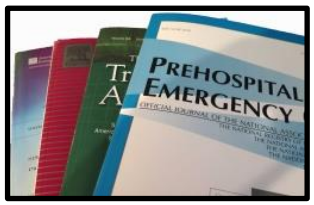
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

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1. **Prehospital traumatic cardiac arrest: a systematic review and meta-analysis.** Vianen NJ, Van Lieshout EMM, Maissan IM, et al. *Europ Jrnl Trauma Emerg Surg* 2022. Open access, available at: https://doi.org/10.1007/s00068-022-01941-y
2. **Etomidate Compared to Ketamine for Induction during Rapid Sequence Intubation: A Systematic Review and Meta-analysis.** Sharda S, Bhatia M. *Indian J Crit Care Med* 2022;26(1):108–113
3. **Controversies and evidence gaps in the early management of severe traumatic brain injury: back to the ABCs.** El-Swaify ST, Refaat MA, Ali SH, et al. *Trauma Surg & Acute Care Open* 2022;7:e000859. Open access, available at: https://tsaco.bmj.com/content/7/1/e000859
4. **The use of the word "quiet" in the emergency department is not associated with patient volume: A randomized controlled trial.** Geller JE, Strickland PO, Bucher JT. *Am J Em Med.* 2022;56:10-12.

1. **Prehospital traumatic cardiac arrest: a systematic review and meta-analysis.** Vianen NJ, Van Lieshout EMM, Maissan IM, et al. *Europ Jrnl Trauma Emerg Surg* 2022.

Great improvements have been made in the prehospital management and survival of medical cardiac arrests in the past decade. However, little has changed regarding survival from traumatic cardiac arrest. Traumatic Cardiac Arrest (TCA) calls are a common EMS response in most areas of the world. Many variables come into play; these include EMS system design (Physician vs. Paramedic vs. EMT), mechanism of injury (penetrating vs. blunt), and transport time to a trauma center.

The authors of this study conducted a systematic review to investigate the reported mortality rate for prehospital TCA, the type of EMS system (physician vs. non-physician), as well as prognostic factors regarding outcome. The authors reviewed 2957 articles, of which 2865 were excluded following the studies parameters which included pediatric patients, military or combat related patients, studies that evaluated a single intervention such as REBOA, and studies prior to 1995. Thirty-six (36) were included in the final review. EMS systems were categorized into physician vs. non-physician systems (10 and 17 respectively) based upon information in the original study.

A total of 51,722 patients, both blunt and penetrating trauma, were included in this review. The reported mortality rate for all prehospital traumatic cardiac arrest was 96.2% (3.8% survival). Favorable neurological outcomes were seen in 43.5% of the survivors. When broken into the study groups mortality rates were 93.9% if a physician was available on scene and 97.6% if no physician was in attendance on scene. Neurological outcomes were favorable in 57% of the patients if a physician was in attendance vs 38% if no physician was on scene. The only factor associated with improved outcome was a shockable initial ECG rhythm.

The authors noted many limitations to the included studies. Data on scene time, time to ROSC, and distance to trauma center were not available for analysis. They also noted that many of the studies used different reporting formats for mortality and neurological outcomes. In addition, the studies combined blunt and penetrating mechanisms which should be analyzed separately.

An overall mortality rate of 96% is not unexpected when dealing with TCA. The breakdown of physician vs. no physician on scene shows slightly better survival when the EMS system included a physician. There could be many explanations for this difference. Was there a difference in time spent on the scene? Was there a difference in interventions performed on scene or en route? Was there a difference in the mechanism of injury? Of the 36 studies included in this paper, only 5 were from the U.S. Physician dominated EMS systems are prominent in Europe while in the USA the systems are primarily non-physician. Mechanisms of injury are also different in that the USA has a higher incidence of penetrating trauma. Future studies differentiating between Physician, ALS Paramedic and BLS EMT EMS systems would provide better insight as to the optimal EMS system structure. The authors appropriately suggest that future studies should also use an Utstein consensus format to allow for more uniform data reporting, thus providing greater strength to the conclusions.

2. Etomidate Compared to Ketamine for Induction during Rapid Sequence Intubation: A Systematic Review and Meta-analysis. Sharda S, Bhatia M. *Indian J Crit Care Med* 2022;26(1):108–113

Rapid Sequence Intubation (RSI) is an increasingly utilized and effective way to gain definitive control of a critically ill patient's airway. Once used exclusively by anesthesiologists, the procedure has found its way into the practice of critical care physicians, emergency physicians, aeromedical providers and emergency medical services' paramedics. The procedure itself involves sedating the patient before introducing a paralytic agent to facilitate intubation. Multiple regimes of medications have been used to accomplish this task. These patients are typically critically ill and often have tenuous vital signs. Oxygen saturation and blood pressure be optimized prior to RSI. It is imperative that the patient remains sedated and receives adequate analgesia pre, during and post procedure.

For years, etomidate has commonly been used as the induction agent of choice. Etomidate restricts neuroexcitation by blocking gamma amino butyric acid (GABA) receptors. Ketamine, a dissociative anesthetic, has gained popularity as an RSI induction agent. Ketamine is an N-methyl- D-aspartate (NMDA) receptor antagonist. Additionally, ketamine is an indirect sympathomimetic, but also has a myocardial depressant effect.

The authors of this paper conducted a literature search for published studies that looked at RSI with ketamine or etomidate as induction agents given by emergency physicians, aeromedical services and emergency medical services. This systematic review and meta-analysis attempted to determine which of the two commonly used induction agents had the least post intubation effect on hypotension and secondarily, had the better first pass intubation success rate

They initially identified 84 articles. After culling out duplicate articles, reviewing and excluding articles based on abstract description and then full article content, nine articles remained and were included in their meta-analysis.

Six of the studies, totaling 12,060 patients, looked at the incidence of post-induction hypotension (< 1 hour to 24 hours). Etomidate had a significantly lower incidence of post-induction hypotension than ketamine when given as the induction agent for RSI (OR: 0.53; 95% CI: 0.31–0.91; p = 0.02). Patients included had a systolic blood pressure of 100 mm/hg or higher pre-induction.

Seven of the studies, totaling 15,574 patients, examined first pass intubation success rate with either ketamine or etomidate as the induction agent. The authors report no difference in first pass success rate with either induction agent (OR: 1.13; 95% CI: 0.95–1.36; p = 0.17).

Limitations of this review include that there was no analysis of clinician skill or of which paralytic agent was used when evaluating first pass success rate. In addition, only two of the studies included in the analysis were randomized controlled studies with the remainder being retrospective reviews that had small sample sizes.

Endotracheal intubation in general and RSI specifically are frequently debated skills for pre-hospital providers. For systems that use RSI, it is crucial that providers think long term about patient care and not just focus on the skill of passing an endotracheal tube. They should know the long terms effects of the medications they use and the consequences of those choices for their patients. Post RSI hypotension should be considered when choosing induction medication. Additionally, providers should look to see what, if any, effect their choice of paralytic, and post-intubation sedatives and analgesics will have on their critically ill patient's outcome.

3. Controversies and evidence gaps in the early management of severe traumatic brain injury: back to the ABCs. El-Swaify ST, Refaat MA, Ali SH, et al. *Trauma Surg & Acute Care Open* 2022

Thirty percent of all trauma deaths result from traumatic brain injury (TBI). There has been a significant increase in these injuries and deaths underscoring the importance of improving care and outcomes. In this narrative review the authors sought to outline controversies in the early care of TBI's that were not settled by the publication of the Brain Trauma Foundation's 4th edition Guidelines for the Management of Severe Traumatic Brain Injury, published in 2017. They organized the discussion into categories as follows:

- Prehospital transport,
- Airway and cervical spine,
- Breathing and ventilation,
- Circulation, which includes optimizing circulation, cardiovascular physiology, the optimal resuscitation fluid, the utility of blood products, antithrombotics and their reversal, and tranexamic acid, and
- Difficult neurological decisions (which does not apply to EMS).

While many of the discussion points were focused on in-hospital care, there were a number of important considerations for EMS providers.

Prehospital Transport:

While several studies have shown that helicopter transport has better outcomes when compared with ground ambulance transport, helicopter transport had longer prehospital times. The impact of confounders such as crew configuration and capabilities is not clearly understood. This casts some doubt on the value of Helicopter transport itself in improving outcomes.

Airway and Cervical Spine:

Hypoxia is a known predictor of poor outcome. One would think that endotracheal intubation (ETI) would have a positive effect on resolving for hypoxia and thereby improve outcomes. While one study demonstrated improved neurological outcomes with ETI, there was no improvement in survival. Several recent studies have shown just the opposite, with ETI requiring longer prehospital times and ultimately reduced survival. The authors opined that the difficulty of intubation in these patients may have contributed to longer periods of hypoxia and regional differences in protocols, training and expertise might also play a role. For this reason, they suggest that basic airway management with facemasks and supraglottic airways may improve outcomes.

In patients with blunt trauma and TBI, cervical spine injuries also occur. Cervical collars are known to affect intracranial pressure by increasing jugular venous pressure, however the clinical effect of this increase on outcome is not well established. In addition, it is necessary to remove the anterior portion of the collar in order to intubate a patient while at the same time providing manual in-line stabilization. Video laryngoscopy and modified blades, if available, are reasonable alternatives. Lastly, they suggest that in cases where intubation has failed or access to the airway is limited, surgical airways should be considered.

Breathing and ventilation:

Adequate oxygenation must be maintained while avoiding hyperventilation. Normocapnia should be the goal except when mild hyperventilation (PCO2 30-35 mm Hg) is needed

Circulation:

- **Optimizing cardiovascular physiology**

Hypotension in TBI patients is a known cause of increased mortality. A single episode of hypotension (SBP<100) was found to double the odds of death which increased to 6-times the death rate when the SBP<70. There have been recent studies and calls for increasing the suggested SBP target in patients with TBI to a SBP≥110.

A concern was raised that "permissive hypotension" protocols used for multi-trauma patients will have an adverse effect on mortality of TBI patients. Multiple trauma patients with TBI should have their SBP maintained at >100 to minimize the deleterious effect of lower SBP on the TBI and to strike a balance with the need to avoid over-resuscitation fo the trauma victim.

- **The optimal resuscitation fluid**

The best prehospital fluid for the TBI patient remains a subject of controversy. Albumin (colloid), once thought to be the answer, actually had worse outcomes in TBI patients. The crystalloid comparison (Ringer's lactate versus normal saline) remains a controversy. One study showing increased mortality with the use of Ringer's despite no differences between it and saline detected in biochemical or physiologic parameters. Hypertonic saline and its promise of volume expansion and cerebral edema reduction has no evidence of improved outcomes.

- **Utility of Blood products**

Some of the evidence suggests that specific patients may benefit but further study will be needed to draw that out.

- **Pre-injury antithrombotics**

An increasing number of brain injured patients are on anticoagulants or antiplatelets. Knowledge of the possible ways to counteract the effects of these drugs is important in the hospital, although the benefit to these strategies is as yet unclear,

- **Is Tranexamic Acid the solution?**

The evidence is clear that TXA should be administered within 3 hours of injury in patients with extracranial bleeding (thorax, abdomen), however, when dealing with isolated TBI, the evidence is not as clear. Additional well-designed randomized, clinical trials are need to determine the role of TXA in TBI.

Limitations:

This paper is a narrative overview of the various topics related to the management of the TBI patient. It represents the authors subjective assessment of the issues and is therefore subject to their biases.

Summary:

This review points out the lack of hard science to support making significant changes in prehospital TBI care. While there are ideas that show promise, the evidence to implement them remains lacking. What is known and clearly important is that to optimize outcome from TBI it is essential to avoid episodes of hypoxia and hypotension and to critically monitor CO2 levels.

4. The use of the word "quiet" in the emergency department is not associated with patient volume: A randomized controlled trial. Geller JE, Strickland PO, Bucher JT. *Am J Em Med.* 2022;56:10-12.

"It sure is quiet" is one of the most dreaded phrases uttered in the emergency medical world. The provider immediately pictures impending chaos and overwhelming patient volume replacing an otherwise tranquil shift once these words are spoken. This myth has been perpetuated through generations of healthcare workers but has surprisingly rarely been studied.

The authors conducted a randomized controlled trial at a major tertiary care facility with a level one trauma center. Over 400 members of the emergency department (ED) were surveyed over a 30-day period. The trial covered 47 shifts throughout the entire 24-hour period. A random number generator generated a "1" or a "2." If a "1" was selected the investigator asked the ED

staff member "Has it been quiet in here?" If a "2" was selected the investigator greeted the ED staff member without saying the phrase. Three hours later that ED staff member was administered a survey with three questions using a visual analog scale (VAS) of 0-100 (similar to a scale used for patients to rate their pain from 0-100 after anesthesia). The three questions the study participants answered on 0-100 scale on the survey were:

1. Where would you say is your feeling toward how crowded the emergency department is?
2. Where would you say is your feeling toward how many patients have entered the ER over the past few hours?
3. Where on this scale is your belief that the use of the word "quiet" subsequently plays a role in how busy the rest of the day gets?

On the days when the word "quiet" was used, those staff members who already believed that the use of the word increased volume (question 3) were more likely to believe that it actually did despite evidence to the contrary. There was no association with a perceived increase in volume when the word was not used. The use of the word was not associated with a statistically significant actual increase in patient volume.

Limitations to the study include the same researcher conducting the interviews, so the individual became associated with the use of the word "quiet." Some staff members were studied more than once since as many members as possible were included in the survey. This is a single-site study and may not apply to every hospital.

In summary, the use of the word "quiet" was not associated with an actual increase in patient volume in the emergency department. Those with a preconceived bias against the word perceived an increase in volume regardless, while those who did not believe the superstition were unaffected by the use of the word. Finally, while this was an ED study, it no doubt applies to those who work in the prehospital setting, although a formal study would be needed to confirm it.