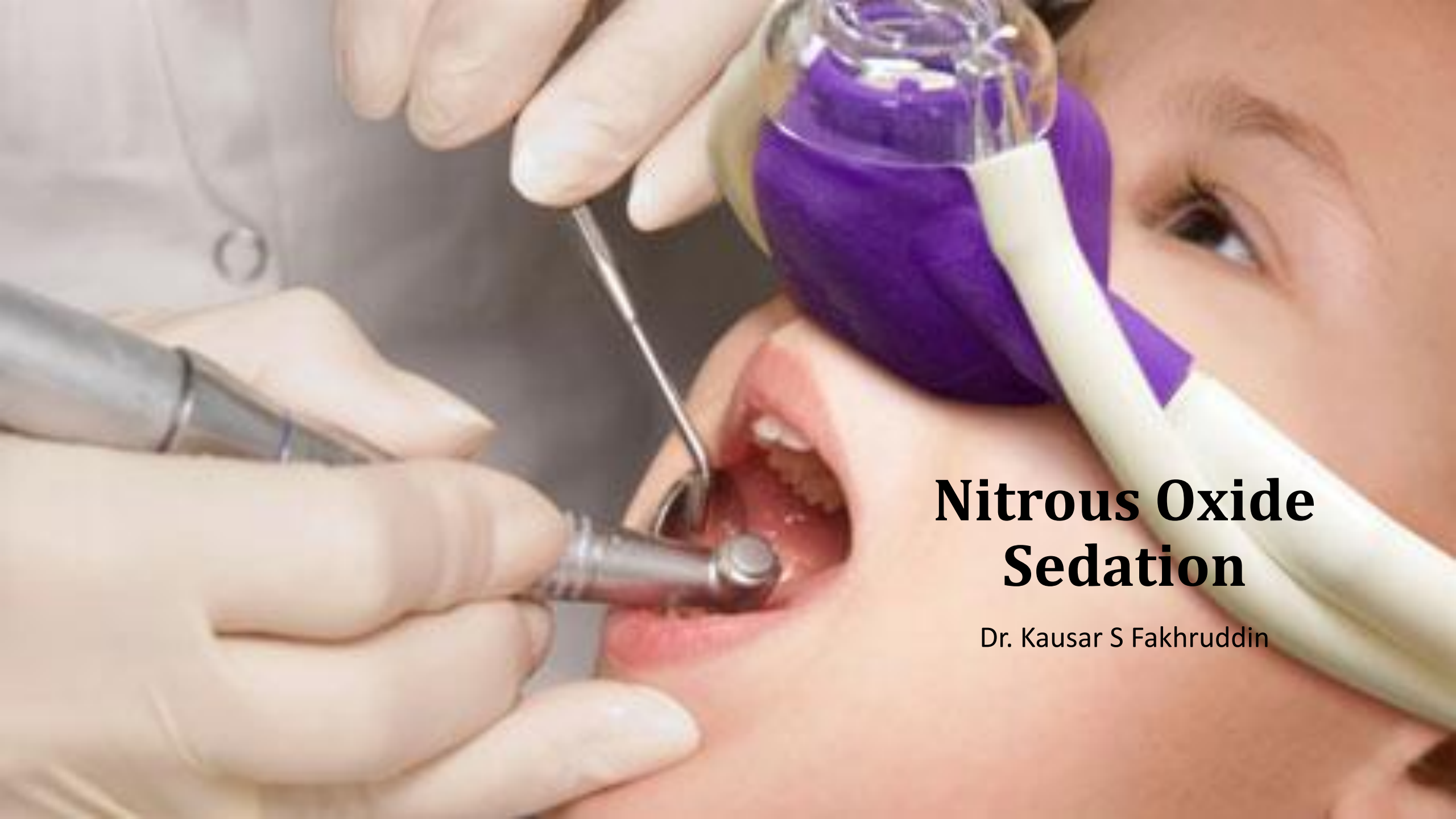


Nitrous Oxide Sedation

Dr. Kausar S Fakhruddin

Sedation Definitions

Sedation:

Mild suppression of arousal and behavior.

Sedative drugs decreases the activity, moderates excitement and calms the recipients

Anxiolysis:

Specific ability to remove anxiety

Hypnotics:

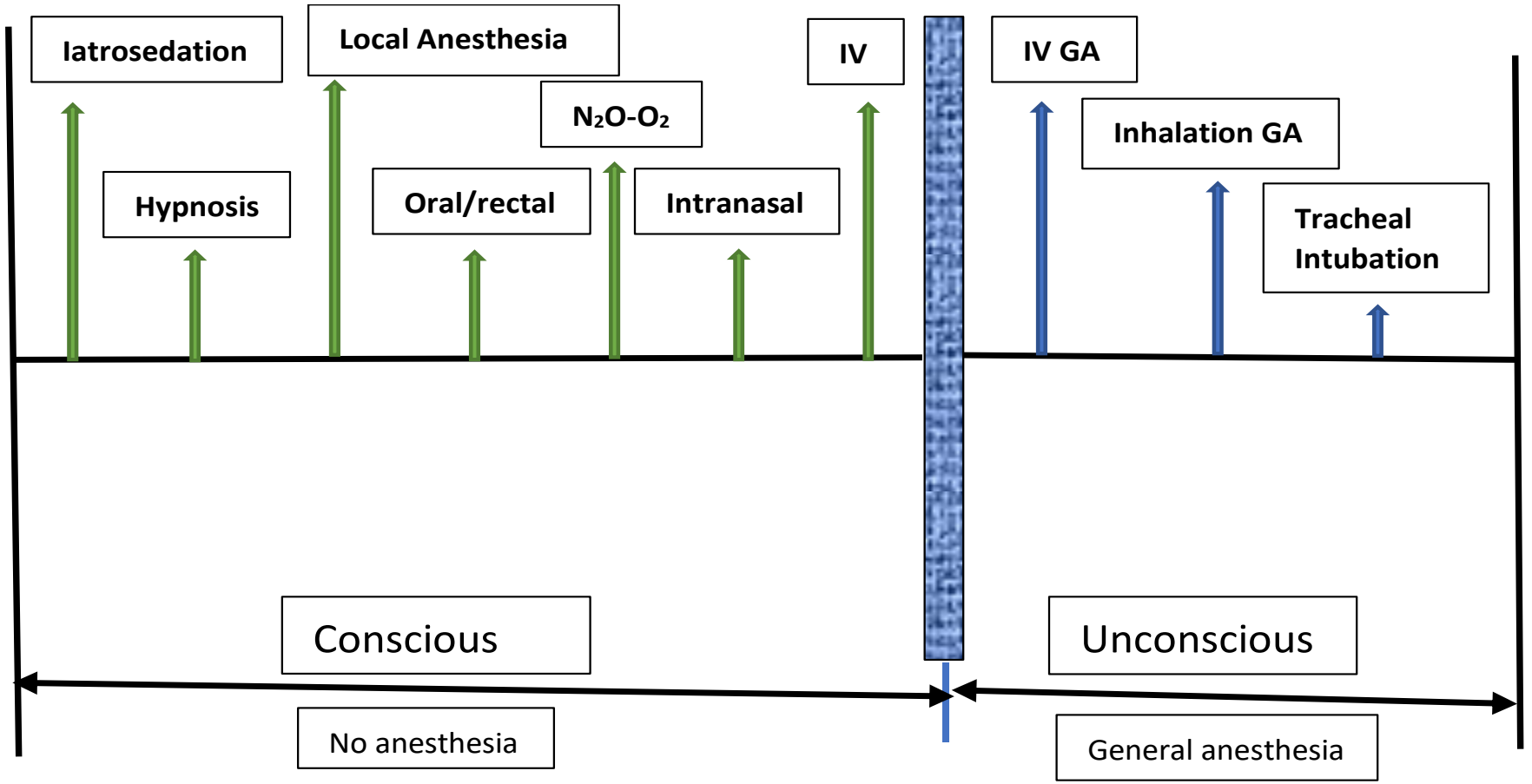
Drugs which produce drowsiness and facilitates the onset and maintenance of sleep

Conscious Sedation:

Minimally depressed level of consciousness

Retains ability to independently and continuously maintain an airway

And respond appropriately to physical stimulation and verbal command



SPECTRUM OF ANXIETY CONTROL

	Consciousness	Response to Verbal Commands	Responsiveness to tactile stimulation	Protective Reflexes	Airway Maintenance	Spontaneous Ventilation	CVS Function	Monitoring	Efficacy
Minimal Sedation	Maintained	Maintained	Normal Response	Intact	Maintained	Unaffected	Unaffected	Basic	If mild to moderate anxiety
Moderate Sedation	Maintained	Maintained	Purposeful response	Intact	No intervention required	Adequate	Maintained	Increased	If moderate anxiety or fear
Deep Sedation	Obtunded (Not Sensitive)	Absent	Purposeful response following painful stimulation	Depressed	May require intervention	May be inadequate	Maintained	Advanced	If significant fear or phobia
General Anesthesia	Unconscious	Absent	Unarousable even with painful stimulus	Absent	Intervention usually required	Frequently inadequate	Impaired	Advanced	All patients

Comparison of levels of Sedation

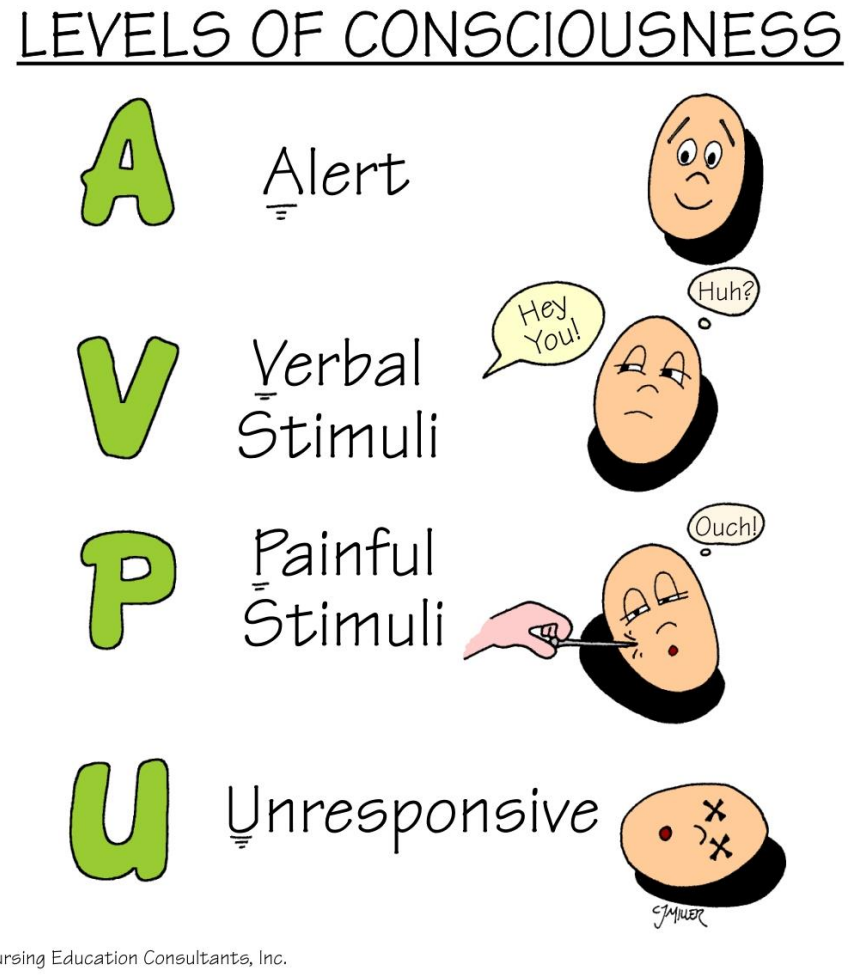
Consciousness:

Minimal sedation: maintained

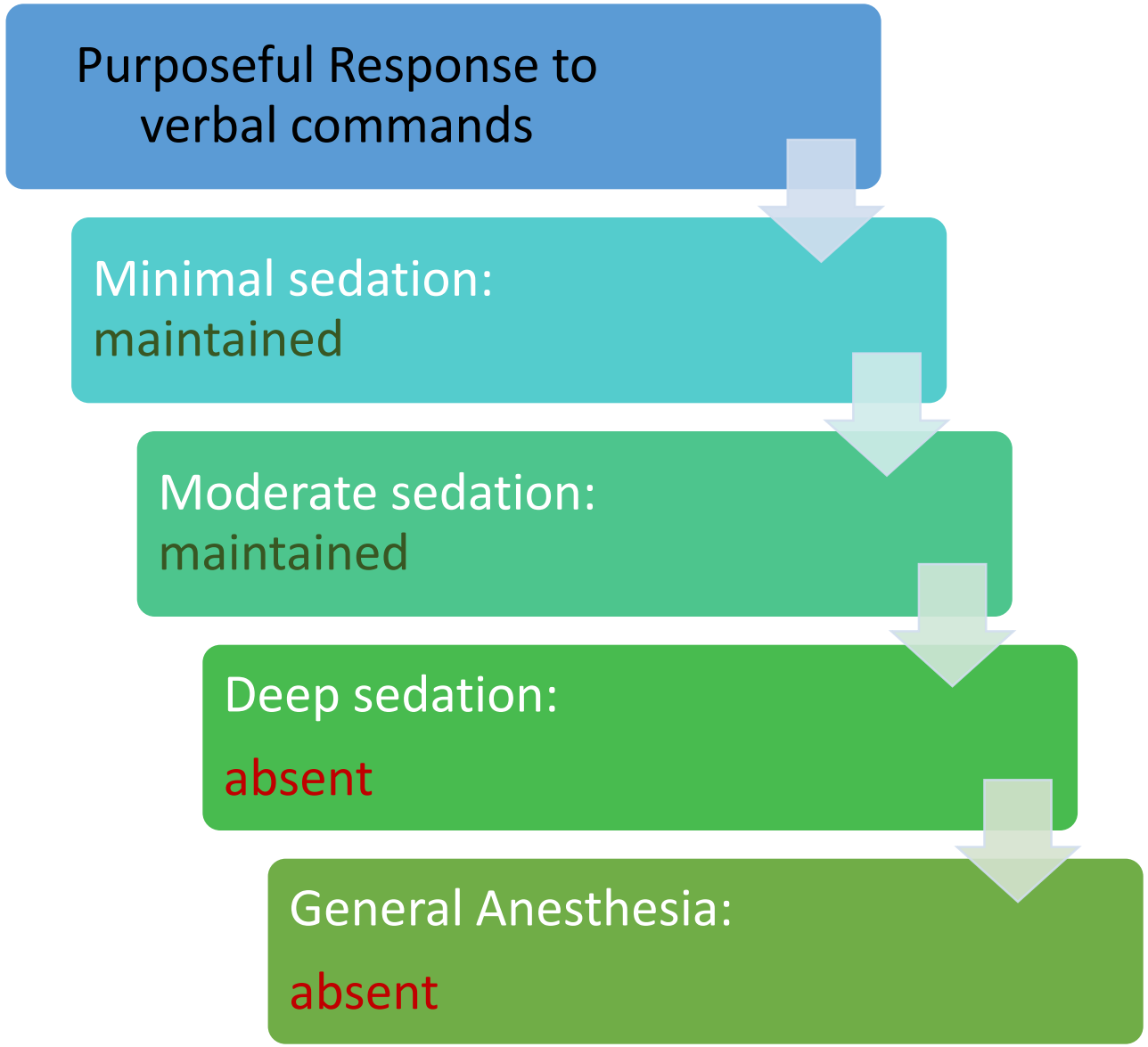
Moderate sedation: maintained

Deep sedation: obtunded

General Anesthesia: unconscious



Comparison of levels of Sedation



Comparison of levels of Sedation

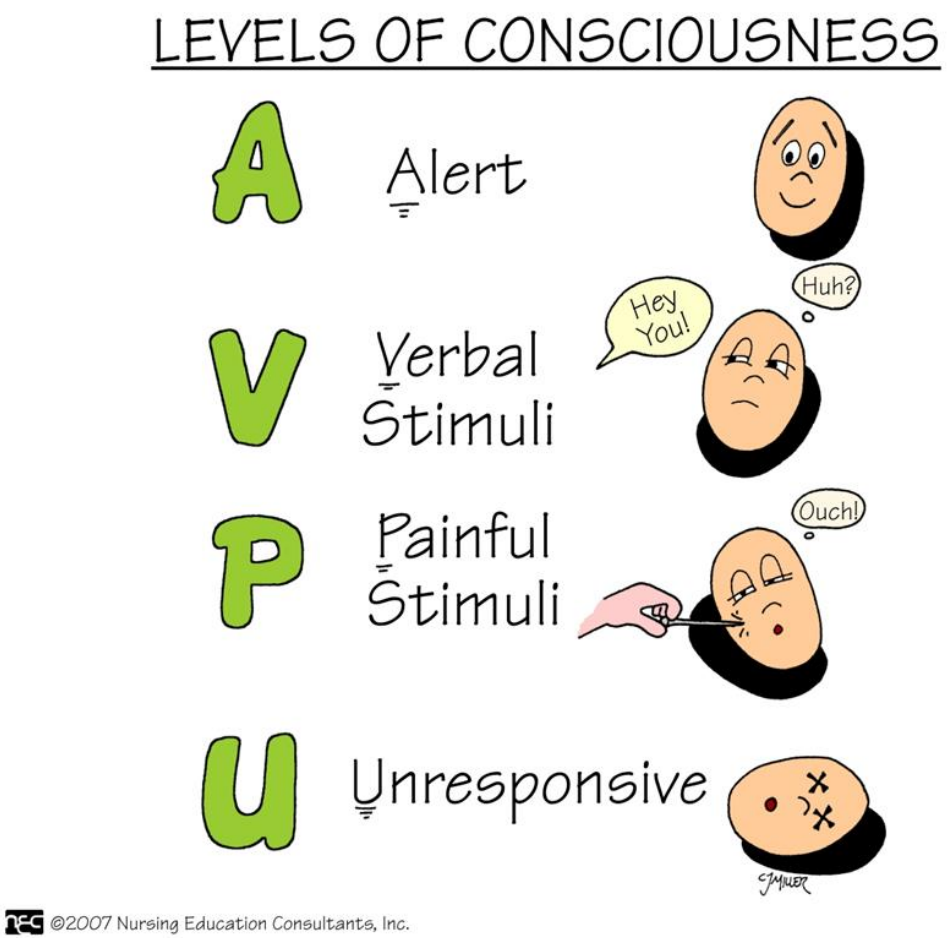
Responsiveness

Minimal sedation: normal response to verbal and tactile stimulation

Moderate sedation: purposeful response to verbal with tactile stimulation

Deep sedation: purposeful response following repeated or painful stimulation

General Anesthesia: unarousable, even with painful stimulus



Comparison of levels of Sedation

Protective Reflexes

Minimal sedation: intact

Moderate sedation: intact

Deep sedation: depressed

General Anesthesia: absent

Comparison of levels of Sedation

Airway Maintenance
Minimal sedation: maintained
Moderate sedation: no intervention required
Deep sedation: may require intervention
General Anesthesia: intervention usually required

Comparison of levels of Sedation

Spontaneous Ventilation

Minimal sedation: unaffected

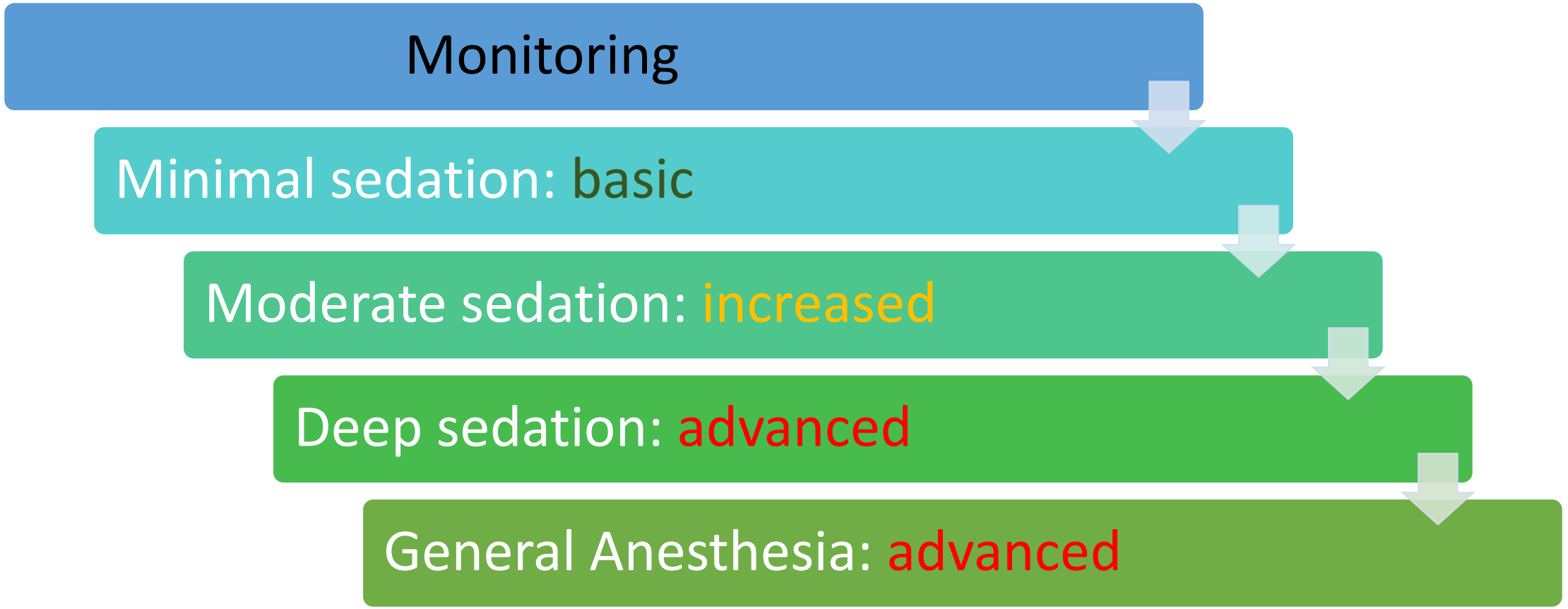
Moderate sedation: adequate

Deep sedation: may be inadequate

General Anesthesia: frequently inadequate

Comparison of levels of Sedation

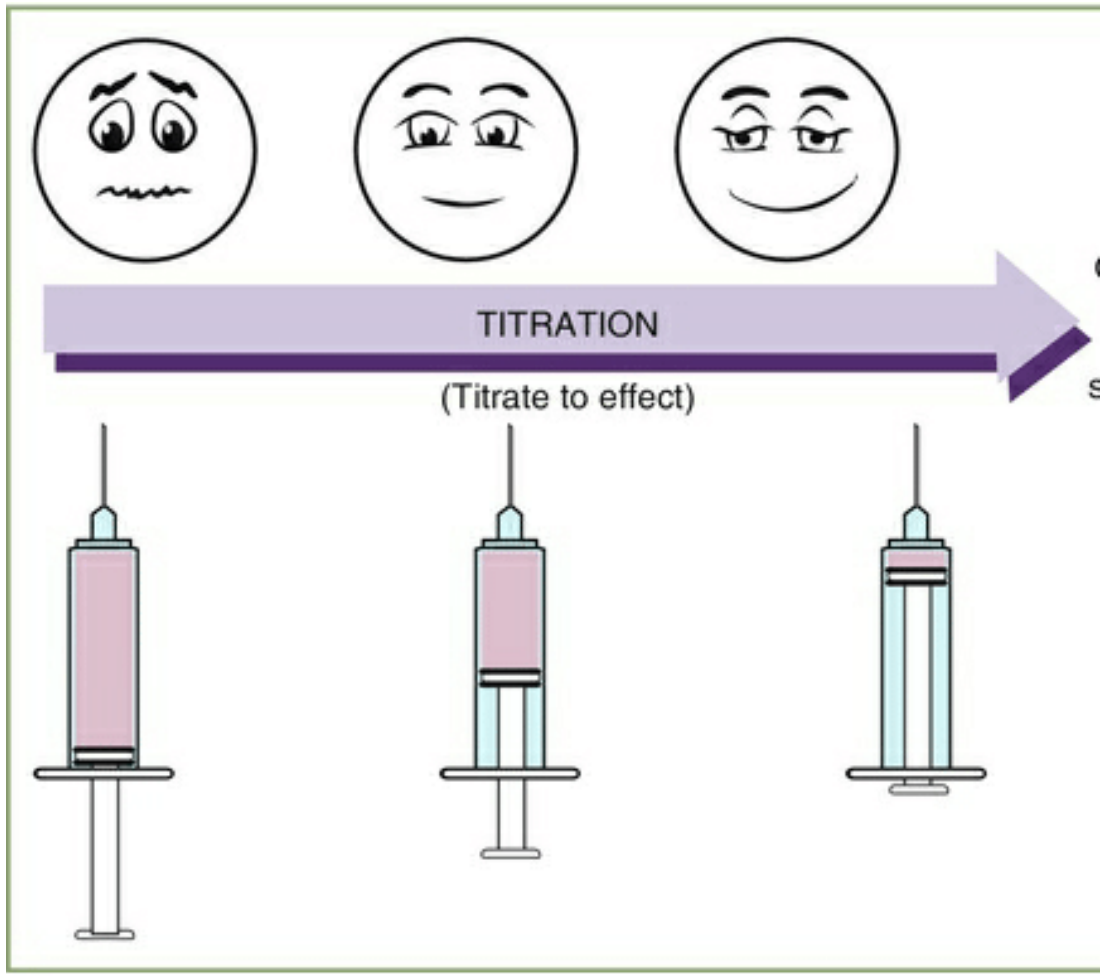
CVS Function
Minimal sedation: unaffected
Moderate sedation: usually maintained
Deep sedation: usually maintained
General Anesthesia: may be impaired



Comparison of levels of Sedation

Comparison of levels of Sedation

Efficacy
Minimal sedation: if mild to moderate anxiety
Moderate sedation: if moderate anxiety or fear, possibly phobia
Deep sedation: if significant fear or phobia
General Anesthesia: all patients



Optimal point of format

Routes of administration comparison

Ability to Titrate

- Inhalation: Excellent
- Oral: None
- Intravenous: Excellent

Nitrous Oxide Effects

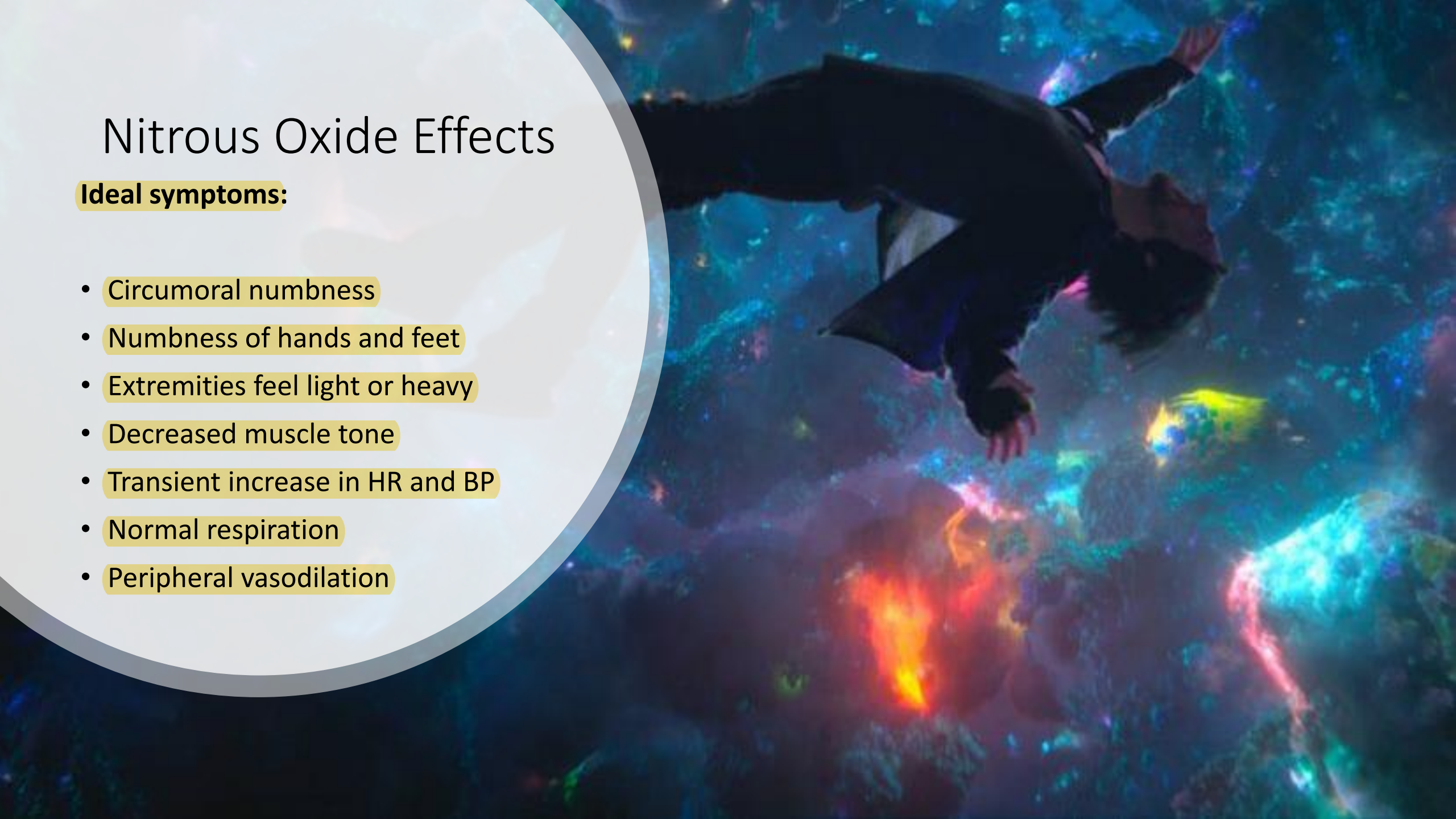
Ideal symptoms:

- Relaxation
- Light-headedness
- Tingling of hands and feet
- Warmth

Nitrous Oxide Effects

Ideal symptoms:

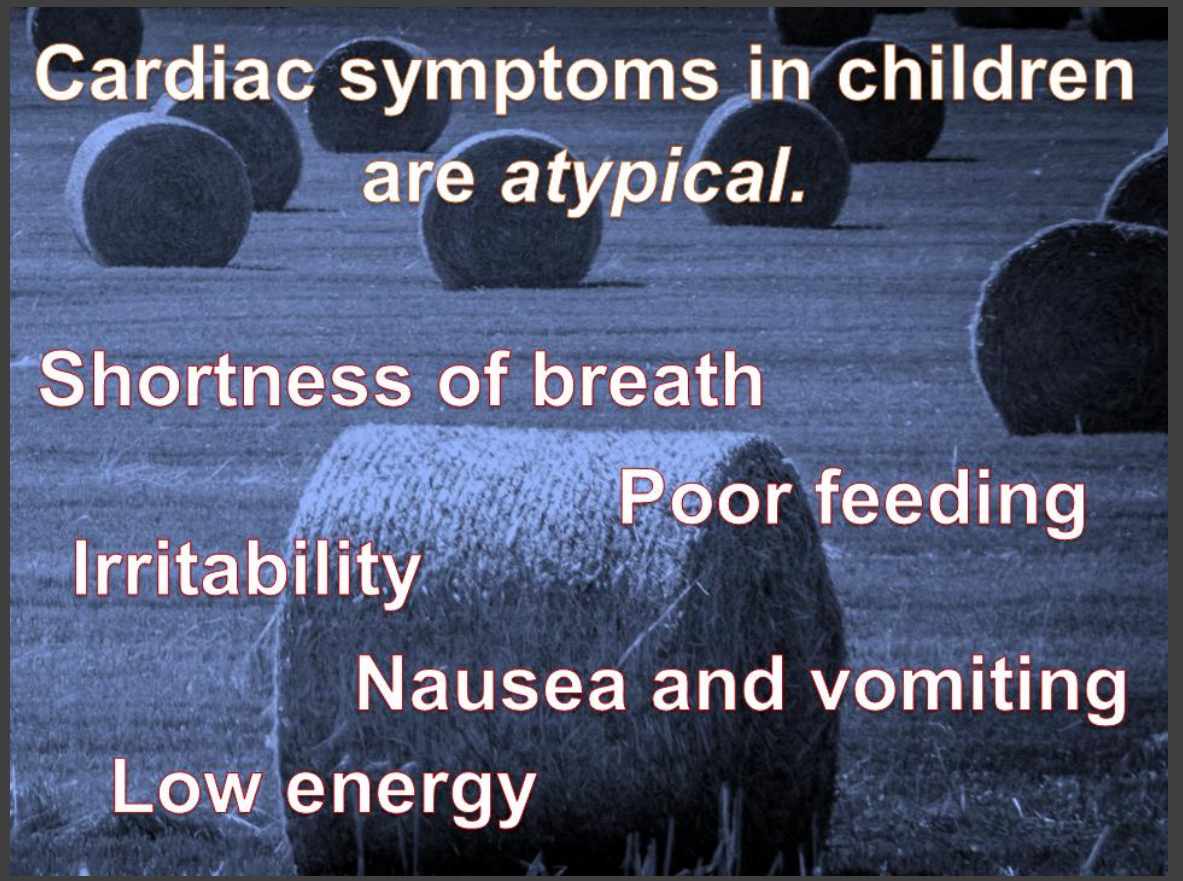
- Circumoral numbness
- Numbness of hands and feet
- Extremities feel light or heavy
- Decreased muscle tone
- Transient increase in HR and BP
- Normal respiration
- Peripheral vasodilation



Nitrous oxide

Cardiovascular effects:

- Weak myocardial depressant
- Mild sympathomimetic
- Overall, negligible effect



Nitrous oxide

Respiratory Effects:

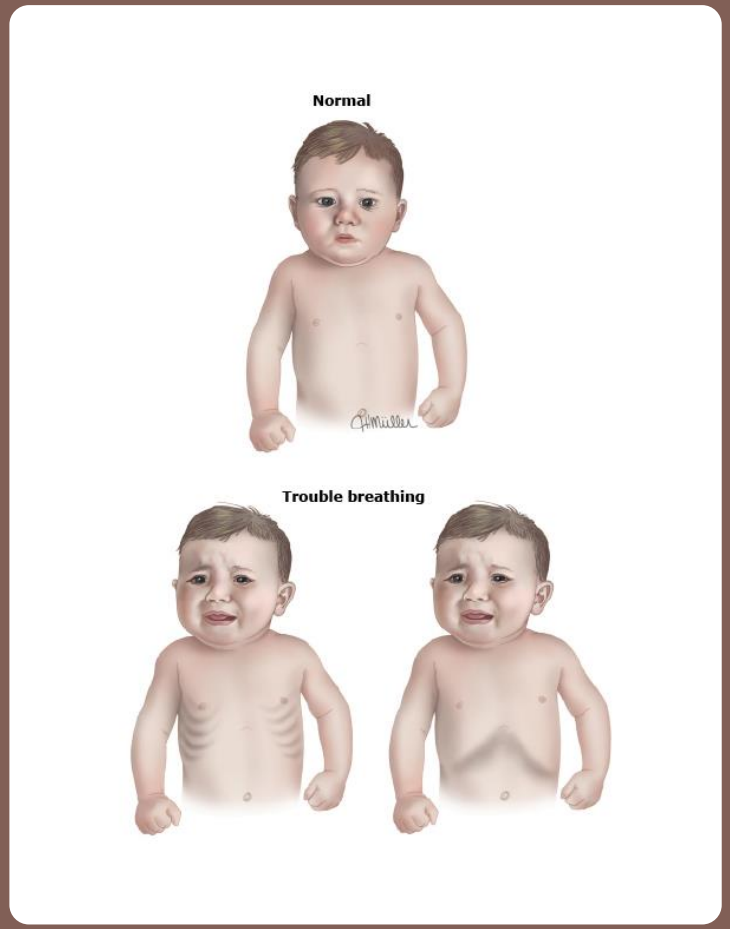
- Mild depressant
- Overall, effect is not significant
  - Slight increase in rate
  - Slight decrease in tidal volume

  - Depresses: central hypercapnic (CO_2) response and peripheral hypoxemic (O_2) centers
  - Concern re: COPD patients

The Pediatric Patient

- Children less than 6-years-old and those with developmental delay require deep levels of sedation to gain control of their behavior

- Need of thorough pre-operative evaluation
- Appropriate drug selection
- Appropriate physiologic monitoring and continuous observation

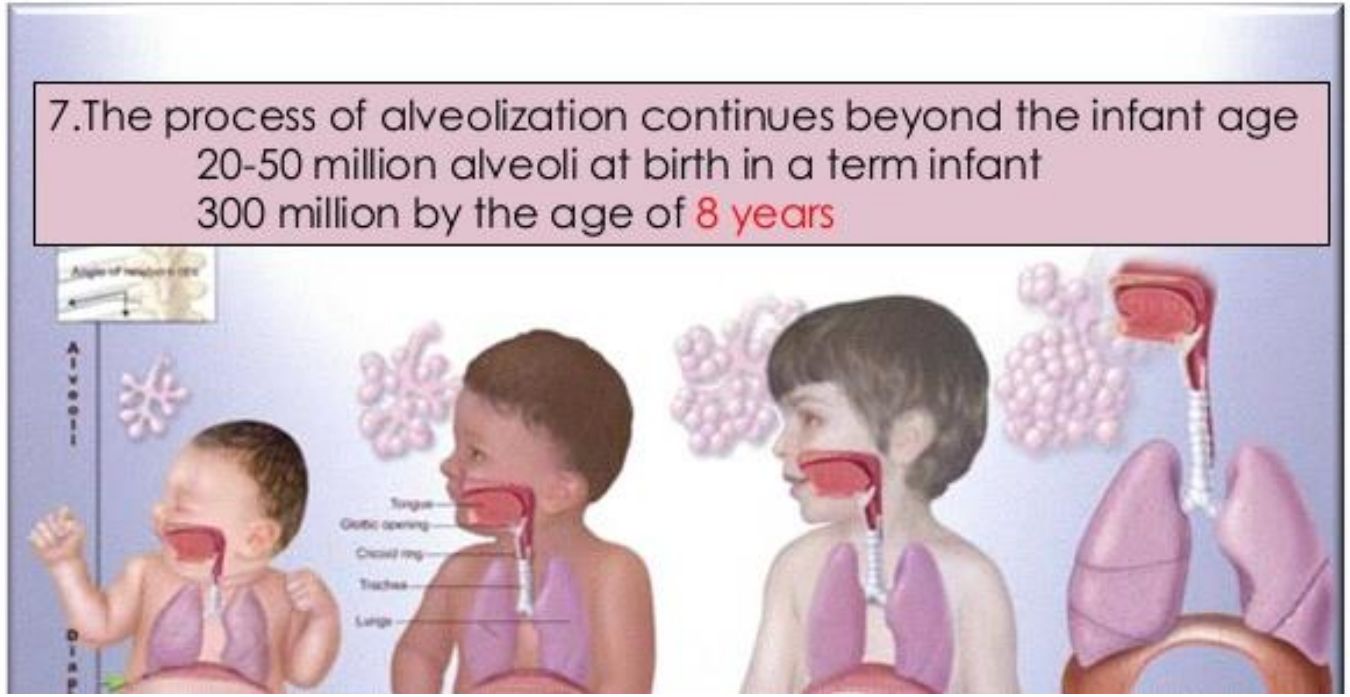


The Pediatric Patient

Sedation of pediatric patients has serious associated risks, such as:

- Hypoventilation
- Apnea
- Airway obstruction
- Laryngospasm
- Allergic reactions
- Seizures
- Cardiopulmonary impairments

Pediatric Airway Anatomy



The Pediatric Patient

Anatomy

Head (large occiput): maintenance of patent airway is more challenging

- ✓ Placement of a roll under the shoulders

Nose (narrow nares): easily obstructed by secretions or swelling

Tongue: larger size relative to mouth

Trachea: narrowest diameter –cricoid cartilage

Epiglottis- longer, floppier

Pediatric Respiratory Rates

Age range	Respiratory Rates (breaths/mins)
2- 3 years old	20- 30
4- 5 years old	20- 25
6-11 years old	16- 20
≥ 12 years old	16

Pediatric Heart Rates

Age range	Minimum Systolic (mmHg)
2- 3 years old	65
4- 5 years old	70
6- 7 years old	75
8- 9 years old	80
10- 11 years old	85
≥ 12 years old	90

+ 2

Add 5 for every range

Preparation for Sedation

- S (suction)
- O (oxygen)
- A (airway)
- P (pharmacy)
- M (monitors)
- E (equipment)

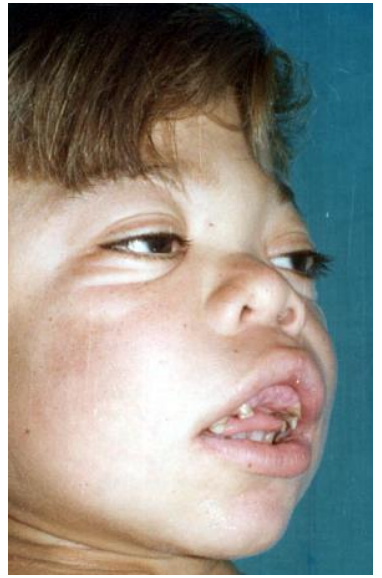
Pulse Oximeter

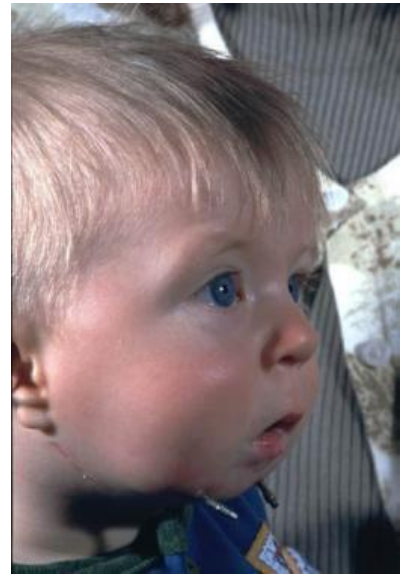
NORMAL OXYGEN SATURATION RANGE

95% - 100%

Congenital Pediatric Airway Problems

- Hurler's Syndrome
- Pierre Robin Syndrome
- Treacher Collin's Syndrome
- Goldenhar's Syndrome
- Crouzon's Syndrome
- Cleft Lip and Palate





Pre-operative Evaluation

- Age and weight
- Allergies and previous adverse drug reactions
- Medication/drug history (including herbal meds)
- Relevant diseases, physical abnormalities, neurological impairment that may increase risk of airway obstruction e.g., snoring, obstructive sleep apnea (adeno-tonsillar hypertrophy)

Pre-operative Evaluation

- Vital signs- HR, BP, respiratory rate and temperature
- Physical examination: evaluation of the airway
- History of Asthma (ER vs. ICU)
- Heart murmur (shortness of breath on exertion and/or at rest)
- Upper respiratory tract infection (nasal blockage, bronchospasm)

- ASA classification

References:

- Dr. Daniel Haas. Nitrous Oxide Pharmacology 2010.
- Dr. M Tang. Physiology and management of airway during sedation in Pediatric patients
- Malamed SF. Sedation in Dentistry. 8th ed., Mosby, 2007.
- Haas DA. Emergency drugs in Dental Clinics of North America, Vol 46: October 2002.