Literature Review and Recommendations

The Use of Ketamine in the Pre-hospital Setting

EMS Bureau Protocol Review Steering Committee

Background

Ketamine was first developed in 1962 and is on the World Health Organization (WHO) Model List of Essential Medications. Ketamine is commonly used for pediatric sedation in emergency or operating room settings prior to painful procedures. The safety profile and effectiveness of ketamine make it a desirable medication for use in the pre-hospital setting. The use of ketamine in EMS has been somewhat limited to sedation for psychosis, other behavioral health issues, and intubation. In 2011, the Committee on Tactical Combat Casualty Care (CoTCCC) added it to the Tactical Combat Casualty Care (TCCC) guidelines and soon after the Defense Health Board authorized it for battlefield/pre-hospital analgesia.[1] The TCCC course is the military counterpart to the Prehospital Trauma Life Support Course. It is designed for military medics, corpsmen, and pararescuemen who are preparing to deploy in support of combat operations.

The health profession, including EMS, has continually sought out the most effective and safe medications for analgesia and sedation. There has been significant interest and activity nationwide in the expanded use of ketamine by EMS.

Ketamine for agitated and/or violent patients, as well as sub-dissociative doses of ketamine for pain, was a topic of discussion at the March 4, 2016 Medical Direction Committee (MDC) meeting.[2] A motion was moved to add ketamine to the paramedic scope of practice. Discussion ensued regarding the concern that emergency department use may not translate to prehospital care and that there must be good evidence-based pre-hospital data to support such a use for ketamine. With the high-risk population of patients who experience excited delirium, there is a need for caution.

Question

There has been an increased interest here in New Mexico for the use of ketamine in ground based EMS agencies. The EMS Bureau is anticipating more applications for this to be a special skill drug. Some have suggested that this should become part of the scope of practice, either as an adjunct to or potential replacement for opioids for analgesia in the pre-hospital setting. Also, there is an interest in utilizing ketamine as part of a rapid sequence intubation (RSI) protocol. RSI is a special skill and will remain so.

The primary question for this review: Is the use of ketamine in the pre-hospital setting for analgesia and sedation safe and effective?

Methods

NMDOH digital library; keywords searched: pre-hospital, ketamine, analgesia, sedation, excited delirium, RSI
Search engine used: PubMed, Clinical Trials
Review process: A review of the literature was conducted using two electronic medical literature databases. Medical Subject Headings, keywords and a pre-hospital search filter were used to yield relevant literature.
Number of articles reviewed: Twelve
Number of articles deemed to be relevant: Five
Types of Articles: One randomized controlled trial; one prospective observational study; three retrospective chart reviews.
Articles cited to draw conclusions and formulate recommendations: Five

Results

Most of the information found in articles and studies regarding ketamine is hospital based. There is a paucity of evidence regarding its use in the pre-hospital setting.

A 2009 study reported ketamine to be a valuable agent for procedural sedation in combative patients, mentally disabled patients and autistic patients who were being transferred via air ambulance from scenes and small hospitals to tertiary facilities. This study suggested that IM ketamine in the prehospital setting is a good choice to gain rapid medical control of patients with potential excited delirium and those exhibiting violent and agitated behavior. The conclusion stated that ketamine sedation is effective and safe in agitated patients with a psychiatric illness in the aeromedical setting and does not lead to worsening agitation in the subsequent 72 hour period.[3]

One small study looked at 13 cases where EMS had administered ketamine for chemical restraint. While the goal of restraint was indeed achieved, the study found that 3 patients developed hypoxia, 2 of which required intubation. Of the non-intubated patients, 3 were diagnosed with emergence reaction, and 5 required additional sedation. The authors' conclusion found that "ketamine's administered by EMS produced moderate or deeper sedation. Respiratory complications included hypoxia, laryngospasm, and hyper-salivation. Emergence reactions occurred in 30% of non-intubated patients" which were treated with further sedation.[4]

Another study performed chart reviews involving the administration of ketamine by Columbus, Ohio Division of Fire EMS caregivers. 35 charts were reviewed, with no patients under the age of 17. The indications for administration were agitation and suspected excited delirium. It is the authors' conclusion of this study that "paramedics reported a subjective improvement in patient condition" for the study's cohort. The author reports that 40% of the patients that received ketamine needed "additional sedation", which includes forcible restraint. Also, 23% of the patients needed endotracheal intubation. [5]

Regarding the use of ketamine for pain control, two articles were reviewed. The first, "Sub-

dissociative-dose intranasal ketamine for moderate to severe pain in adult emergency department patients" studied the effectiveness of sub-dissociative intranasal ketamine as a primary analgesic agent for adult patients. Results of the study showed a relatively low response rate. The authors suggested intranasal or I.V. opioids might be more effective first-line analgesics for adults in the emergency setting and that ketamine may be more effective as an adjunctive therapy for those with poor response to opioids. [6]

One out-of-hospital, prospective, randomized controlled trial of 135 trauma patients compared the analgesic efficacy of IV ketamine vs IV morphine. There was reported better pain control with the ketamine (mean pain score change of -5.6 (95% confidence interval [CI], -6.2 to -5.0) versus -3.2 (95% CI, -3.7 to -2.7) in the morphine group). However, side effects were noted in 27 of 70 patients in the ketamine group compared with 9 of 65 patients in the morphine group.[7]

Discussion

Ketamine is the only dissociative anesthetic agent currently in clinical use. It is structurally related to the street hallucinogen phencyclidine (PCP). Unique features of ketamine, which make it particularly attractive for procedural sedation, include the provision of amnesia, sedation, immobilization and profound analgesia along with limited deleterious effects on hemodynamic and respiratory function. These characteristics allow for the completion of short, painful procedures such as fracture reduction. There is significant research showing the safety and efficacy of ketamine for hospital use, particularly in the pediatric population. Because of rapid growth and popularity in hospital situations, there has been a movement towards using ketamine in the prehospital setting for many different situations. The studies reviewed in this document illustrate a need for more study of the effectiveness and safety in the prehospital setting. The numbers of patients in the studies are small, and the scopes limited. In two of the studies that report "positive" results and conclusions, there were several patients – a significant percentage of the study - that had unexpected and undesired effects from ketamine administration.[4, 5]

There have been promising results from the use of ketamine in agitated and/or violent patients; however, evidence for sub-dissociative doses for pain is still mixed, with significant side effect rates reported. More studies are needed to bring a more complete understanding of the effectiveness and safety of prehospital ketamine usage.

Recommendations

1. **There is not enough evidence to support the addition of ketamine to the New Mexico Scope of Practice.** While there are indeed positive results being reported, there are also areas of concern regarding harmful effects of ketamine.

2. **Ketamine should remain subject to special skill approval, and only at the paramedic level.** Each application for ketamine must be critically reviewed for the applying agency's stated educational plan, indications for use, and data acquisition regarding outcomes. Approved applications should propose a protocol including data acquisition that furthers the evidence and body of knowledge for the prehospital use of ketamine.

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