

## Example of a Critically Appraised Topic (The CAT)

- I. **Title:** Does Midazolam Decrease the Adverse Effects of Intravenous Ketamine Sedation in Children
- II. **Reviewer:** Robert Englander, M.D., M.P.H.
- III. **Date of Appraisal:** June 19, 2001
- IV. **Clinical Question:** Does the addition of Midazolam to conscious sedation with Ketamine decrease the incidence of emergence phenomena?
- V. **The Study:** The investigators present a randomized, double-masked study of 266 patients between 4.5 months and 11 years who received either Ketamine and glycopyrrholate or Ketamine, Glycopyrrholate, and Midazolam as conscious sedation for procedures in the Emergency Department. All patients were ASA I or II. Adverse outcomes, specifically emergence phenomena (recorded by videotape and judged by trained nurses blinded to the treatment group), desaturation (<90%), apnea, laryngospasm, vomiting and emergence phenomena. Secondary outcomes included patient and physician satisfaction and length of sedation. Telephone f/u was utilized to evaluate for delayed adverse effects. Both objective and subjective measures of effectiveness of sedation were used.
- VI. **Clinical Bottom Lines:**

- A. No difference between groups in the occurrence or the emergence phenomena, either immediate or delayed
- B. Emergence phenomena of any type are common in the use of Ketamine (around third of patients)
- C. Oxygen desaturation occurs in 7.3% of combined therapy patients versus 1.6% of Ketamine only patients
- D. Apnea and laryngospasm were rare in both groups and showed no significant difference between groups
- E. No difference in average length of sedation between groups.

## VII. The Evidence

### Primary Outcomes

Adverse Effects	Ketamine	Ketamine/ Midazolam	Rate Difference (AAR)	95% CI for Rate Difference
Oxygen Desaturation	1.6%	7.3%	-5.7%	-10.6% to -0.9%
ED				
Vomiting	19.4%	9.6%	9.8%	1.4% to 18.2%
Emergence Phenomena-significant*	7.1%	6.2%	0.9%	-5.3% to 7.0 %
Emergence Phenomena-any	27.1%	26.3%	0.8%	-9.8% to 11.5%
Home				
Vomiting	7.0%	3.6%	3.4%	-2.4% - 9.2%
Emergence Phenomena-significant*	12.9%	11.3%	1.6%	-6.8% to 10.0%
Emergence Phenomena-any	23.5%	21.2%	2.3%	-8.6% to 13.1%

\* Significant emergence phenomena described as nightmares, hallucinations or severe agitation

### Secondary Outcomes

Variable	Ketamine	Ketamine/ Midazolam	Difference	95% CI for Difference
Physician Satisfaction (% satisfied or very satisfied)	98.3%	95.0%	3.3%	-1.2% to 7.8%
Parental Satisfaction (% satisfied or very satisfied)	98.2%	97.3%	0.9%	-2.8 to 4.7%
Total sedation time	78 minutes	75 minutes	3 minutes	-5 to 10 mins

**VIII. Comments/Validity of the Evidence** (From Gyatt G, Sackett DL, and Cook DJ. Users' Guide to the Medical Literature: II. How to use an article about therapy or prevention: B. What were the results and will they help me in caring for my patients. JAMA, 1994; 271 (1); 599-63.)

A. Are the results of the study valid?

Primary Questions:

1. Was the assignment of patients to treatments randomized? Yes.
2. Were all the patients who entered the study properly accounted for? Yes (Figure1). In addition, the authors had a 90% response rate for the telephone f/u.

Secondary Questions:

1. Were patients, health workers, and study personnel masked to treatment groups? Yes.
2. Were the groups similar at the start of the trial? Yes (Table 1).
3. Aside from the experimental intervention, were the groups treated equally? Yes.

B. Will the results help me in caring for my patients?

1. Can the results be applied to my patient care? *Yes*. For our patients undergoing routine conscious sedation who are ASA I or ASA II, Ketamine with or without Versed seems to be a reasonable approach. I would probably continue to use Midazolam as well, as the decrease in vomiting outweighs the increase in desaturation (which we can easily treat with oxygen anyway!). For every 10 patients treated with Midazolam and Ketamine, one patient will not experience the side effect of vomiting; that is, **NNT = 10**.
2. Were all clinically important outcomes considered? *Yes*. In addition, the desaturation issue may not be clinically significant in a monitored environment with supplemental oxygen available.
3. Are the likely treatment benefits worth the potential harms and costs? *Yes*. Minimal harm/risk in a monitored setting for midazolam, and some benefit with regards to vomiting as outlined above. I do not know the monetary cost of a 2 mg vial of Versed.

**IX. Citation:** Wathen JE, Roback MG, Mackenzie T, and Bothner JP. Does Midazolam alter the clinical effects of intravenous Ketamine sedation in children? A double-blind, randomized, controlled, emergency department trial. *Annals of Emergency Medicine*. 2000; 36(6); 579-88.