Administering Medications with the MAD Device

2015 VSHP Spring Seminar
April 18, 2015

Megan Davis Hoesly, PharmD, BCPS
Sentara Virginia Beach General Hospital
Clinical Pharmacy Specialist, Emergency Medicine
Disclosures

- Nothing to disclose
Learning Objectives for Pharmacists

- Describe general principles of intranasal drug delivery using the MAD device
- Discuss indications and literature to support intranasal administration of medications using the MAD device
- Explain administration techniques for intranasal administration of medication using the MAD device
- Review example protocols for the administration of intranasal medications using the MAD device
Learning Objectives for Technicians

• Review the advantages of intranasal medication administration with the MAD device

• Identify medications that are commonly administered via the intranasal route using the MAD device

• Discuss clinical pearls for administering medications using the MAD device
Patient Case Scenarios

10 year old male in severe pain
- Presents to ED with obvious left arm deformity
- Patient is screaming
- Will not let the RN touch him to start an IV

3 year old female with h/o seizure
- EMS called for grand mal seizure, duration 10 minutes
- Unable to establish IV access

40 year old unconscious male
- Presents to ED with slow respirations, pinpoint pupils, cool dusky skin with obvious track marks bilaterally
- Unable to establish IV access
Routes of Medication Administration

- Intravenous
- Oral
- Intramuscular
- Subcutaneous
- Topical
- Rectal

Intranasal
Advantages of IN administration

- Easy, convenient
- Non-invasive
- Needleless
- Painless
- Favorable tolerability profile
- Rapid onset of clinical effect
IN Drug Absorption

Physiological factors of nasal mucosa

IN Drug Absorption

Properties of formulation

Drug Characteristics

Nasal Cavity: Why IN delivery?

- **Respiratory region**
  - Large mucosal surface area
  - Rich vascular bed of highly permeable capillaries

- **Olfactory region**
  - “Nose-brain pathway”

- Avoids 1\textsuperscript{st} pass metabolism
Drug and Formulation Characteristics

- Lipophilic
- Low molecular weight
- pH
- Concentration
- Volume
Delivery Characteristics

- **Nasal mucosal**
  - Use of vasoconstrictors
  - Bloody nose, nasal congestion, mucous discharge
  - Destruction of nasal mucosa

- **Delivery system**
  - Large surface area = higher bioavailability
  - Atomized devices
## LMA® MAD NASAL™ Device Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Particle Size</td>
<td>30-100 microns</td>
</tr>
<tr>
<td>System Dead Space</td>
<td>0.13 mL MAD100 and MAD140</td>
</tr>
<tr>
<td></td>
<td>0.07 mL MAD300</td>
</tr>
<tr>
<td></td>
<td><em>Round to 0.1 mL for clinical purposes and accuracy of dosing</em></td>
</tr>
<tr>
<td>Tip Diameter</td>
<td>0.17 inches (4.3 mm)</td>
</tr>
<tr>
<td>Applicator Length (MAD300)</td>
<td>1.65 inches (4.2 cm)</td>
</tr>
</tbody>
</table>

Places in Therapy

- Acute pain
- Seizures
- Opioid reversal
- Sedation
- Hypoglycemia
- Epistaxis
IN Fentanyl Drug Characteristics

- Opioid analgesic
- Lipophilic
- Potent
- Rapidly absorbed through nasal mucosa
- Bioavailability: 55-89%
  - Peak effect: ~6-10 minutes
  - Short acting: 30-60 minutes
IN Fentanyl Concentrations

![Graph showing plasma fentanyl concentration over time after study drug administration.](image)
Objective
- Compare IN fentanyl vs. IV morphine for treatment of pediatric orthopedic fractures

Methods
- Randomized, double blind, placebo controlled trial
- Pediatric patients aged 7-15 years with clinically deformed closed long-bone fracture
- IV morphine or IN fentanyl

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Initial dose IN fentanyl</th>
<th>Initial dose IV morphine</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30</td>
<td>30 mcg</td>
<td>2 mg</td>
</tr>
<tr>
<td>31-40</td>
<td>45 mcg</td>
<td>3 mg</td>
</tr>
<tr>
<td>41-50</td>
<td>60 mcg</td>
<td>4 mg</td>
</tr>
</tbody>
</table>

Pain scores rated with 100-mm visual analog scale at 0, 5, 10, 20, and 30 minutes
Pain Scales

Verbal Pain Intensity Scale

Visual Analogue Scale

0-10 Numeric Pain Intensity Scale

“FACES” Scale*

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Mild Pain</td>
<td>Moderate Pain</td>
<td>Severe Pain</td>
<td>Very Severe Pain</td>
<td>Worst Pain</td>
<td>No Pain</td>
<td></td>
<td></td>
<td></td>
<td>Worst Possible Pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO HURT</td>
<td>HURTS LITTLE BIT</td>
<td>HURTS LITTLE MORE</td>
<td>HURTS EVEN MORE</td>
<td>HURTS WHOLE LOT</td>
<td>HURTS WORST</td>
</tr>
</tbody>
</table>

*HURTS*

- Mean Doses: IN fentanyl 1.7 mcg/kg   IV morphine: 0.11 mg/kg

![Graph showing mean pain score over time with VAS (mm) on y-axis and Time (min) on x-axis. The graph compares Intravenous Morphine and Intranasal Fentanyl, indicating n=34 subjects for IV morphine and n=33 subjects for IN fentanyl.](image)

• Results
  ▫ No difference in pain scores for IV morphine and IN fentanyl at all time points
  ▫ No serious adverse effects

• Conclusions
  ▫ IN fentanyl is effective as IV morphine for treating pain associated with long bone fractures
Borland, et al 2008

• Objectives
  ▫ Compare time to analgesia with IN fentanyl and IV morphine
  ▫ Rate of IV access for analgesia alone

• Methods
  ▫ Retrospective chart review
  ▫ Tertiary pediatric ED after implementation of IN fentanyl protocol
Borland, et al 2008

- **Results**
  - Decrease in mean time to opiate delivery
    - 53 minutes to 23 minutes
  - Decrease in IV line starts for pain control
    - 100% to 42%

- **Conclusion**
  - IN fentanyl can decrease time to analgesia in patients requiring immediate pain relief
  - Reduce the need to IV access
# Additional Studies for IN Fentanyl

<table>
<thead>
<tr>
<th>Study</th>
<th>Patient Population</th>
<th>Intervention</th>
<th>Results/Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rickard, et al 2007</td>
<td>• Prehospital analgesia&lt;br&gt;• Adult patients aged 18-65 years presenting with severe pain</td>
<td>• IN fentanyl 180 mcg vs. IV morphine 2.5-5mg&lt;br&gt;• Primary outcome: change in pain score using verbal rating 10-point scale</td>
<td>• n=227&lt;br&gt;• No statistically significant difference between IN fentanyl and IV morphine from baseline to destination&lt;br&gt;• IN fentanyl is effective as IV morphine for treating pain in adult EMS patients</td>
</tr>
<tr>
<td>Finn, et al 2010</td>
<td>• Pediatric ED patients aged 1-16 years presenting with severe pain</td>
<td>• IN fentanyl 1.5 mcg/kg&lt;br&gt;• Primary outcome: change in pain score using 100-mm visual analog scale</td>
<td>• n=81&lt;br&gt;• IN fentanyl resulted in substantial reductions in pain scores</td>
</tr>
<tr>
<td>Saunders, et al 2010</td>
<td>• Pediatric ED patients aged 3-18 years presenting with painful orthopedic injuries</td>
<td>• IN fentanyl 2 mcg/kg single dose&lt;br&gt;• Primary outcome: change in pain score using 100-mm visual analog scale or Wong Baker Faces Scale</td>
<td>• n=81&lt;br&gt;• IN fentanyl resulted in a statistically significant reduction in pain scales</td>
</tr>
</tbody>
</table>
IN Fentanyl for Pain Management
Systematic Review

3 important points:
• IN fentanyl is as efficacious as IV/IM/PO morphine or IV fentanyl
• No difference in adverse effects
• Decreases time to analgesia administration and pain relief
Seizure Control

- 15% of all pediatric EMS calls in the US

- Prolonged or recurrent seizure activity can cause significant morbidity and mortality

- 1st line treatment:
  - IV lorazepam

- Alternatives:
  - PR or IV diazepam
  - IM or IN midazolam
IN Midazolam Drug Characteristics

- Quick acting benzodiazepine
- Water soluble
  - Lipophilic at physiologically pH allowing it to cross nose-brain barrier
- pH 3.5
- Bioavailability: 50-83%
  - Rapid onset: peak effect ~10 minutes
  - Short acting: 30-60 minutes
IN Midazolam Concentrations
Fisgin, et al 2002

• **Objective**
  - Compared safety and efficacy of IN midazolam vs. PR diazepam

• **Methods**
  - Odd days: diazepam PR 0.3 mg/kg
  - Even days: midazolam IN 0.2 mg/kg
  - HR, RR, BP obtained at 5, 10 minutes after drug administration
  - ED physician categorized seizure
Fisgin, et al 2002

Results (n=45)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PR Diazepam n(%)</th>
<th>IN midazolam n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11 (50)</td>
<td>15 (65.2)</td>
</tr>
<tr>
<td>Male</td>
<td>11 (50)</td>
<td>8 (34.8)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-24 months</td>
<td>16 (72.7)</td>
<td>12 (52.1)</td>
</tr>
<tr>
<td>25 months-7 years</td>
<td>4 (18.1)</td>
<td>7 (30.4)</td>
</tr>
<tr>
<td>&gt; 7 years</td>
<td>2 (9)</td>
<td>4 (17.3)</td>
</tr>
<tr>
<td><strong>Fever</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Febrile</td>
<td>5 (22.7)</td>
<td>5 (21.7)</td>
</tr>
<tr>
<td>Non-febrile</td>
<td>17 (77.3)</td>
<td>18 (78.3)</td>
</tr>
</tbody>
</table>

- IN midazolam effective in 87% of seizures
- PR diazepam 60%
Fisgin, et al 2002

- Conclusions
  - IN midazolam is more effective for controlling seizures than PR diazepam
  - IN midazolam will be “very useful” in the emergency setting
Holsti, et al 2007

- **Objective**
  - Compare IN midazolam vs. PR diazepam for treatment of pediatric seizure in EMS setting

- **Methods**
  - Retrospective review
  - Patients < 18 years old, had a seizure in the presence of an EMS provider, received PR diazepam or IN midazolam in the pre-hospital setting
<table>
<thead>
<tr>
<th>IN Midazolam</th>
<th>PR Diazepam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>Apply oxygen; suction nose if there are secretions</td>
</tr>
<tr>
<td>Indication</td>
<td>Seizure &gt; 5 minutes</td>
</tr>
<tr>
<td>Dose</td>
<td>0.2 mg/kg</td>
</tr>
<tr>
<td>Route</td>
<td>IN; divided into each nare using MAD®</td>
</tr>
<tr>
<td>Maximum dose</td>
<td>10 mg</td>
</tr>
<tr>
<td>Repeat dose</td>
<td>0.2 mg/kg, 5 minutes after 1st dose</td>
</tr>
</tbody>
</table>
Holsti, et al 2007

• Results:
  ▫ 39 patients in IN midazolam group vs. 18 in PR diazepam
  ▫ IN midazolam: 19 minutes less seizure activity
    • 11 minutes vs. 30 minutes
  ▫ PR diazepam: more likely to…
    • Re-seize (OR 8.4)
    • Need intubation (OR 12.2)
    • Require hospitalization (OR 29.3)
    • Require ICU admission (OR 53.5)

• Conclusions:
  ▫ IN midazolam controlled seizures better than PR diazepam in the prehospital setting and resulted in fewer complications
### Additional Studies for IN Midazolam

<table>
<thead>
<tr>
<th>Study</th>
<th>Patient Population</th>
<th>Intervention</th>
<th>Results/Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahat, et al 2000</td>
<td>Pediatric patients aged 6 months to 5 years with prolonged (at least 10 minutes) febrile seizures</td>
<td>IN midazolam (0.2 mg/kg) vs. IV diazepam (0.3 mg/kg)</td>
<td>n=53 patients&lt;br&gt;IN midazolam effective in 88.5% vs. 92.3% in IV diazepam group&lt;br&gt;Overall time from arrival to cessation of seizures was shorter with IN midazolam (6.1 min vs. 8 min; p=00.1)</td>
</tr>
<tr>
<td>Bhattacharyya, et al 2006</td>
<td>Pediatric patients aged 3 months to 12 years presenting with a seizure to ED</td>
<td>IN midazolam (0.2 mg/kg) vs. PR diazepam (0.3 mg/kg)</td>
<td>n= 46 patients (188 episodes)&lt;br&gt;96.7% of seizures were controlled with IN midazolam at 10 minutes compared to 88.5% with PR diazepam</td>
</tr>
<tr>
<td>Harbord, et al 2004</td>
<td>Pediatric patients aged 4-18 years with at least 1 generalized tonic clonic seizures in community settings</td>
<td>IN midazolam (0.2-0.3 mg/kg)</td>
<td>n=22 patients (45 episodes)&lt;br&gt;89% of seizures controlled with IN midazolam&lt;br&gt;90% of caregivers reported no difficulty in administering</td>
</tr>
</tbody>
</table>

IN Midazolam Considerations

- Home use
  - Education for caregivers
  - Better social acceptance

- Cost*
  - Rectal diazepam 20 mg: brand $289.59/pack and generic $232.09/pack
  - Midazolam (5 mg/ml): $0.86 per vial
  - MAD®300 Nasal Mucosal Atomization device: $2.98 per atomizer

Drug Overdose

- Drug overdose was the leading cause of injury death in the United States in 2012
- 43,982 deaths reported in 2013
  - Approximately half of those deaths were related to prescription medications
  - Majority involved opioid analgesics
  - Also observed an increase in heroin overdoses

IN Naloxone

- Opioid Antagonist

- Pharmacokinetic studies:
  - Human data lacking
  - Animal studies:
    - 100% bioavailability in rats
    - Onset of action: 3 minutes
Barton, et al 2002

- **Objective**
  - Assess effectiveness and safety of IN naloxone administered by EMS providers for possible opioid overdoses

- **Methods**
  - All patients aged 14 and older
  - Diagnosis of “altered mental status,” “found down,” or “suspected opioid overdose”
  - 2 mg IN naloxone
  - IV naloxone used for rescue
Barton, et al 2002

- **Results**
  - 52 patients included in study
  - 43 patients defined as IN naloxone responder
    - Median time to response was 3 minutes following IN administration
  - 9 patients reported to only respond to IV naloxone

- **Conclusion**
  - Potential use of IN naloxone in EMS practice
Kelly, et al 2005

- **Objective**
  - Determine the effectiveness of IN naloxone vs. IM naloxone for treatment of respiratory depression due to suspected opiate overdose in the prehospital setting

- **Methods**
  - Prospective, randomized, unblinded study of suspected overdose patients
  - 2 mg IN naloxone or 2 mg IM naloxone
  - Primary outcome: response time to regain a respiratory rate > 10 breaths/minute
Kelly, et al 2005

• Results
  ▫ 155 patients (81 IN naloxone; 71 IV naloxone)
  ▫ IM group more likely to have > 10 spontaneous breaths/min compared to the IN group (82% vs. 63%, p=0.017)
  ▫ No statistically significant difference between needing rescue naloxone (13% in IM vs. 26% in IN, p=0.06)

• Conclusions
  ▫ IN naloxone is effective in treating opiate-induced respiratory depression, but not as effective as IM naloxone
  ▫ IN delivery of naloxone reduce risk of needlestick injury to EMS providers
Saved by the Nose: Bystander-Administered Intranasal Naloxone Hydrochloride for Opioid Overdose

Maya Doe-Simkins, MPH, Alexander Y. Wailey, MD, MSc, Andy Epstein, RN, MPH, and Peter Moyer, MD, MPH

Administering naloxone hydrochloride (naloxone) during an opioid overdose reverses the overdose and can prevent death. Although typically delivered via intramuscular or intravenous injection, naloxone may be delivered via intranasal spray device. In August 2006, the Boston Public Health Commission passed a public health regulation that authorized an opioid overdose prevention program that included intranasal naloxone education and distribution of the spray to potential bystanders. Participants were taught by trained nonmedical needle exchange staff. After 15 months, the program provided training and intranasal naloxone to 385 participants who reported 74 successful overdose reversals. Problems with intranasal naloxone were uncommon. Overdose prevention education with distribution of intranasal naloxone is a feasible public health intervention to address opioid overdose. *Am J Public Health*. 2009;99:788-791. doi:10.2105/AJPH.2008.146647.
Patient Case Scenarios

10 year old male in severe pain
- Presents to ED with obvious left arm deformity
- Patient is screaming
- Will not let the RN touch him

3 year old female with h/o seizure
- EMS called for grand mal seizure, duration 15 minutes
- Unable to establish IV access

40 year old unconscious male
- Presents to ED with slow respirations, pinpoint pupils, cool dusky skin with obvious track marks bilaterally
- Unable to establish IV access
Example IN Fentanyl Protocol

- **Indications:**
  - Adult and pediatric minor painful injuries or procedures
  - Orthopedic trauma not requiring an IV (or prior to starting an IV)
  - Burn dressing changes
  - Re-packing wounds such as abscesses
  - Any time an IM shot for pain control is considered

- **Dose:**
  - IN Fentanyl: 2-3 mcg/kg
  - May repeat half the initial dose at ~10 minutes intervals until desired effect is achieved
**IN Fentanyl Dosing Table**

*Fentanyl concentration 50 mcg/ml*

<table>
<thead>
<tr>
<th>Patient Weight (kg)</th>
<th>Fentanyl dose (2 mcg/kg)</th>
<th>Fentanyl volume (dose + dead space)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5 kg</td>
<td>10 mcg</td>
<td>0.3 ml (0.2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>6-10 kg</td>
<td>20 mcg</td>
<td>0.5 ml (0.4 ml + 0.1 ml)</td>
</tr>
<tr>
<td>11-15 kg</td>
<td>30 mcg</td>
<td>0.7 ml (0.6 ml + 0.1 ml)</td>
</tr>
<tr>
<td>16-20 kg</td>
<td>40 mcg</td>
<td>0.9 ml (0.8 ml + 0.1 ml)</td>
</tr>
<tr>
<td>21-25 kg</td>
<td>50 mcg</td>
<td>1.1 ml (1 ml + 0.1 ml)</td>
</tr>
<tr>
<td>26-30 kg</td>
<td>60 mcg</td>
<td>1.3 ml (1.2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>31-35 kg</td>
<td>70 mcg</td>
<td>1.5 ml (1.4 ml + 0.1 ml)</td>
</tr>
<tr>
<td>36-40 kg</td>
<td>80 mcg</td>
<td>1.7 ml (1.6 ml + 0.1 ml)</td>
</tr>
<tr>
<td>41-45 kg</td>
<td>90 mcg</td>
<td>1.9 ml (1.8 ml + 0.1 ml)</td>
</tr>
<tr>
<td>46-50 kg</td>
<td>100 mcg</td>
<td>2.1 ml (2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>51-55 kg</td>
<td>110 mcg</td>
<td>2.3 ml* (2.2 ml + 0.1 ml)</td>
</tr>
</tbody>
</table>

*Volumes in this range should be divided in half and administered 10 minutes apart*

Sentara Intranasal Administration of Medications Job Aid. Approved February 2015

IN Fentanyl Administration

- **Materials Needed:**
  - 1 ml or 3 ml syringe*
  - Blunt and/or filter needle to draw up medication
  - Mucosal atomization device
  - Medication of appropriate concentration

- **Aspirate the proper dose/volume of medication** *(**Remember** to account for dead space)*

*exception: naloxone (use prefilled 2mg/2ml syringe)
IN Fentanyl Administration

• Attach atomizer tip via Luer lock mechanism and twist into place

• Use the free hand to hold the crown of the head stable, place the tip of the atomizer snugly against the nostril aiming slightly up and outward

• Briskly compress the syringe plunger to deliver half of the medication into the nostril

• Move to other nostril and repeat
Patient Case Scenarios

10 year old male in severe pain
- Presents to ED with obvious left arm deformity
- Patient is screaming
- Will not let the RN touch him

3 year old female with h/o seizure
- EMS called for grand mal seizure, duration 15 minutes
- Unable to establish IV access

40 year old unconscious male
- Presents to ED with slow respirations, pinpoint pupils, cool dusky skin with obvious track marks bilaterally
- Unable to establish IV access
Example IN Midazolam Protocol

- **Indication:**
  - Treatment of seizures when IV access is unavailable

- **Dose**
  - IN midazolam: 0.2 mg/kg
  - Use table to determine proper volume
  - Concentration: 5 mg/ml
  - If seizures persist after treating:
    - Consider repeating ½ dose of midazolam either intranasally, intramuscularly or intravenously
    - Secure airway if necessary
## IN Midazolam Dosing Table

*Midazolam concentration 5 mg/ml*

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Midazolam dose (~0.2 mg/kg)</th>
<th>Midazolam volume (dose + dead space)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5 kg</td>
<td>1 mg</td>
<td>0.3 ml (0.2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>6-10 kg</td>
<td>2 mg</td>
<td>0.5 ml (0.4 ml + 0.1 ml)</td>
</tr>
<tr>
<td>11-15 kg</td>
<td>3 mg</td>
<td>0.7 ml (0.6 ml + 0.1 ml)</td>
</tr>
<tr>
<td>16-20 kg</td>
<td>4 mg</td>
<td>0.9 ml (0.8 ml + 0.1 ml)</td>
</tr>
<tr>
<td>21-25 kg</td>
<td>5 mg</td>
<td>1.1 ml (1 ml + 0.1 ml)</td>
</tr>
<tr>
<td>26-30 kg</td>
<td>6 mg</td>
<td>1.3 ml (1.2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>31-35 kg</td>
<td>7 mg</td>
<td>1.5 ml (1.4 ml + 0.1 ml)</td>
</tr>
<tr>
<td>36-40 kg</td>
<td>8 mg</td>
<td>1.7 ml (1.6 ml + 0.1 ml)</td>
</tr>
<tr>
<td>41-45 kg</td>
<td>9 mg</td>
<td>1.9 ml (1.8 ml + 0.1 ml)</td>
</tr>
<tr>
<td>46-50 kg</td>
<td>10 mg</td>
<td>2.1 ml (2 ml + 0.1 ml)</td>
</tr>
<tr>
<td>&gt; 50 kg</td>
<td>10 mg</td>
<td>2.1 ml (2 ml + 0.1 ml)</td>
</tr>
</tbody>
</table>

Sentara Intranasal Administration of Medications Job Aid. Approved February 2015
Patient Case Scenarios

10 year old male in severe pain
- Presents to ED with obvious left arm deformity
- Patient is screaming
- Will not let the RN touch him

3 year old female with h/o seizure
- EMS called for grand mal seizure, duration 15 minutes
- Unable to establish IV access

40 year old unconscious male
- Presents to ED with slow respirations, pinpoint pupils, cool dusky skin with obvious track marks bilaterally
- Unable to establish IV access
Example IN Naloxone Protocol

• Indication
  ▫ Suspected opiate overdose when IV access is unavailable

• Dose
  ▫ IN naloxone: 2mg
  ▫ Concentration: 2mg/2ml
  ▫ If no arousal occurs after 5 minutes, consider repeat dose of IV or IN naloxone
  ▫ Secure airway if necessary
Clinical Pearls

- Minimize volume and maximize concentration
  - Ideal volume: 1/3 to 1/4 ml per nostril
  - Maximum volume: 1 ml per nostril
  - Use concentrated formulations when available

- Maximize total mucosal absorptive surface area
  - Use both nostrils to double the absorptive area
  - Atomize the medication (rather than drip it in) to increase surface area

- Beware of abnormal mucosal characteristics
  - Mucous, blood and vasoconstrictors reduce absorption
  - Suction nostrils or consider alternate drug deliver method in these situations
Additional medications…

- IN dexmedetomidine
- IN ketoralac
- IN glucagon
- IN ketamine
- IN lidocaine
- IN sufentanil
Summary

- IN drug delivery is convenient and easy
- Can provide an alternative for rapid drug administration
- Be aware of the limitations and characteristics needed for optimal absorption
- Education and protocols are important to ensure appropriate administration
- Nasal drug delivery cannot completely replace the need for injections
- Additional studies are needed
What concentration of midazolam should be used for IN administration?

A. 1 mg/mL
B. 2 mg/mL
C. 5 mg/mL
What concentration of midazolam should be used for IN administration?

A. 1 mg/mL  
B. 2 mg/mL  
C. 5 mg/mL

- Slides: 48, 49
A 4 yo male with an obvious left distal arm deformity. Patient is in severe pain with no IV access. The patient is screaming and crying with thick mucous coming out of his nose. Is this patient an appropriate candidate for IN fentanyl?

A. No, just take the patient to X-ray without any medication
B. No, the patient has thick mucous that will prevent absorption
C. Yes, if the patient’s nasal cavity is cleared by suction before administration
D. Yes, the patient has no IV access and mucous does not affect absorption
A 4 yo male with an obvious left distal arm deformity. Patient is in severe pain with no IV access. The patient is screaming and crying with thick mucous coming out of his nose. Is this patient an appropriate candidate for IN fentanyl?

A. No, just take the patient to X-ray without any medication  
B. No, the patient has thick mucous that will prevent absorption  
C. Yes, if the patient’s nasal cavity is cleared by suction before administration  
D. Yes, the patient has no IV access and mucous does not affect absorption

• Slides: 11, 52
What extra volume must be drawn up to account for dead space in the MAD 300 device?

A. 0.1 mL
B. 0.3 mL
C. 0.5 mL
D. 1 mL
What extra volume must be drawn up to account for dead space in the MAD 300 device?

A. 0.1 mL  
B. 0.3 mL  
C. 0.5 mL  
D. 1 mL

• Slides: 12, 44