

Change of Venue: Old Drugs Come to EMS

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I. Introduction

- a. Historically, most EMS interventions have been first utilized in the hospital environment before they have been translated to the field. Sometimes this is a very slow process. Many drugs have been placed into the field on the assumption that “if it works in the ED, it should work in EMS”. The medical field is now moving towards evidence-based medicine to prove the efficacy of drugs and other interventions before their use becomes widespread.
- b. Part of the process of translating a drug to the prehospital environment includes an assessment of a drug’s characteristics, to see if it is suitable for this environment.

I. Important drug characteristics

- a. Stability
 - i. Does this drug deteriorate quickly under field storage conditions?
 1. Storage temperature
 2. Shelf-life
- b. Ease of use
 - i. Does this drug require extra or different equipment to administer?
 1. Glass bottles vs. IV bags
 2. IV pump
 - ii. Is the drug easy to use?
 1. Does it require mixing or special mixing techniques?
 2. Is it compatible with a needle-less delivery system?
- c. Time to onset of drug effect
 - i. Will this drug start to work quickly enough to benefit the patient during transport?
 - ii. Does giving this drug early in treatment benefit the patient in the long run?
- d. Duration of drug effect
 - i. Is it advantageous to EMS for this drug to have a short duration of effect or a longer one?
 1. Narcotics
 2. Sedatives
 3. Paralytics
- e. Risk profile
 - i. Do the benefits of the drug outweigh the risks?
 1. What drug interactions might occur?
 2. What side effects or other adverse reactions might occur?
 3. Is there a narrow therapeutic window?
 4. Is there a specific antidote if needed?
- f. Availability
- g. Expense
- h. Multifunctionality
- i. What does the research say?

II. Pain management

- a. Pain is almost universally under treated, not only by EMS, but in all of medicine
- b. There is still some reluctance by some surgeons about prehospital pain management
 - i. Alleged inability to adequately evaluate the patient after medicated
 - ii. Research now showing that pain management can actually improve the physician's ability to evaluate, when administered appropriately
- c. Characteristics of a good prehospital analgesic
 - i. Rapid acting
 - ii. Short duration
 - iii. Reversibility
 - iv. Lack of effect on hemodynamic status
 - v. Works as well or better than other alternatives
 - vi. Lack of respiratory suppression
 - vii. Alters mental status minimally
 - viii. Premixed or easily mixed
- d. **Fentanyl (Sublimaze ®)**
 - i. Used for many years in OR; in ED for last 5 or so years
 - ii. Opiate with analgesic and sedative properties
 - iii. May be used IV or IM
 - iv. Short time of onset:
 - 1. IV: 1 minute (Morphine: 5 – 20 minutes)
 - 2. IM: 7 – 15 minutes
 - v. Peak effect:
 - 1. IV: minutes
 - 2. IM: 15 minutes
 - vi. Relatively short duration:
 - 1. IV: 30 – 60 minutes (Morphine: 3 – 6 hours)
 - 2. IM: 1 – 2 hours
 - vii. Minimal effect on BP and heart rate, ventilatory drive (See DeVellis, et al.)
 - viii. May be used safely in children (See DeVellis, et al.)
 - ix. Also effective for treatment of acute ischemic chest pain
 - x. Reversible with Narcan
 - xi. Less associated emesis than with morphine
 - xii. Inexpensive
 - xiii. Chest wall rigidity or muscle twitching may occur (reversible with Narcan)
 - xiv. Dosages
 - 1. RSI premedication: 2.0-3.0 mcg/kg IV
 - 2. Sedation: 1.0 mcg/kg IV
 - 3. Pain management: 1.0-2.0 mcg/kg IV, titrate every 2 – 3 minutes

III. Facilitated intubation via sedation

- a. Useful when paralytics aren't available or might be contraindicated
- b. Characteristics of a good sedative for facilitated intubation
 - i. Rapid acting
 - ii. Lack of adverse hemodynamic effects
 - iii. Short or moderate duration
 - iv. Lack of ventilatory suppression
 - v. Cerebroprotective
 - vi. Amnestic

- vii. Easily stored
- viii. Premixed or easily mixed
- ix. Reversible
- c. Midazolam (Versed®)**
 - i. Benzodiazepine
 - ii. Sedative and amnestic properties
 - iii. Does not increase ICP (cerebroprotective if no hypotension)
 - iv. Onset:
 - 1. IV: 1.5 minutes
 - 2. IM: 5 – 7 minutes
 - v. Peak effect:
 - 1. IV: 5 – 10 minutes
 - 2. IM: 10 – 15 minutes
 - vi. Duration 30-60 minutes (half life up to 3 hours)
 - vii. Usually minimal decrease in BP, but can be dose related. Do not use if patient is already hemodynamically compromised. (See Davis, et al.)
 - viii. May be administered IM, with onset of action in approximately 15 minutes
 - ix. Most respiratory suppression occurs with IV administration. Use with caution for COPD patients
 - x. Use lower doses for the elderly, debilitated patients, and neonates.
 - xi. Side effects: occasional agitation, muscle tremor, bronchospasm, seizures (especially in neonates and/or children with seizure disorders)
 - xii. May be used for treatment of seizures
 - xiii. Reversible with Romazecon
 - xiv. Compatible with D5W, lactated ringers, and saline, as well as other drugs
 - xv. Does not require mixing
 - xvi. May be stored at 30 C or less for 30 to 60 days (See Gottwald, et al.)
 - xvii. Dosages
 - 1. Adult IV: 2.0-2.5 mg IV initially over 2 - 3 minutes, then may titrate slowly upward every 2 to 3 minutes
 - 2. Adult IM: 0.07 - 0.08 mg/kg (about 5 mg for average adult)
 - 3. Pediatric (non-neonate) IV: up to 0.2 mg/kg over 2 - 3 minutes
 - 4. Pediatric (non-neonate) IM: 0.1 mg/kg - 0.5 mg/kg
 - xviii. Wang, et al, 1999
 - 1. Retrospective chart review study
 - 2. Authorization and dosage at medical control discretion
 - 3. 683 endotracheal intubations in study period
 - a. 72 midazolam facilitated (MF)
 - b. Overall 87.6% successful intubations
 - c. MF patient successful intubations 62.5%
 - d. MF significantly more successful for medical than for trauma patients (69.1% vs. 41.2%)
 - e. 43.1% of nonfacilitated intubation failures had documented indications for use of MF 23/58
 - 4. Subject to the usual limitations of retrospective reviews and interpretive definitions of “attempt”

d. Etomidate (Amidate, Hypnomidate)

- i. Ultra-short acting nonbarbiturate sedative hypnotic
- ii. Not amnestic
- iii. In use in U.S. since 1983
- iv. Lowers ICP and cerebral metabolic rate of oxygen consumption
 1. Lidocaine in addition to etomidate does not further influence ICP (Stringham, et al.)
 2. Head trauma patients intubated with etomidate do NOT require lidocaine in addition
 3. For optimal protection against increased ICP associated with intubation, use etomidate AND succinylcholine
- v. Has low incidence of clinically significant hypotension (See Sokolove, et al., Swanson, et al., Smith, et al., and Vinson and Bradbury)
- vi. Minimal ventilatory suppression (See Reed, et al.). Increased incidence of desaturation in older patients (See Vinson and Bradbury)
- vii. Onset of action: 30 – 60 seconds
- viii. Duration of action: 3 – 5 minutes (up to 10 minutes)
- ix. Side effects:
 1. vomiting in a small percentage of patients
 2. fairly frequent myoclonic twitching, mostly when drug pushed over less than 20 – 30 seconds
 3. Reported adrenal cortical suppression with IV drips, but not clinically significant with single dosing (See Sokolove, et al.)
- x. Should be stored at 25 ° C or less
- xi. Though not listed as safe for children under 10, at least one study reports no clinically important adrenocorticoid suppression or hypotension in pediatric patients (Soklove, et al.)
- xii. Dosage: 0.2 – 0.3 mg/kg IV
 1. Elderly patients, particularly if they have hypertension, are more prone to cardiac depression (per FDA, 1999)
 2. No mixing required. Available in 2mg/ml concentration
- xiii. Mostly used as an adjunct to rapid sequence intubation, but may be used alone to facilitate intubation
 1. Dociszewski, et al. studied airmedical intubations with etomidate (ETOM) vs. Succinylcholine (SUX)
 - a. 98.1% of SUX patients were successfully intubated
 - b. 96.8% of ETOM patients were successfully intubated
 - i. BUT 11.1% of those required rescue sux
 - c. ETOM patients were more likely to require multiple intubation attempts (33.3% vs. 16.3%)
 2. Bozeman, et al. studied another airmedical service using etomidate alone.
 - a. Described 44 trauma cases with intubation using etomidate
 - b. Overall success rate was 89%
 - i. 16% of these were “difficult” intubations (ie. required more than 3 attempts or repeat doses of etomidate)
 - c. 11% unsuccessful (i.e., not intubated)
 - i. 60% of these had trismus or jaw clenching (unknown how many caused by etomidate)

- d. Dose ranged from 0.3 mg/kg to 1.1 mg/kg
- e. Hemodynamic parameters unchanged
- f. Seizure-like activity seen in 1 of 44 patients, vomiting in 8 of 44 patients

IV. Acute treatment of seizures

a. Characteristics of useful drugs for acute treatment of seizures

- i. Fast acting
- ii. Moderate duration
- iii. Lack of adverse hemodynamic or ventilatory effects
- iv. Multiple routes of administration effective
- v. Cerebroprotective
- vi. Easily stored
- vii. Premixed or easily mixed

b. Midazolam (Versed[®])

- i. See IV b. above
- ii. Midazolam has longer half-life than diazepam (Valium)
- iii. Vilke, et al. showed midazolam via IM and IV routes are effective in the prehospital treatment of pediatric seizures
 - 1. Success rates 96% for IV vs. 80% for IM
 - 2. No patients has respiratory compromise attributed to midazolam alone
- iv. Chamberlain et al, found that IM midazolam is superior to IV diazepam
- v. Gilbert, et al. found diazepam was less efficacious than midazolam, thiopental, pentobarbital, and isoflurane, with midazolam having the lowest mortality rate.

c. Lorazepam (Ativan[®])

- i. Benzodiazepine anxiolytic, sedative
- ii. Onset of action: 10 – 15 minutes
- iii. Duration of action: 6 – 8 hours (Valium = 20 – 30 minutes)
- iv. Effective when given both IV and IM
- v. Respiratory suppression much more common than adverse hemodynamic effect
- vi. Use smaller doses in elderly > 50 years of age
- vii. May have paradoxical agitation, especially in pediatrics
- viii. May be stored up to 60 days in unrefrigerated conditions (less with higher temperature).
- ix. Must mix with sterile H₂O or saline prior to administration IV, but may be given undiluted IM
- x. May produce burning feeling with administration
- xi. Dosage:
 - 1. Adults: 1.0 – 2.0 mg IV; repeat in 10 – 15 minutes if needed
 - 2. Peds: Not officially approved in peds, but studied with good effect at 0.13 mg/kg (See Wassment, et al.)
 - 3. IM administration: Very quickly absorbed, so doses similar to IV
- xii. Multiple studies show lorazepam as effective or more effective than diazepam, with similar adverse effect profile (See Alldredge, et al., Cock and Schapira, Wassmer, et al., and Treiman)
- xiii. No studies found comparing midazolam and lorazepam for treatment of seizures

V. Summary

Resources

Fentanyl (Sublimaze ®)

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Midazolam (Versed®) - Sedation Facilitated Intubation

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