Respiratory Depression

H. William Gottschalk, D.D.S.
Fellow, Academy of General Dentistry
Fellow, American Dental Society of Anesthesiology
Diplomate, American Board of Dental Anesthesiology
Diplomate, National Dental Board of Anesthesiology
Member, American Society of Dentist Anesthesiologists
Member, American Society of Anesthesiologists
Faculty, USC School of Dentistry
Founder, Alpha Anesthesia Seminars

How do you anesthetize a 16,000 lb. elephant?

How do you anesthetize a 4000 lb. rhinoceros?
How do you anesthetize a 1,000 lb. elk?

Immobilon (carfentanil)

Elephant anesthesia
Dinosaur anesthesia

-effects of narcotics
  - Analgesia
  - Somnolence

Heroin user after the initial "rush"
Opium den in China (circa 1900)

You must utilize caution when administering narcotics, because they cause....

Respiratory Depression
Narcotics utilized in sedation and anesthesia

What is respiratory depression?

Is it a decrease in the respiratory rate?
Is it a decrease in the respiratory rate?

Is it a decrease in the tidal volume?

Is it a decrease in the tidal volume?
Is it a decrease in airway patency?

Is it a decrease in airway patency?

Is it a decrease in the excursive movement of the diaphragm?
Is it a decrease in the excursive movement of the diaphragm?

Or is it all of the above in varying percentages depending on the individual patient?

Key mechanisms important for airway protection
pharyngeal function and the integration of breathing and swallowing
The oropharynx and hypopharynx are shared passages for breathing and swallowing. Swallowing is normally initiated during exhalation, interrupting the expiratory airflow with a period of apnea extending briefly before and after swallowing. Consequently, impaired pharyngeal function and disrupted integration of breathing and swallowing increase the risk for aspiration.

Nitrous oxide depresses the swallowing reflex, increasing latency to initiate swallowing and decreasing spontaneous swallow frequency.

Midazolam depresses the swallowing reflex, increasing the latency time to initiate a swallow even after recovery of consciousness. 16% showed pharyngeal dysfunction at baseline, increasing markedly to 48% at 10 min and 59% at 30 min. Midazolam markedly increased the incidence of pharyngeal dysfunction and disrupted coordination with breathing, impairing airway integrity. Penetration of contrast medium occurred only to the vocal cords or to a level immediately above the vocal cords (aspiration) in any of the swallowing maneuvers.
Midazolam
Swallowing and Pharyngeal Dysfunction.

midazolam administered to young healthy adults in doses causing sedation but not anesthesia affected pharyngeal function and coordination of breathing and swallowing, ultimately impairing airway protection. This is especially worth considering because midazolam commonly is regarded as safe for use in clinical settings with limited vital parameter monitoring.

Midazolam
Swallowing and Pharyngeal Dysfunction.

elderly patients frequently experience age-related impairment of pharyngeal function and may therefore be at increased risk for adverse effects compared with the young.

Morphine
Swallowing and Pharyngeal Dysfunction.
morphine prolonged the apneic period preceding swallowing. Pre-swallow apnea has been described as a safety mechanism to warrant the cessation of respiratory airflow before swallowing.
When there is a loss of capnography tracing, a problem is coming.

Patient response to 20mcg of remifentanil
Patient response to 25mcg doses of fentanyl

Reversing the effects of narcotics

Naloxone (Narcan) 0.4mg up to 4 mg for an adult
1/2 IV (20 minute duration) and 1/2 IM (onset begins in 20 minutes)

Reversing the effects of narcotics

Intranasal Mucosal Atomization Device (MAD)

30-100 micron droplet size
Other drugs that cause respiratory depression

1:30am Valium 10mg P.O.
2:00am Ativan 2mg IV
3:00am Midazolam 2mg IV
5:00am Ativan 2mg IV
10:40am Midazolam 2mg IV
10:50am Propofol (w lidocaine)25mg IV **

Administration of narcotics

analgesia
somnolence

The only drug that we titrate to the side effect

Respiratory Rate
Thank You

H. William Gottschalk, D.D.S.
hwgdds@socal.rr.com

Administration of narcotics

Morphine MSO4

Introduced in 1827

The “gold standard” by which all narcotics are judged
Outstanding analgesic, outstanding euphoria

Releases histamine
Contraindicated in asthmatics, hypertension
Poorly absorbed via oral administration

T1/2β: 2 - 3 hours (IV administration)
Titrate 1 - 2 mg IV to effect (up to 15mg)

Meperidine

Introduced in 1939

6X more potent than morphine
Worst analgesic of all the opioids, outstanding euphoria

Releases histamine
Contraindicated in asthmatics, MAO inhibitors,
SSRIs (Prozac, Zoloft, Paxil, Celexa), liver disease, seizure disorders

T1/2β: 2.5 - 4 hours
Fentanyl

Introduced in 1964
Created as a synthetic structural analog of morphine

Titrate 10-25 mcg (1.0-1.5 mcg/kg dose)
Distribution time- 1.7 minutes
T1/2ß - 10-20 min
6 hour analgesic tail

Alfentanil

Introduced in 1978

Titrate 10-25 mcg (1.0-1.5 mcg/kg dose)
Distribution time- 1.7 minutes
T1/2ß - 10-20 min
6 hour analgesic tail

Sufentanil

Introduced in 1975
10X more potent than fentanyl
500X more potent than morphine
Must dilute to 5mcg/cc (1ml of 1mg/ml)

Administer in 1.25 - 2.5 mcg/kg increments
Onset similar to fentanyl
T1/2ß - 162 min
2 hour analgesic tail
Administration of narcotics

Remifentanil

Introduced in 1996
- 2X more potent than fentanyl
- 15X more potent than alfentanil
- 100-200X more potent than morphine

Quickly achieves plasma blood levels (fast onset)
- T1/2β - 4 min after a 4 hour infusion
- NO analgesic tail (explosive emergence)

Baxter infusO.R. Syringe Pump

- Runs about $2,500 online
  - Analog pump
  - Discontinued
  - Uses Smart Plates® for individual drugs

B Braun 8713030US Space Syringe Pump

- Runs about $4,000 online
  - Digital pump
  - Best replacement for the analog Baxter InfusOR pump
Administration of narcotics

Hydromorphone

Introduced in 1996

8-10X more potent than morphine

Slowly achieves plasma blood levels (slow onset)

Can’t be titrated, must calculate the dose

0.1mg/kg (70kg pt. receives 0.7mg IV)

Contraindicated in renal impairment

Sugar cravings associated with hydromorphone use are the result of a glucose crash after transient hyperglycemia following injection

T1/2β - 2.3 hours

In 2009, Ohio approved the use of an intramuscular injection of 500 mg of hydromorphone and a supratherapeutic dose of midazolam as a backup means of carrying out executions when a suitable vein cannot be found for intravenous injection.

Hydromorphone and midazolam was injected intravenously to execute double-murderer Joseph Wood in Arizona on July 24, 2014. Wood was heavily sedated (Stage 3 “Surgical anesthetic”) within 4 minutes from start but took almost two hours to transition to stage 4 (cessation of respiration) and death.

Narcotic Tolerance

Regular usage of opioids increases a patient’s tolerance level to a point where dosage amounts continue to rise too.

Massive overdoses are rarely observed in opioid-tolerant individuals, but, when they occur, they may lead to circulatory system collapse.

A new report believes a particular compound could be to blame for the development of opioid tolerance.

The study, published in Anesthesiology, found that CXCL1, a protein produced by spinal cord tissue, plays a significant role in the process.