Effect of System-Wide Interventions on the Assessment and Treatment of Pain by Emergency Medical Services Providers

Kari B. Haley MD, E. Brooke Lerner PhD, Clare E. Guse MS & Ronald G. Pirrallo MD, MHSA

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EFFECT OF SYSTEM-WIDE INTERVENTIONS ON THE ASSESSMENT AND TREATMENT OF PAIN BY EMERGENCY MEDICAL SERVICES PROVIDERS

Kari B. Haley, MD, E. Brooke Lerner, PhD, Clare E. Guse, MS, Ronald G. Pirrallo, MD, MHSA

ABSTRACT

Background: An estimated 20% of patients arriving by ambulance to the emergency department are in moderate to severe pain. However, the management of pain in the prehospital setting has been shown to be inadequate. Untreated pain may have negative physiologic and psychological consequences. The prehospital community has acknowledged this inadequacy and made treatment of pain a priority. Objectives: To determine if system-wide pain management improvement efforts (i.e. education and protocol implementation) improve the assessment of pain and treatment with opioid medications in the prehospital setting and to determine if improvements are maintained over time. Methods: This was a retrospective before and after study of a county-wide prehospital patient care database. The study population included all adult patients transported by EMS between February 2004 and February 2012 with a working assessment of trauma or burn. EMS patient care records were searched for documentation of pain scores and opioid administration. Four time periods were examined: 1) before interventions, 2) after pediatric specific pain management education, 3) after pain management protocol implementation, and 4) maintenance phase. Frequencies and 95% confidence intervals were calculated for all patients meeting the inclusion criteria in each time period and Chi-square was used to compare frequencies between time periods. Results: 15,228 adult patients transported by EMS during the study period met the inclusion criteria. Subject demographics were similar between the four time periods. Pain score documentation improved between the time periods but was not maintained over time (13% [95%CI 12–15%] to 32% [95%CI 31–34%] to 29% [95 CI 27–30%] to 19% [95%CI 18–21%]). Opioid administration also improved between the time periods and was maintained over time (7% [95%CI 6–8%] to 18% [95%CI 16–19%] to 24% [95%CI 22–25%] to 23% [95% CI 22–24%]). Conclusions: In adult patients both pediatric-focused education and pain protocol implementation improved the administration of opioid pain medications. Documentation and assessment of pain scores was less affected by specific pain management improvement efforts. Key words: emergency medical services; emergency medical technicians; pain; clinical protocols

INTRODUCTION

Patients presenting in pain to the emergency department is a varied but common occurrence. It is estimated that nearly 1 in 5 patients transported by prehospital personnel are in moderate to severe pain. Fortunately, it has been well documented that the treatment of pain is inadequate in the prehospital setting. The prehospital setting is a unique environment for the initiation of pain management in the acutely ill patient, and emergency medical services (EMS) providers could be a key player in reducing the time to pain treatment. Reduced time to pain treatment may contribute to the avoidance of the detrimental physiologic effects caused by pain.

It has been well documented that pain can cause both an emotional and physiological toll on the body resulting in significant morbidity. Studies have shown that long-term consequences of pain and changes in the body’s perception of pain occur soon after injury. Opioid pain medications work by blocking the perception of pain via inhibition of the release of neuropeptides mediating the body’s response. This provides both the emotional and physiologic relief from acute pain for patients.

The under-assessment and under-treatment of pain has been examined by researchers in the past. They have identified specific barriers to EMS personnel assessing and treating pain. These include limited education, inadequate pain assessment tools, lack of pain management treatment protocols, and attitudes regarding pain management. Acknowledging this deficit, professional organizations have made statements emphasizing the need for both the assessment and management of pain in the prehospital setting. In 2001, The Joint Commission and Accreditation of Healthcare Organizations (JCAHO) highlighted pain management as a standard of care for patients while in the hospital. Furthermore, the National Association of Emergency Medicine Service Physicians published a position paper in 2003 that stressed the importance of prehospital involvement in the management of pain, stating “…the relief of pain and suffering of patients must be a priority for every emergency medical services (EMS) system.”

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Address correspondence to E. Brooke Lerner, PhD, Medical College of Wisconsin, 9200 W. Wisconsin Ave., Milwaukee, WI 53226, USA. E-mail: eblerner@mcw.edu

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In order to improve pain management, Milwaukee County Emergency Medical Services (MCEMS) System implemented multiple interventions. In 2006, pediatric-specific pain modules were given to prehospital providers which included lectures regarding pain assessment tools in the pediatric population and the use of opioid pain medications. Case-based scenarios and small group discussions amongst providers were also incorporated to facilitate learning. This was a multi-day encounter required for all MCEMS providers. Module 1 consisted of content within a PowerPoint presentation and Module 2 consisted of case-based learning opportunity. The pediatric-specific pain modules were part of a project developed in Milwaukee for a Health Resources and Services Administration sponsored EMS for Children Targeted Issues Grant. In February 2008, a pain management protocol was implemented to create a systematic approach to the management of pain for all age groups (Figure 1). Prior to implementation of the pain management protocol, MCEMS providers did not have any explicit direction for the treatment of pain. Pain management was addressed within protocols for specific working assessments (e.g., angina/MI, burns, trauma) where personnel were directed to “consider pain management” within the respective protocols. The pain management protocol defined a treatment strategy for paramedics if patients were in pain with a working assessment of “candidate for narcotic pain management” (Figure 1).

The objective of this study was to evaluate these system changes within Milwaukee County EMS by determining if these interventions improved the assessment and treatment of pain for adult patients in the prehospital setting. Specifically, we compared pain assessment and treatment in adults before and after each system change.

METHODS

This study was a before and after retrospective chart review, that evaluated system changes that took place to improve prehospital patient pain management. It was approved with a waiver of consent by the local institutional review board at the Medical College of Wisconsin.

Setting

Milwaukee County Emergency Medical Services (MCEMS) covers approximately 241 square miles and has a population of approximately 900,000. MCEMS uses a tiered fire-based response system that is made up of Basic Life Support (BLS) ambulances or fire trucks that have an average response time of 5 minutes and Advanced Life Support (ALS) ambulances that have an average response time of 9 minutes. Over the study period all EMS agencies in Milwaukee County were required to submit standardized patient care data to a county wide medical record database using a scannable paper patient care report. During the study period some agencies started to use electronic medical records but all were required to collect the same standardized variables that were included in both scannable paper and electronic formats.

In 2006 all Milwaukee County paramedics were provided with specific education on pediatric pain management (as previously described). This was done during a required continuing medical education conference for paramedics and was approximately 60 minutes long. This conference was given multiple times in person. Further in 2008 a specific pain treatment protocol was implemented within the EMS system.

Study Inclusion

This study included any patient 18 years or older transported by MCEMS between February 1, 2004 and February 29, 2012 with a working assessment of trauma or burn. The study population was divided into four phases. Phase 1 (February 1 2004–January 31 2006) encompassed the time period prior to any interventions. Phase 2 (February 1 2006–February 13 2008) encompassed the time after the pediatric specific pain education was provided. Phase 3 (February 14, 2008–February 28 2010) was the time period after the implementation of a new pain management protocol. Phase 4 (March 1 2010–February 29 2012) was our maintenance phase after all interventions were in place.

Data Abstraction

EMS patient records for all included patients were electronically reviewed to determine if the fields for initial and/or final pain score were documented. These fields were part of the patient care record (PCR) although providers are not forced to include data in these fields for every patient. The records were also searched to determine if an IV opioid pain treatment was provided. At the time of this study the only approved analgesia treatment was by an intravenous route. Further, basic descriptive variables and vital signs that were decision points of the pain protocol were also electronically abstracted.

Data Analysis

Data were analyzed using Stata version 13.0. The percent of patients who had pain score documentation (either initial or final) and narcotic pain medication administration was then calculated and Chi-squared
Figure 1. Milwaukee County Pain Management Protocol 2008.

Notes:
- Goal is to reduce pain scale score below 4
- IV, IM, SQ, IO routes acceptable for administration of morphine
- ALS transport is required for all patients receiving morphine
- If unable to acquire BP secondary to uncooperative patient due to painful condition, may administer morphine if no clinical evidence of shock AND if GCS is 14 or greater
- 2-24.1
analysis was used to compare across the study time periods. In addition, because the pain protocol required patients to have a pain score greater than 4, a subanalysis was performed for the patients who had a recorded pain score greater than 4, comparing the percent who received narcotic pain treatment across the four time periods. We also compared narcotic administration across the 4 time periods for those patients who were documented as meeting the other criteria for pain management (i.e., GCS score greater than or equal to 14, systolic blood pressure greater than or equal to 90 and oxygen saturation at least 94%; Figure 1).

### RESULTS

A total of 15,228 adults transported by Milwaukee County EMS had a working diagnosis of trauma or burns during the study period and were included in this study. Patient demographics were comparable across each study phase (Table 1). In all phases, blunt trauma was the most common working assessment and males outnumbered females. The average age in all phases was relatively young. An increasing number of patients met our inclusion criteria between the study time periods. Also, females made up an increasing proportion of the population over time.
Documentation of vital signs was good for systolic blood pressure but SPO2 and GCS were poorly documented (Table 2). Recording of vital signs were variable depending on the specific vital sign.

Across the four study phases, documentation of pain score was poor, but a large increase after the interventions occurred that was not sustained over time (Table 3). Opioid administration increased with both interventions and the increase in treatment was sustained over time (Table 4). Although, the population was relatively small, there were similar findings for the group of patients who were documented as meeting the protocol for pain treatment. It is of note that even in this group during the maintenance phase nearly half of all eligible patients were treated with opioids.

**DISCUSSION**

Our results indicate that education on use of pain scores and initiation of a pain management protocol improves documentation of pain scores but that improvement was not maintained over time. In contrast, treatment of pain improved significantly with the interventions and was maintained over time. These findings contrast with a previous state-wide 12-month study that found no improvement in documentation of pain scores or opioid administration pre-and post-implementation of a state-wide pain management protocol. This may be due to our more localized approach or to our broader approach which included both protocol changes and provider education.

While the pain score documentation results are disappointing, it is possible that providers were assessing pain more frequently, but failed to improve on documentation. Perhaps pain scores were considered for these patients but not documented or not assessed using a formalized score. Alternatively, it has been shown that the assessment of pain in trauma patients is extremely low, because it is not perceived as a priority in the management of the patient. The importance of
Table 4. Opioid Administration

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Opioid Administered</td>
<td>209/3047 (6.86%)</td>
<td>763/4357 (17.51%)</td>
<td>859/3642 (23.59%)</td>
<td>966/4182 (23.10%)</td>
<td>p &lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td>(95% CI: 6.01–7.81%)</td>
<td>(95% CI: 16.41–18.67%)</td>
<td>(95% CI: 22.23–24.99%)</td>
<td>(95% CI: 21.85–24.40%)</td>
<td></td>
</tr>
<tr>
<td>Documented Pain ≥4 and Opioid Administered</td>
<td>110/360 (30.56%)</td>
<td>590/1273 (46.35%)</td>
<td>532/926 (57.45%)</td>
<td>357/716 (50.07%)</td>
<td>p &lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td>(95% CI: 26.01–35.52%)</td>
<td>(95% CI: 43.62–49.10%)</td>
<td>(95% CI: 54.24–60.60%)</td>
<td>(95% CI: 46.40–53.74%)</td>
<td></td>
</tr>
<tr>
<td>Documented Vital Signs that Met Criteria and Opioid Administered</td>
<td>70/888 (7.88%)</td>
<td>247/1328 (18.60%)</td>
<td>281/1173 (23.96%)</td>
<td>316/1223 (25.84%)</td>
<td>p &lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td>(95% CI: 6.28–9.85%)</td>
<td>(95% CI: 16.60–20.78%)</td>
<td>(95% CI: 21.60–26.48%)</td>
<td>(95% CI: 23.46–28.37%)</td>
<td></td>
</tr>
<tr>
<td>Pain ≥4, Documented Vital Signs that Met Criteria and Opioid Administered</td>
<td>45/163 (27.61%)</td>
<td>194/463 (41.90%)</td>
<td>169/321 (52.65%)</td>
<td>89/166 (53.61%)</td>
<td>p &lt; 0.0005</td>
</tr>
<tr>
<td></td>
<td>(95% CI: 21.27–35.00%)</td>
<td>(95% CI: 37.48–46.46%)</td>
<td>(95% CI: 47.16–58.07%)</td>
<td>(95% CI: 45.97–61.09%)</td>
<td></td>
</tr>
</tbody>
</table>

Pain management in this population was highlighted in the development of an evidence-based guideline for prehospital pain control published in 2013. These recommendations were created by a panel made up of multi-disciplinary stakeholders and were based on the available literature for pain assessment and narcotic medication administration. Given the patient mix it is possible that certain subjects were unable to verbalize a pain score for providers to document due to altered mental status or distracting injuries. This may have diminished the difference between the two groups leading to our results not reaching statistical significance although a very modest improvement in documentation was observed. Regardless it will be important to work with providers to determine their reasons for not documenting pain scores and to identify pain measures that are useable in the prehospital setting.

Interestingly, there was a large improvement in documentation after the education and protocol implementation phase but this was not maintained in the final phase. It is possible that in the education and new protocol time period communication to the providers and emphasis on pain score documentation was made. System managers should consider how to sustain these messages over time. As more emphasis is placed on the prehospital management of pain, it will be important to determine the best tools to promote and facilitate consistent assessment and documentation of pain by prehospital providers. Lack of documentation may also identify a failure of the system to include a quality improvement component that gave providers specific feedback on their pain score documentation. Integrated electronic medical record use may make it possible to incorporate pain scales as a required field for patients who have certain conditions, which may also improve documentation. This study highlights that continued investigation and improvement in this area is needed.

Our finding that treatment improved and was sustained is encouraging. Our results are consistent with a previous study that showed both education and protocol implementation improved administration of pain medications in an emergency department setting. Interestingly, the education lead to an improvement in the adult population even though it was pediatric focused. This is an important finding in a time of limited training budgets, since these data show that it is possible to use pediatric based education to improve care across the entire age spectrum. Unfortunately, a previously published study by Browne et al. in the same catchment area did not show equally high rates of treatment were achieved in the pediatric population. This supports survey findings in this same EMS system that demonstrated a higher degree of comfort with treating pain in adult patients compared to children.

Based on the finding that the protocol change sustained the improvement in pain treatment into the maintenance phase, it appears our system changes addressed barriers that have been previously identified in the literature. However, our results highlight that there are still significant numbers of patients who are not treated. In fact, 46% of patients in the maintenance phase were documented as meeting the criteria of the pain management protocol and did not receive pain treatment. It is important to determine what barriers are still present that precluded the administration of narcotic pain medications during the maintenance phase of this study. Our findings indicate that while the addressed measures (i.e., education and protocol change) had some impact, room for improvement still exists.

Finally, with the current focus on a reduction in opioid prescriptions to reduce the societal burden of opioid addiction and overdose, it will be important to evaluate if there is a distinction between prehospital
acute pain treatment and post care pain management in the use of opioids. The recent release of the Centers for Disease Control and Prevention’s Guideline for Prescribing Opioids for Chronic Pain emphasize the role of the medical community in opioid related death and disability. It is likely that prehospital narcotics will have little effect on the treatment of chronic pain, it will be important to make that distinction to both providers and the community at large.

LIMITATIONS

Our study is limited primarily due to its retrospective nature and our reliance on documentation. We do not know what was actually assessed at the time of treatment or why pain scores or other factors were not documented. Additionally, our main analysis was on all patients with potentially painful chief complaints; some of the included patients may not have been eligible for opioid pain medication based on the local protocols. Our analyses included these patients because of the overall low rate of vital sign documentation. However, our subanalyses looking at only those patients who were documented as meeting the protocol for treatment showed similar results to our main analysis. Therefore, we are confident that the underlying rate of pain treatment is low in those adult patients who met the protocol for treatment.

CONCLUSION

A focused pediatric pain management education module and the implementation of a pain management protocol significantly increased the number of adult EMS patients who received opioid analgesia in the prehospital setting. However, there is a need for additional efforts to improve pain treatment. Improvement in documentation of pain scores was minimal with these interventions and was not sustained.

References