Controversies in ED Procedural Sedation and Analgesia

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Roadmap for today

- Pre-procedure fasting
- Ketamine for minor head injury

Pre-Procedural Fasting

- Organization guidelines (ASA, ACEP, UCSF)
- Research challenges
- Evidence
- Recommendations
Case

3 yo F BIB parents for repair of facial laceration after fall about 1 hour ago.
Pt was climbing over back of chair, fell and cut face on metal door frame.

Case (cont.)

PMHx/PSHx/Meds/All – none
Imm – UTD
Exam
VS normal
Anxious but alert, consoles w mom
Gapping, 4 cm, horizontal lac to L cheek

Case (cont.)

Of note, the child had just finished a plate of macaroni & cheese prior to the fall.
How do you proceed?

Options

1. No sedation
   Hold ‘em down and suture while awake (aka, Brutane)
2. Obs in the ED x 6 h
   Then sedate w empty stomach
3. Sedate with full stomach
   Risk mac-n-cheese pneumonitis
**Pre-Procedure Fasting**

- Organization Guidelines
- Research Challenges
- Evidence
- Conclusions

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**ASA Guidelines**

“It is appropriate to fast from intake of clear liquids at least 2 hours and solids at least 6 hours before...sedation/analgesia.”

-ASA Practice Guidelines, March, 2011

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**ACEP Guidelines**

“Recent food intake is not a contraindication for administering procedural sedation and analgesia, but should be considered in choosing the timing and target level of sedation.”

-ACEP Clinical Policy, 2007

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**UCSF Guidelines**

“Minimum NPO criteria for procedural sedation:
Solids > 6 hours, Clear liquids > 4 hours”

-UCSF Policy on Sedation Administration by Non-Anesthesiologists, 2008
UCSF Guidelines

“For certain emergent or urgent procedures, the above criteria may not be feasible...The benefits of sedation against the risk of possible aspiration must be assessed and documented.”

- UCSF Policy on Sedation Administration by Non-Anesthesiologists, 2008

Pre-Procedure Fasting

- Guidelines
- Research challenges
- Evidence
- Conclusions

Risk factors for aspiration the OR:

- GERD
- Significant comorbidities (ASA status >2)
  - Severe systemic disease
  - Extremes of age
  - Altered mental status
  - Deeper levels of sedation

Can we extrapolate from anesthesia literature?
**ED patients are different**

- Less deeply sedated
- Airway not manipulated
  - 2/3 of OR aspiration occurs with airway manipulation

**ED patients are different (cont.)**

- ED drugs are less emetic
  - Inhalational agents have higher risk of vomiting
- Patients are healthier
  - ED patients are ASA 1 or 2

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**How do we study aspiration in ED procedural sedation?**

- Difficult to study in the ED
  - An extremely rare event
  - Providers might be reluctant to report it
  - May not always be associated with vomiting

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**Pre-Procedure Fasting**

- Guidelines
- Challenges
- Evidence
- Conclusions
Studies in children

- Three key studies since 2003
  - Included data on
    - Fasting status
    - Agents used
    - Vomiting
    - Aspiration

Studies in children (cont.)

- Agarwal, 2003
  - 1,014 consecutive children
  - Variety of agents
  - 509/905 (56%) did not meet ASA fasting guidelines
    - Liquids: 2 h NPO
    - Solids: 6 h NPO

Studies in children (cont.)

- Agarwal, 2003
  - 15/905 (1.5%) vomited
    - 6 fasted
    - 9 unfasted
  - No aspiration reported

Studies in children (cont.)

- Roback, 2004
  - 2,085 consecutive children
  - Sedated with
    - Ketamine (1,199)
    - Ketamine + midazolam (295)
    - Fentanyl + midazolam (284)
    - Midazolam (225)
    - Other (82)
**Studies in children (cont.)**

- Roback, 2004
  - 156/2,085 (7.5%) vomited
  - Vomiting not assoc w NPO
    - 10 pts (7%) < 2 hrs NPO
    - 70 pts (10%) 2-6 hrs NPO
    - 45 pts (15%) > 6 hrs NPO
    - 31 pts NPO not documented

- No reports aspiration
- No significant association between fasting time and vomiting

**Studies in children (cont.)**

- Bell, 2007
  - 400 pts sedated w iv propofol
  - 70% were not fasted by ASA guidelines

- 2/400 vomited
  - 1 fasted
  - 1 unfasted
- No aspiration events
Studies in children (cont.)

- Summary
  - Vomiting
    - Rare
      - 0.5%, 1.5%, 7.5%
    - No correlation with fasting
  - No aspiration in 3,499 pediatric patients

Fasting studies in adults

- Since 2001
  - 1 study
  - 1 literature review

Studies in adults (cont.)

- Thorpe, 2010
  - Literature review
  - 25 procedural sedation reports with
    - Fasting status
    - Vomiting
    - Aspiration

Studies in adults (cont.)

- Thorpe, 2010
  - Variety of methods
    - Case series, cohort studies, convenience samples
  - None specifically designed to address NPO status and aspiration
**Studies in adults (cont.)**

- Thorpe, 2010
  - 4,657 patients in 25 studies
  - Variety of drugs
    - Propofol, etomidate, methohexital, midazolam/fentanyl

- 136 fasted by ASA guidelines
- 17 vomited
  - 1/136 (0.7%) fasted
  - 16/4,521 (0.4%) not fasted
- No reports of aspiration

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**Studies in adults**

- Taylor, 2011
  - 11 Australian EDs
  - 2,623 consecutive patients
  - Variety of drugs/procedures
  - 1,392 (52%) not fasted by ASA guidelines
  - 34 (1.6%) vomited

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**Studies in adults (cont.)**

**Taylor, 2011**

<table>
<thead>
<tr>
<th>NPO Status (#)</th>
<th># vomited (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 hours (224)</td>
<td>6 (2.7)</td>
</tr>
<tr>
<td>2-6 hours (1,168)</td>
<td>18 (1.5)</td>
</tr>
<tr>
<td>&gt;6 hours (754)</td>
<td>10 (1.3)</td>
</tr>
<tr>
<td>Total 2,146</td>
<td>34 (1.6)</td>
</tr>
</tbody>
</table>
Studies in adults (cont.)

- Taylor, 2011
  - Trend to more vomiting in NPO < 2 hrs, not significant
  - NPO status not associated with adverse events
  - 1 aspiration event in pt who was fasted and did not vomit

Studies in adults

- Summary
  - Only one study examined NPO status and vomiting/aspiration
  - No association between NPO status, vomiting and aspiration found

Two Case Reports of Aspiration During ED Procedural Sedation

Two reports of aspiration

- Case #1 (Taylor, 2011)
  - 83 yo F with hip dislocation
  - h/o hiatal hernia
  - Fasted x 24 hours
Two reports of aspiration

- Case #1 (Taylor, 2011)
  - 83 yo F w hip dislocation
  - Sedated w fentanyl 50 mcg and propofol 50 mg
  - Deeply sedated
  - Required chin lift and BVM
  - No vomiting observed

- Case #1 (Taylor, 2011)
  - 83 yo F w hip dislocation
  - O2 sat slowly dropped after procedure
  - Intubated & admitted to ICU
  - CxR c/w aspiration

- Case #2 (Cheung, 2007)
  - 65 yo F w L ankle fx
  - Lg meal w alcohol 5 hrs PTA
  - At 6 hrs NPO, sedated w
    - fentanyl, 100 mcg iv
    - propofol, titrated, total 120 mg iv

- Case #2
  - 65 yo F w ankle fx
  - Sedation was uneventful
  - Initial reduction failed
Two reports of aspiration

- Case #2
  - 65 yo F w ankle fx
    - 7 hrs NPO second reduction attempted
    - Sedated again w
      - fentanyl, 100 mcg iv
      - propofol, 60 mg iv

Two reports of aspiration

- Case #2
  - 10 min after 2nd propofol
    - Vomited into oxygen mask
    - Aspirated
    - 02 sat dropped to 86%

Two reports of aspiration

- Case #2
  - Intubated, admitted to ICU
  - CxR c/w aspiration
  - ORIF performed 2 d later
  - At 3 mon f/u, no pulmonary complaints

Two reports of aspiration

- Summary
  - Elderly w comorbidities
  - Fasted > 6 hours
  - Deeply sedated
  - 1 observed vomiting, 1 not observed vomiting
Pre-Procedure Fasting

- Guidelines
- Challenges
- Evidence
- Conclusions

Summary

- Reports of aspiration rare
  - ED patients are different
    - No airway manipulation
    - Different agents
    - Younger & healthier
    - Less deeply sedated
  - Reluctance to report?

Summary

- Little evidence for routinely fasting all ED patients by ASA guidelines

Summary

- Use clinical judgment
- Weigh risks and benefits for each individual patient
Summary

- Use caution in patients with risk factors
  - Elderly
  - Pts w comorbid illnesses
  - AMS (trauma, EtOH)
  - Deeper sedation required

Case

3 yo F BIB parents for repair of facial laceration after fall about 1 hour ago.

Options

1. No sedation
   Hold ‘em down and suture while awake (aka, Brutane)
2. Obs in the ED x 6 h
   Then sedate w empty stomach
3. Sedate with full stomach
   Risk mac-n-cheese pneumonitis

Case conclusion

- You choose Option 3: sedate with a full stomach
- Patient sedated w ketamine, 4 mg/kg im x 1
- Laceration repaired, no complications
Case conclusion (cont.)
- Recovers, vs nl, tolerating po, ambulating
- D/C’d home
- Phone f/u, report emesis x 1 on arrival at home
- Otherwise well, no resp or behavioral changes

Roadmap for today
- Pre-procedure fasting
- Ketamine for minor head injury

Ketamine for minor head injury
- Ketamine pharmacology
- Origin of the controversy
- The evidence
- Summary and recommendations

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**Ketamine Pharmacology**

- Structurally related to phencyclidine
- NMDA antagonist
  - Inhibits glutamate release
  - Thought to be neuroprotective

![Ketamine](image1)

![Phencyclidine](image2)

**Ketamine Pharmacology (cont.)**

- Catecholamine surge
  - Increased BP and HR

**Ketamine Pharmacology (cont.)**

- Dissociative anesthetic
  - Cortico-limbic dissociation
  - CNS receives input, but unable to process
  - Appear awake, maintain airway reflexes, completely unaware of environment

**Ketamine Pharmacology (cont.)**

- Clinical Effects
  - Unique because produces profound anxiolysis, amnesia and analgesia
Ketamine for minor head injury

- Ketamine pharmacology
- Origin of the controversy
- The evidence
- Summary and recommendations

The Controversy

"It is commonly stated that ketamine increases intracranial pressure...data from animal studies and human observations are conflicting...Until this is clarified, it is prudent to avoid ketamine in patients with head injuries.”


Initial Reports

- Six case reports & small series (n=1 to n=20) from 1970-1972
- Examined effect of ketamine on ICP

Summary of reports from 1970s

<table>
<thead>
<tr>
<th></th>
<th>Abnormal brain</th>
<th>Normal brain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased ICP</td>
<td>20</td>
<td>11*</td>
</tr>
<tr>
<td>No increased ICP</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Totals</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>

*healthy volunteers, CSFP increased by mean 18 mmHg
Summary of Reports from 1970s (cont.)
- Heterogeneous methods and quality
- Small sample sizes

Trend toward increased ICP w ketamine
- More common w structurally abnormal brains
- Origin of concept ketamine not safe in ED patients with minor head injuries

Ketamine for head injury
- Ketamine pharmacology
- Origin of the controversy
- The evidence
- Summary and recommendations

Evidence from Neuro ICU
- 5 small prospective studies btwn 1995-2009 (n=20 to 35)
  - Intubated
  - Continuous ketamine infusion
  - Confounded by presence of other sedating agents
  - 4/5 studies were TBI pts
Evidence from Neuro ICU

- No association between ketamine and increased ICP
- In 4/5 studies, no change in ICP with ketamine
- In 1/5 studies, reduced ICP in ketamine group

Summary of Neuro ICU Data

- In intubated ICU patients
  - No evidence ketamine increases in ICP
  - Some evidence it decreases ICP

Evidence from Neuro ICU

- Bar-Joseph, 2009
  - 82 sedations
  - Intubated, neuro ICU patients
  - ICP decreased in 76/82 pts*
  - ICP decreased from 26 mmHg to 18 mmHg (30%)*

Evidence in ED patients

- Ben Yehuda, 2006
  - 39 children, 6 mon-14 yrs
  - Sedated for LP for suspected aseptic meningitis
  - Not randomized
    - Ketamine weekdays
    - Midazolam all other times
Evidence in ED patients (cont.)

- Ben Yehuda, 2006
  - Group A
    - Midazolam (0.05 mg/kg) + ketamine (1 mg/kg)
  - Group B
    - Midazolam (0.1 mg/kg)

- Group A (ketamine + midazolam)
  - Mean OP 24 cm H20
- Group B (midazolam)
  - Mean OP 20 cm H20
  - P=0.011

Evidence in ED patients (cont.)

- Ben Yehuda, 2006

- Ketamine pharmacology
- The controversy
- The evidence
- Summary and recommendations

Evidence in ED patients (cont.)

- Ben Yehuda, 2006

- All confirmed w viral meningitis
- No difference in clinical course or outcomes

Ketamine for head injury
Ketamine Summary

- Ketamine effects
  - In intubated ICU pts -> does not increase and may decrease ICP
  - In awake pts w structural brain abnormalities -> increases ICP

Ketamine Summary (cont.)

- Ketamine effects
  - May cause transient elevation in ICP in normal patients
  - In many pediatric pts w minor head injury, benefits may outweigh risks

Ketamine for head injury

- Summary (cont.)
  - Until more data available, avoid in patients at risk for herniation
    - AMS
    - Focal neuro deficits
    - Known structural brain abnormality

Questions?
Questions?