**Critical Review Form**
**Case Series**

Scheppke KA, Braghiroli J, Shalaby M, Chait R. Prehospital use of i.m. ketamine for sedation of violent and agitated patients. West J Emerg Med. 2014 Nov;15(7):736-41.

**Objectives:** **To study "a protocol for paramedics to administer intramuscular [IM] ketamine" in patients with excited delirium syndrome (ExDS).**

**Methods:** **This retrospective cohort study was conducted in Palm Beach County, Florida, where the medical director of five municipal fire/rescue agencies developed a protocol to allow rapid chemical restraint of violent, agitated patients with a single IM dose of ketamine (4 mg/kg estimated body weight). Following adequate sedation, IV access was established and 2.0-2.5 mgs of IV midazolam was given to prevent an emergence reaction. Standard medical care and ED transport was then carried out.**

**Paramedic run sheets from January 1, 2011 through May 1, 2014 were retrospectively reviewed, and cases of violent, aggressive behavior felt to be psychiatric or substance-induced in nature, in which IM ketamine was given, were retrieved. The primary endpoint being looked at was adequate sedation to treat and transport patients to the hospital. Secondary endpoints were time to adequate sedation (at a level to allow transport and treatment without further violence or agitation) and untoward hemodynamic or respiratory effects (need for resuscitation for a systolic BP < 90 mm Hg or need for positive pressure ventilation).**

**A total of 52 patients with violent or agitated behavior were treated with IM ketamine by the five agencies during the time period evaluated. While demographic information was not provided for the group as a whole, but rather for each individual, it would seem that the vast majority of cases were males under the age of 50.**

| Guide | | Comments |
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| **A.** | **Are the results valid?** | |
| 1. | Were there clear criteria for inclusion in the case series? | Yes. All patients with violent or agitated behavior felt to require chemical sedation by the treating paramedics, who received IM ketamine, were included. |

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| 2. | Was the condition identified and measured in a standard, reliable way for all participants included? | No. The condition (agitation due to psychiatric or drug-induced state) was highly subjective, determined at the time of the encounter by the treating paramedics. It is possible that some patients may have suffered from medical conditions (i.e. delirium, dementia). |
| 4. | Were consecutive patients included and was inclusion complete? | Yes and no. Purportedly, all patients who received IM ketamine under the treating agencies' protocols during the specified time period were included in the analysis. However, the authors do not make it clear if some agitated patients were treated with alternate regimens (i.e. haloperidol or midazolam), and if such patients differed in some appreciable way from the included patients. |
| 5 | Was sufficient demographic information provided for included patients? | No. While the authors provided detailed individual data regarding age, gender, and some initial vital signs, no data are provided regarding medical history or underlying cause for agitation (beyond psychiatric vs. drug), and key data is missing for several patients. Additionally, there is no data for the group as a whole. |
| 6. | Was follow-up of subjects long enough to detect the outcome of interest? | Yes. The primary and secondary outcomes are all short-term outcomes, and hence were measurable during the EMS encounter. |
| 7. | Was follow-up complete? | Uncertain. While there would appear to be primary outcome data for all patients, there is no way to verify this. Time to adequate sedation was unknown for 2 (4%) patients. |
| **B.** | **What were the results?** | |
| 1. | What were the outcomes? | • Adequate sedation was achieved in all but two patients (96%, 95% CI 87% to 99%[*]).<br>• Among those patients who were adequately sedated, and for whom times were available, time to adequate sedation was just over two minutes.<br>• There were 3 cases (6%, 95% CI 2% to 16%[*]) of respiratory depression requiring positive pressure ventilation. BVM was required in one case and endotracheal intubation was necessary in the other two cases.<br><br>[*]Calculated using http://www.vassarstats.net/prop1.html |
| 2. | How precise was the estimate of the outcomes? (i.e. what were the 95% confidence intervals?) | See above. 95% CIs were not provided, but could be calculated where appropriate. For the time to adequate sedation, median values and interquartile ranges were not provided. |
| **C.** | **How can I apply the results to patient care?** | |

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| 1. | Were the study patients similar to my patient? | Likely yes. These were primarily young males with psychiatric or substance-induced agitation requiring chemical restraint in the field. Such patients are commonly encountered in our prehospital system and in our ED. |
| 2. | Were all clinically important outcomes considered? | No. The authors did not look at duration of sedation, need for additional chemical restraint, or ED length of stay, all of which could be affected by the choice of initial agent. |
| 3. | What are the implications of the results? Are the likely treatment benefits worth the potential harm and costs? | The results suggest that use of IM ketamine results in fairly rapid time to adequate sedation at the expense of a seemingly high rate of endotracheal intubation. Unfortunately, this study does not compare outcomes to more traditional sedative agents (e.g. IM haloperidol and lorazepam) and does not look at longer-term consequences such as duration of sedation, time to adequate psychiatric evaluation, or length of stay. Havint said that, IM ketamine is typically very short acting, and would be expected to wear off quickly, though without the antipsychotic benefit of haloperidol. |

**Limitations:**

1. **It is unclear if there were additional patients with acute agitation who received other agents for chemical sedation.**
2. **No details were provided regarding chart review methods were (see Gilbert 1996 and Worster 2004).**
3. **Important statistical methods were either missing or used improperly:**
    a. **No 95% confidence intervals were provided.**
    b. **For time to adequate sedation, a crude mean was given when a median value would have been appropriate (with the corresponding interquartile range).**
4. **This study was comprised of a single arm, and hence does not allow comparison of treatment efficacy or adverse events to traditional methods of chemical restraint.**
5. **Small sample size resulting wide confidence intervals (imprecision).**

**Bottom Line:**

**This small, retrospective, cohort study seems to suggest that use of IM ketamine (4 mg/kg) by prehospital providers results in fairly rapid time to adequate sedation for patients with ExDS with some notable adverse effect (4% requiring endotracheal**

**intubation). The study was limited by small sample size, its retrospective nature, and limited reporting of chart review methods and important statistical details.**