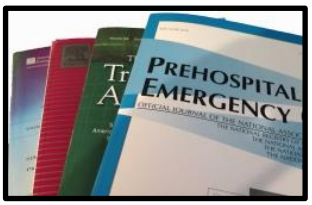
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

Vol. 6.1

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1. Patterns of change in prehospital spinal motion restriction: a retrospective database review.

McDonald N, Kriellaars D, Pryce RT. *Acad Emerg Med* 2023;30:698-708

Beginning in the 1960's, emergency medical services (EMS) personnel were taught to perform spinal immobilization (SI) by using a cervical collar and straps to hold the patient on a long backboard. They were often instructed to immobilize all patients who could potentially have a spine or spinal cord injury based upon clinical findings or the mechanism of injury alone. In the early 1980's, the PreHospital Trauma Life Support (PHTLS) and other educational programs still utilized spinal immobilization but emphasized that life threatening conditions took precedence over potential spine / spinal cord injuries. Over time, critics noted that there was little evidence demonstrating the efficacy of spinal immobilization and focused on potential complications of this procedure, including pain/discomfort, respiratory compromise and pressure ulcers. In 2000, the National Emergency X-Radiography Utilization Study (NEXUS) was published which provided a scientific underpinning for "clinical clearance" of the cervical spine without diagnostic imaging, providing the patient met certain criteria.

Over the next few years, these NEXUS criteria were incorporated into prehospital care guidelines, which aided EMS personnel regarding the decision to apply spinal immobilization. Realizing that complete immobilization was virtually impossible to achieve, the term "spinal motion restriction" (SMR) largely replaced spinal immobilization. Additional data demonstrated that victims of penetrating trauma, unlike those of blunt trauma, rarely suffered unstable injuries to their spine that could subsequently damage the spinal cord if manipulated. Therefore, experts concluded that spinal motion restriction was rarely indicated for patients with penetrating trauma. More recent position statements from professional organizations have noted that spinal motion restriction can be accomplished satisfactorily using methods other than a long backboard.

In this current study, McDonald and colleagues examined the practice of spinal immobilization over a nearly 11 year period (April 2009 – February 2020) in a single Canadian EMS agency (Winnipeg Fire Paramedic Service). The time period was determined by the initial availability of electronic patient care

records (ePCRs) until the outbreak of the COVID-19 pandemic. In March of 2009, the agency implemented a selective spinal immobilization protocol based upon NEXUS. In July 2012, the ePCR was modified to require the paramedic to enter the indication for applying SMR. In November 2014, cases involving isolated penetrating trauma were exempted from the SMR protocol. In late 2016 the EMS providers acquired the option to manage patients in need of SMR with only a cervical collar, rather than in conjunction with a long backboard.

This study consisted of a retrospective review of select ePCRs during three periods: 1) April 2009 to July 2012 (change in documentation requiring indication for SMR), July 2012 to April 2016 (protocol change to permit only cervical collar). Because of the low number of penetrating trauma victims, these cases were felt not to impact results. The primary outcome was the rate of SI/SMR during the study period, calculated a monthly rate (April and October for each year) expressed by the number of instances of SI/SMR per 100 trauma calls. Associations between treatment practices and patient characteristics were also examined by dichotomizing key treatments including immobilization choice (collar versus board and collar), patient position (supine versus all others) and cervical collar size (no-neck versus all others). The study was approved by the local research ethics review board and the primary investigator received funding in the form of a graduate fellowship from the University of Manitoba.

After removing duplicate cases, the study population included 25,747 cases of SI/SMR out of 141,445 trauma calls. This group had a median age of 40 years and were 58% male. Twenty percent of the patients were considered high acuity. The rate of treatment with SI/SMR decreased significantly during the first two time periods, but not during the third. There was a significant increase in the rate of SI/SMR of 5.8 treatments per 100 trauma cases associated with the documentation change; that is, despite a decrease in rate over the first period, once providers were mandated to document the indication for SI/SMR, the rate jumped back up, and then declined again over the second time period. Regarding mechanism of injury, falls and MVCs were most common (23% each), followed by assaults (15%) and sports (2%). At the beginning of the third period, 47% of patients receiving SI/SMR were treated with only a cervical collar. This rate increased by about 6.3% per year, rising to 60% in 2020. Changes in patient positioning were noted throughout the entire study period, with the supine position decreasing on average by about 3.1% per year, while the use of semi-Fowler's position increased from 0.8% in 2009 to 25% in 2020. Collar-only treatment was significantly associated with low-acuity cases (OR 3.01, 95% CI 2.64 – 3.43).

In their discussion, the authors point out that adoption of a selective spinal immobilization policy just prior to the start of the study could explain some decrease in SI/SMR, however the decease continued to the middle of the study period where an apparent floor effect was noted during the second half of the study period. Similarly, a protocol change that allowed for collar-only SMR would expect some increase over time, but not for years. The investigators postulate that these results reflect changing attitudes of front-line providers, perhaps being slow to adopt selective spinal immobilization or a collar-only approach.

One positive outcome noted herein is the use of less SI/SMR, especially among those with lower acuity. It is these patients who most benefit from selective spinal immobilization protocols. Despite this, the study is disappointing for several reasons. There is no mention of the rate of SI being performed in the system prior to the adoption of the selective spinal immobilization protocol, so we do not really see the true effect of this protocol change. Most likely, this is the result of a lack of ePCRs prior to the start of the study. While the data in the study supports my personal observations (decrease in the use of SI/SMR over time), witnessed in several different EMS systems, it didn't address two of the key issues in prehospital care: are selective spinal immobilization protocols being applied appropriately by EMS providers and are patients being harmed by this change in practice? The answer to these questions would most likely require prospective data collection rather than a retrospective approach.

Another concern is that EMS providers may have been notably influenced by the vocal critics of SI/SMR to the point where they are becoming complacent and minimizing appropriate indications for this treatment. Despite these concerns, emergency and trauma providers have not noted a marked increase in unstable spine injuries in patients transported without SI/SMR performed by EMS. While this study confirmed some anecdotal observations, it has raised more questions than it answered.

2. Risk of Harm in Needle Decompression for Tension Pneumothorax. Thompson P, Ciaraglia A, Handspiker E, et al. *J Spec Oper Med* 2023;23(2):9-12.

The United States military's Tactical Combat Casualty Care (TCCC) and the civilian version Tactical Emergency Casualty Care (TECC) guidelines stress the early recognition and treatment of the three leading causes of preventable death. The leading cause of preventable death remains uncontrolled hemorrhage, followed by airway obstruction and then tension pneumothorax. For tension pneumothorax, providers are taught to decompress the effected pleural space with a needle thoracentesis, commonly referred to as a Needle Decompression (NDC)). The needle of choice for this procedure is a 10- or 14-gauge catheter 83 mm (3.26 inches) long. Recently, TCCC now recommends the 4th or 5th intercostal space (ICS) in the Anterior Axillary Line (AAL) location for NDC in addition to the 2nd ICS, mid clavicular line (MCL) to. TCCC teaches to insert the needle to the hub and hold it in place for 5 – 10 seconds to allow the air in the pleural space to escape and decompress the tension pneumothorax. The 4th and 5th ICS AAL was chosen to facilitate ease of access for a patient wearing body armor covering the chest and for the lesser degree of chest muscle mass in that location.

The authors of this paper investigated the probability of an 83 mm (3.26 inch) needle inserted to the hub at the left 4th or 5th intercostal space AAL reaching and injuring the patient's pericardium. This dual institution review board waived, retrospective study was conducted at two American College of Surgeon's verified Level 1 adult trauma centers. Trauma registries at these two centers were searched for chest CT scans of adult patients (age 18 to 40) with a body mass index (BMI) equal to or less than 30, who experienced a traumatic injury between 1 January 2016 and 1 January 2012. Patients with intrathoracic masses or lesions were excluded from the sample group. At each institution, one surgeon collector reviewed the CT scans. An independent third surgeon reviewed the process to ensure data were collected the same way by each surgeon. The surgeons measured the chest wall thickness at the 2nd ICS MCL and at the 5th ICS AAL. Patient demographics were also collected.

The initial sample group was randomly culled to 100 patients from each institution for inclusion in the final study group. The median age for patients was 27 years. The median BMI was 23.8. Male patients comprised 69.5% of the study group. The mean 2nd ICS MCL chest wall thickness was 38 mm (1.5 inches) and at the 5th ICS AAL the chest wall thickness was 30 mm (1.2 inches). The 5th ICS AAL median skin to pericardium distance was 66 mm (2.6 inches).

This study demonstrated the potential for pericardial injury when an 83 mm (3.26 inch) needle is inserted and "buried to the hub" on the left side of the chest in the 5th ICS AAL. The authors also expressed concerns that leaving the needle in place for the TCCC recommended 5-10 seconds could increase the chance of cardiac injury due to the pericardium rubbing against the sharp metal edge of the needle. It was further noted that removing the needle sooner, leaving the only plastic catheter in place, could potentially reduce the potential for a tissue plug remaining in the needle post insertion, blocking air escape from the pleural space.

The authors identified several limitations of their study. This study was conducted using civilian data. Military studies are based on the physical conditioning of a solely military cohort. CT scan procedures at both facilities were similar but may have varied slightly altering results. It should also be noted that while this was a multi-center study, it was retrospective in nature and only included 200 patients.

All prehospital providers should identify and treat life threatening injuries. Tension pneumothorax remains a preventable cause of death with needle decompression being an accepted prehospital treatment option. The recommendation that the decompression needle routinely be inserted to the hub should be re-examined given the findings of this study. Options for field providers to prevent organ injuries when performing NDC include looking and listening for other indicators that the needle has reached the pleural space (air bubbles in a saline filled syringe attached to the decompression needle and aspirated on insertion, or the sound of air escaping as the needle is inserted). Providers should look at the body habitus of the patient and make a reasonable assumption as to the risk of injury to vital organs when blindly "hubbing" an 83 mm (3.26 inches) needle into a patient's chest wall.

3. Video versus Direct Laryngoscopy for Tracheal Intubation of Critically Ill Adults. Prekker ME, Driver BE, Trent SA, et al. *N Engl J Med.* 2023; 389(5):418-429.

Endotracheal intubation is one of the most common procedures performed in the emergency department and intensive care setting. Failure to intubate the trachea on the first attempt occurs in 20-30% of intubation attempts in the emergency department (ED) or intensive care unit (ICU) and is associated with an increased risk of life-threatening complications.

Two types of laryngoscopes are used for intubation: direct and video. A direct laryngoscope, handle, blade and light, is the traditional tool used for intubation in the hospital and pre-hospital setting. The operator directly visualizes the displacement of the tongue and epiglottis to view the vocal cords. The video laryngoscope utilizes the same components as the direct laryngoscope except it also includes a camera positioned in the distal half of the blade and transmits a video signal to a screen. The clinician can then guide the endotracheal tube through the vocal cords without a direct line of sight from the mouth. Use of video laryngoscopy is increasing as the technology continues to improve. Additionally, the COVID-19 pandemic increased use of video laryngoscopy as the clinician is not required to be close to the patient's oropharynx to successfully intubate.

Several single-center trials and one moderate-sized multicenter trial have compared the two intubation techniques with varying results. This trial, called the Direct versus Video Laryngoscope (DEVICE) trial hypothesized that the use of a video laryngoscope would result in a higher incidence of successful intubation on the first attempt.

The DEVICE trial was a multicenter, unblinded, randomized trial in which the use of a video laryngoscope was compared to a direct laryngoscope for tracheal intubation in adults. It involved 17 sites, including 7 ED's and 10 ICUs in 11 medical centers across the United States. Only adults aged 18 years and over were included. The protocol did not specify a particular brand of laryngoscope to be used or style of blade (Macintosh or Miller). At all trial sites, a stylet or bougie was routinely used. Waveform capnography or colorimetric end-tidal carbon dioxide detection was used to confirm placement of the endotracheal tube. The primary outcome was successful intubation on the first attempt. Severe complications within the first two minutes of intubation were tracked, and included severe hypoxemia (saturation < 80%), severe hypotension (systolic blood pressure < 65 mm Hg), new or increased use of vasopressors, cardiac arrest, or death. Pre-trial statistical analysis estimated 2000 patients would need to be enrolled (1000 per group) to adequately power the study. An interim analysis of the data was planned halfway through the study to assess for early significant difference in outcomes.

The most common indication for intubation was altered mental status (45% of patients) and acute respiratory failure (30% of patients). In total, 91.5% of the intubations were performed by an emergency medicine resident or critical care fellow. They had performed an average of 50 previous intubations. Successful intubation on the first attempt without severe complication occurred in 69% of the video-laryngoscope group and 59% of the direct-laryngoscope group. Failure of first attempt intubation due to an inadequate view of the vocal cords occurred in 4% of the video group and 17% of the direct group.

The study was stopped early because the interim analysis clearly showed a benefit in the use of video laryngoscopy for first time intubate rate. Successful intubation occurred in 425 of 494 (86%) of patients in the video group and 365 of 506 (72%) of patients in the direct group. These results were statistically significant ($p<0.001$).

This study has some limitations. The study occurred in the ED and ICU, so may not directly apply to the prehospital setting. The results cannot be used to decide whether one brand or blade shape is preferable over another. Among the clinicians, 97% had performed fewer than 250 intubations, so the results may not be applicable to those with more experience.

This trial demonstrates the superiority of video laryngoscopy over direct laryngoscopy in the intubation of critically ill adults in the ED and ICU settings. Additional studies are needed to see if these results are applicable in the prehospital setting. Intuitively one could assume that the medic intubating in the prehospital setting, in which the conditions are usually much more challenging those in the hospital, would benefit from the use of video laryngoscopy.

4. **Community paramedicine in Central Oregon: A promising model to reduce non-urgent emergency department utilization among medically complex Medicaid beneficiaries.** Currier J, Wallace W, Bigler K, O'Connor M, Farris P, Shannon J. *JACEP Open 2023;4:e12988.* Full text available at https://doi.org/10.1002/emp2.12988

The advent of mobile integrated healthcare (MIH) and the use of community paramedics (CP) has emerged as a needed resource for the care and appropriate redirection of patients suffering from many forms of non-emergency physical and behavioral health issues in the United States. Many studies have demonstrated the benefits of CP in decreasing hospital readmissions, emergency department visits and behavioral health diversions, however the majority of these studies have taken place in larger urban centers. Little research has studied the use of MIH or CPs in the rural setting.

The authors of this prospective randomized study investigate the use of CPs in a rural region in central Oregon. The endpoint of the study was to examine avoidable Emergency Department (ED) visits after the implementation of CPs for a group of patients with previously high ED usage. Avoidable admissions were defined as non-emergent medical care that could be obtained at a primary care facility.

A total of four (4) clinics belonging to the regional healthcare system were used in the selection of patients for the study. Enrollment of the 102 participants in the study required them to be 18 years of age or older, a recipient of Medicaid and discharged from the Emergency Department (ED) within the last 24 hours. Patients who were receiving hospice or home healthcare services were excluded from the study. Patients who met the inclusion criteria were recruited for the study and could opt out at any time. The demographic mix of patients enrolled matched the makeup of general population of the region.

Two (2) community paramedics were trained and worked independently with each assigned a group of participants at home in a non-urgent setting. Each patient participant received five (5) home visits over a 3-month period. On the first visit CPs reviewed hospital discharge instructions, medications and dosing, and a home safety, nutritional and social review. A complete physical examination was performed and comprehensive documentation including appropriate data points. This study demonstrated a 13.9% reduction in avoidable ED visits.

Integration of CPs into general non-emergent healthcare has become a significant segment of care in many communities, mostly in urban areas. While many programs target specific populations and have different goals (behavioral health, re-admission reduction or decreased ED visits), it is clear that these interventions work. This particular study is interesting as it examines CPs being used in rural areas. While there is a demonstrated value to the use of CPs, future consideration must be given to funding of these services if widespread integration is to take place. In this study situation the primary

financial beneficiary to the reduction of ED visits is the hospital system, not the EMS system which does not get reimbursed for care provided in the home but rather only when transport occurs. This study did not investigate whether or not there was a reduction in EMS activations and transports. EMS systems need to be compensated for providing this out-patient care to the community which results in financial reductions in overall healthcare cost and also better patient care.