ORIGINAL RESEARCH

An Assessment of Pain Management Among Patients Presenting to Emergency Medical Services After Suffering a Fall

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Abbreviations:
EMS: Emergency Medical Services
EMT: emergency medical technician
EPCR: electronic patient care report
GCS: Glasgow Coma Scale

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Abstract

Introduction: Emergency Medical Services (EMS) professionals frequently care for patients experiencing acute pain. Analgesics are critical in patient comfort and satisfaction levels during the treatment of acute pain. The objective of this study was to assess the frequency of pain management in patients suffering a fall, the documented pain score, and the location of their injuries. It was hypothesized that the frequency of analgesia administration was low and would be associated with injury location.

Methods: This was a retrospective review of patients presenting with a complaint of an injury from a fall transported by a single municipal EMS system. Administration of analgesia was the primary outcome variable, with pain severity, injury location, age, gender, race, and distance of fall the independent variables of interest. Pain severity was assessed using a 0-10 scale. Injury location was defined as head/neck, extremities, back, and hip. Patients were deemed ineligible for analgesia, according to local protocol, if they reported chest or abdominal pain, or were hemodynamically unstable as determined by an assessment of pulse and blood pressure.

Results: There were 1,200 patients who were classified as having injuries suffered from a fall, with 76 (6.3%) ineligible for analgesia. Ninety-two (8.2%) patients received analgesia, and they had a mean recorded pain score of 9.1 (95% CI, 8.7-9.5), which was higher than those who did not receive analgesia (5.8; 95% CI, 5.5-6.2). Analgesia administration was associated with injury location; patients experiencing an extremity injury (OR = 13.23; 95% CI, 5.58-31.36; $P < .001$) or hip injury (OR = 11.65; 95% CI, 4.64-29.24; $P < .001$) had increased odds of analgesia administration compared to those with head/neck injury. The odds of analgesia administration were decreased for black patients (OR = 0.19; 95% CI, 0.08-0.44; $P < .001$) when compared to white patients.

Conclusion: Analgesia administration was provided to 10% of eligible patients, and was associated with injury location. Of concern was the number of patients who suffered a fall and did not receive a documented pain score. The results from this study indicated a need for education relating to pain management in patients suffering a fall.

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Introduction

Emergency Medical Services (EMS) professionals are trained to assess and manage numerous acute and life-threatening conditions. Acute pain is one of the conditions an EMS professional is expected to treat. This expectation is supported by the National Association of EMS Physicians which indicates the provision of analgesia to patients experiencing pain must be a priority for EMS agencies.[1] It has become apparent that improvements should be made to current prehospital pain management practices to better manage a patient's acute pain.[2-5]

Pain management in emergency systems has been a topic of interest since the 1990s when pain management in emergency departments was deemed inadequate.[6] Researchers have reported oligoanesthesia in the prehospital setting for many patients experiencing acute pain.[2-5,7] A national survey of adults accessing an EMS system in the United States estimated that one-fifth (21%) of patients with pain scores recorded ultimately were administered analgesics for pain management in the emergency department.[2] A study

emphasizing pain management of patients experiencing pain secondary to lower extremity fractures utilized a sample size of 1,000 patients of all ages in the United States. Analysis showed that 1.8% of patients transported who were experiencing pain were treated with either nitrous oxide (1.6%) or morphine sulfate (0.2%).[3]

Previous studies have assessed pain management techniques as they relate to age, in an effort to understand the role of age and the likelihood of receiving analgesia. A 2004 study by Hennes et al assessed for differences in pain management among adults and children. A chart review indicated children were more likely to be administered an analgesic for burns (33% vs 14%), but less likely to be administered analgesics for extremity fractures (4% vs 12%).[4] The patients' race/ethnicity also may be a key contributing factor to their receipt of analgesia, though the previous literature is divided.[8,9] One study highlighted the increased odds of pain management for white patients compared to nonwhite patients, whereas separate analyses indicate no disparity.[8–11]

Recent literature describing pain management in the prehospital setting as a result of falls has been limited. In order to achieve a more complete understanding of where improvements should be made in prehospital pain management protocols, it is necessary to understand both the epidemiology of falls as well as the disparities existing in prehospital pain management. While previous literature has begun to describe the epidemiology of falls in prehospital settings, there is no known research assessing the role of demographic characteristics in the likelihood of receiving pain management prior to hospital admission for patients experiencing a fall.[2–5] Studies observing the prevalence of patients eligible for analgesia based on their mechanism of injury are few.[3,4] The objective of this study was to describe pain and its prehospital management among patients who have suffered a fall and were treated by EMS professionals. Specific objectives were: 1) to identify the proportion of patients eligible to receive prehospital pain management who did not; and 2) to determine if those patients who did not receive pain management in the prehospital setting differed from those patients who did receive pain management, based on demographic or other characteristics unique to their presenting condition.

Methods

Study Design and Setting

This was a retrospective analysis of data abstracted from prehospital electronic patient care reports (ePCRs). The EMS agency under study was an urban public utility service serving approximately 867,000 individuals. Annually, the call volume averages approximately 85,000 patient transports. All of the agency's ambulances are staffed with at least one paramedic and one basic emergency medical technician (EMT). First responders within the city and county are trained at the basic EMT level. Prehospital triage, treatment, and transport protocols are uniform throughout the county. During this study period, paramedics were provided with written protocols for the administration of fentanyl by weight-based dosing to both pediatric and adult patients. Fentanyl could be administered intravenously, intramuscularly, or intranasally. This study was approved by the Carolinas Medical Center Institutional Review Board.

Study Protocol

Patients included in this analysis were those for whom paramedics documented a primary impression in the ePCR as having injuries resulting from a fall, and who were subsequently transported to a hospital. Participants meeting these criteria under the age of 18 were excluded from the analysis. Patients were further excluded from analysis if they reported chest or abdominal pain, were deemed hemodynamically unstable, or had an injury to the head with a decreased level of consciousness. Patients presenting to this EMS agency with abdominal pain were only eligible for pain management if the pain was considered to be secondary to kidney stones, per written protocol (Appendix A, online only). Hemodynamic instability was defined by hypotension (systolic blood pressure of less than 90 mmHg) or hypoventilation (less than or equal to eight breaths per minute) as indicated in local patient care protocols.

The data were collected from incidents occurring from March 1, 2011 through May 31, 2011. This agency utilized an ePCR that allowed for paramedics to chart using standard pull down fields; as such, data abstraction from the notes section was not necessary as all pertinent fields were captured in standardized drop downs. All ePCRs with a primary impression of injury resulting from a fall were reviewed retrospectively by a single data abstractor to determine primary injury location (as documented by the paramedic), pain severity, eligibility for analgesia, and amount of analgesia given. For the purposes of analysis, injury location was categorized as head/neck, back, extremity, hip, or none. Pain severity was reported by the paramedic after asking the patient to rate pain on a scale from 0-10. Consciousness was assessed in the field using the Glasgow Coma Scale (GCS). The study focus was to understand the mechanism of a patient's fall; as such, the exclusion criteria were designed to minimize influence of underlying conditions and disorders. Demographic variables assessed were age, gender, and race. Race was recorded by the paramedics based on self-report from the patient, and further categorized as white, black, and other for analysis. Fall variables included: distance of the fall, which was categorized as falling from a sitting, standing, or other position; and fall surface, which was categorized by the paramedic on scene as soft, hard, or not documented.

Data Analysis

Initially, a descriptive analysis of the data was performed. Means, frequencies, standard deviations (SD), and 95% confidence intervals (CI) were calculated, where appropriate. Univariate logistic regression was conducted to determine if there were associations between administration of analgesia and the explanatory variables. A multivariable logistic regression model was created to identify those variables most significantly associated with the likelihood of receiving analgesia. An investigator-driven backward stepwise approach was undertaken, wherein all explanatory variables were entered into a model. At each step, all variables were assessed and the variable with the highest Wald *P* value was removed from the model. This process was repeated until all variables remaining in the model met statistical significance at the 0.05 level. Confounding was assessed at each step by observing the effects of the next insignificant explanatory variables on the variables remaining in the model. A change in the odds ratio (OR) of 10% among any of the remaining variables was considered sufficient evidence to conclude confounding, and the variable, regardless of its statistical significance, would remain in the model. Model fit and discrimination was assessed using the Hosmer-Lemeshow goodness of fit test. All statistical analyses were conducted using Stata v.10 (StataCorp LP, College Station, Texas USA).

	Total Population (N = 1124)	No Pain Medication Given 1,032 (91.8%)	Pain Medication Given 92 (8.2%)
Age[a]	70.66 (19.48)	71.04 (19.55)	66.47 (18.15)
Gender[b]			
Female	735 (65.39)	665 (64.44)	70 (76.09)
Male	389 (34.61)	367 (35.56)	22 (23.91)
Race[c]			
White	838 (74.56)	759 (73.55)	79 (85.87)
Black	235 (20.91)	228 (22.09)	7 (7.61)
Other	51 (4.54)	45 (4.36)	6 (6.52)
Primary Pain Location[c]			
Head/Neck	356 (31.67)	350 (33.91)	6 (6.52)
Extremity	324 (28.83)	267 (25.87)	57 (61.96)
Back	154 (13.70)	151 (14.63)	3 (3.26)
Hip	166 (14.77)	140 (13.57)	26 (28.26)
None	124 (11.03)	124 (12.02)	0 (0)
Distance of Fall[c]			
Sitting	123 (10.94)	121 (11.72)	2 (2.17)
Standing	897 (79.80)	809 (78.39)	88 (95.65)
Other	104 (9.35)	102 (9.88)	2 (2.17)
Fall Surface			
Soft	173 (15.39)	156 (15.12)	17 (18.48)
Hard	940 (83.63)	865 (83.82)	75 (81.52)
Missing	11 (0.98)	11 (1.07)	0 (0)
Initial Pain Score			
No	637 (56.67)		
Yes	487 (43.33)	5.83 (5.50-6.16)[d]	9.12 (8.69-9.53)[d]

Table 1. Characteristics of Patients Eligible for Pain Management as a Result of Experiencing Pain Following a Fall.
[a]reported as mean and standard deviation (SD).
[b]$P < .05$.
[c]$P < .001$.
[d]reported as mean and 95% confidence intervals (CI).

Results

There were 1,200 patients identified for inclusion in this study based on a documented primary impression of injuries resulting from a fall. There were 76 (6.33%) patients with hemodynamic instability, of which 59 (4.92%) patients also reported chest or abdominal pain, leaving 1,124 patients eligible for analysis (Table 1). Female patients were the majority of the study population with 735 (65.39%) patients. Four hundred eighty-seven (43.33%) patients had an initial pain score documented, with an average score of 6.29 (SD = 3.43). For patients who received pain medication, average pain score recorded was 9.11 (95% CI, 8.69-9.53). Other characteristics can be found in Table 1.

Pain medication was administered to 92 (8.18%) patients, for whom the average age was 66.47 (SD = 18.15) years. When stratified by race, 79 (85.87%) patients were white, seven (7.61%) patients were black, and the remaining six (6.52%) patients were recorded as belonging to some other race. Across all patients receiving pain medication, there were two primary injury locations identified. Injury to the extremities was the most common complaint, with 57 (61.96%) patients. Additionally, hip injuries

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	Unadjusted OR (CI)	All Patients: Adjusted OR (CI)[a]	Only Patients with a Pain Score Recorded: Adjusted OR (CI)[b]
Age	0.99 (0.98-0.99)[c]	0.98 (0.97-0.99)[c]	1.01 (0.99-1.03)
Gender			
Female	1.00	-	-
Male	0.57 (0.35-0.93)[c]	-	-
Race			
White	1.00	-	-
Black	0.29 (0.13-0.65)[c]	0.19 (0.08-0.44)[d]	0.19 (0.07-0.48)[d]
Other	1.28 (0.53-3.10)	0.85 (0.32-2.21)	0.12 (0.01-0.96)[c]
Primary Pain Location			
Head/Neck	1.00	-	-
Extremities	12.45 (5.29-29.32)[d]	13.23 (5.58-31.36)[d]	3.70 (1.31-10.48)[c]
Back	1.16 (0.29-4.69)	1.18 (0.29-4.82)	0.22 (0.04-1.24)
Hip	10.83 (4.36-26.89)[d]	11.65 (4.64-29.24)[d]	2.67 (0.87-8.17)
Distance			
Sitting	1.00	-	-
Standing	6.58 (1.60-27.08)[c]	-	-
Other	1.18 (0.16-8.57)	-	-
Surface			
Soft	1.00	-	-
Hard	0.80 (0.46-1.38)	-	-
Initial Pain Score			
No	1.00	-	-
Yes	4.41 (2.71-7.18)[d]	3.38 (2.02-5.65)[d]	1.70 (1.43-2.03)[d]

Table 2. Logistic Regressions and Modeling of Factors Associated with Administration of an Analgesic.
Abbreviations: CI, confidence interval; OR, odds ratio.
[a]Primary logistic regression utilizing the entire sample.
[b]Secondary logistic regression utilizing only patients assigned a pain score.
[c]$P < .05$.
[d]$P < .001$.

were common in this population, with 26 (28.26%) patients reporting hip pain.

Univariate ORs are presented in Table 2. Those characteristics highly associated with receiving pain medication were age, race, primary pain location, and presence of a documented pain score. The age of the patient was associated with decreased odds of having pain medication administered (OR = 0.99; 95% CI, 0.98-0.99; $P = .03$), in that for every year increase in the patient's age, the likelihood of receiving pain medication was reduced by one percent. Contextually, a 50-year-old was 10% less likely to receive analgesia than a 40-year-old. Patients who were reported as black had decreased odds (OR = 0.29; 95% CI, 0.13-0.65; $P = .002$), whereas all other races had increased odds of being administered pain medication when compared with white patients; however, this association was not statistically significant (OR = 1.28; 95% CI, 0.53-3.10; $P = .58$). Patients presenting with the primary location of pain in their extremities and hips had increased odds of receiving pain management (extremities: OR = 12.45; 95% CI, 5.29-29.32; $P < .001$; hip: OR = 10.83; 95% CI, 4.36-26.89; $P < .001$) when compared to patients with a primary location of pain in their head or neck. Patients who were administered a pain score were 4.41 times as likely to receive pain medication (95% CI, 2.71-7.18; $P < .001$).

In the adjusted logistic regression model, age, race, and primary location of pain were significantly associated with receiving

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analgesia. The adjusted OR for black patients decreased by 0.10, further decreasing the odds of receiving medication for pain among this population (OR = 0.19; 95% CI, 0.08-0.45; $P < .001$). The increased odds of receiving pain medication for extremity or hip injuries further increased once adjusting for other variables; OR = 11.51 (95% CI, 4.83-38.45; $P < .001$) for extremity injuries and OR = 9.82 (95% CI, 3.89-24.80; $P < .001$) for hip injuries. This model demonstrated good fit with $P = .39$.

A secondary analysis was conducted among only those patients who had a recorded pain scale score to determine if pain medication administration varied in this population based on clinical and demographic characteristics (Table 2). In this model, race and primary injury location remained associated with the provision of pain medications. While hip injuries were no longer significant in this subpopulation (OR = 2.67; 95% CI, 0.87-8.17; $P = .09$), extremity injuries maintained increased odds and significance, though the impact was attenuated (OR = 3.70; 95% CI, 1.31-10.48; $P = .01$). This model demonstrated good fit with $P = .44$.

Discussion

Past research assessing pain management in the prehospital setting for patients suffering a fall has been limited, and focused on the rate at which analgesia was administered.[2-5] The current study builds on previous research by incorporating the mechanism of the patients fall through the inclusion of new variables, including primary location of pain, distance of a fall, the surface landed upon, and the patient's initial pain score. One-tenth of patients in this study received pain management when they were eligible, a frequency which is consistent with reports of low rates from previous literature.[2-5,11,12]

Demographically, this study found patients who were elderly, white, or female were most likely to be administered pain medication, which is consistent with previous literature.[8] A previous study on adult patients indicated an average age similar to this study for patients who received analgesia (64.0 and 66.5 years, respectively).[5] Overall, patients experienced more extremity and hip pain than any other pain source, and subsequently, were administered pain medication more frequently. The finding of increased odds of receiving medication as a result of pain in the extremities is supported by the Hennes et al study,[4] which reported a similar magnitude of increased odds.

This study's analysis also suggested that EMS providers select whom they will administer pain medication to by assigning them a pain score, which is consistent with a similar study.[11] Only patients who were assigned a pain score ultimately received pain management. The average score for patients not receiving pain management was 5.8, which is consistent with being in moderate to severe pain.[13] Individuals who were assigned any pain score during the call had over three times the odds of receiving pain management. These results indicate that being assigned a pain score in the prehospital setting improves the patient's odds of being administered pain medication following injury from a fall.[11] This may suggest that the subjective assessment by EMS professionals could be a selection of who will receive analgesia prior to arrival at the hospital, based on who the provider believes warrants the pain medication. If improvements are needed in the provision of analgesia to prehospital patients in pain, perhaps a first step toward this improvement would be emphasizing the importance of obtaining a pain score on all patients, and increasing the awareness that patients in moderate pain are eligible for analgesia.

Limitations

There are several limitations inherent with retrospective cross-sectional studies. Assessing previously collected data limits the analysis to the variables collected, and there is a case to be made for the introduction of bias into this study design. The data suggest pain scores were assigned based on the self-report of pain by only patients who were perceived by the EMS professional to be in pain. Based on that suggestion, recorded pain scores would have been based on perceptions of the EMS professional; as a result, they likely misclassified individuals who were in pain as not. Similarly, the patient's report of their pain also may have been subject to misclassification, supported by findings in previous literature identifying the patient's individual pain tolerance as a reliable indicator of pain.[1] Patients with high pain thresholds may be subject to misclassification if the provider's perception is that the patient is not in pain and does not require analgesia, for example.

In this study, analysis was limited by the type, completeness, and accuracy of data recorded by EMS professionals. Additionally, though the sample size was adequate to detect a difference between groups, the number of patients receiving medication was low. Low administration of pain medication limited the secondary analysis, and also may have limited the measure of effect. Previous literature supports the results gathered in this study, and finds them to be comparable to other studies with similar sample sizes.[3]

Finally, in this study, only patients who had a traumatic injury secondary to a fall were analyzed. Results from this analysis are likely generalizable to the adult fall population, but not so to patients who receive a traumatic injury from other mechanisms. Focusing research on specific mechanisms of injury may provide more insight into why patients do or do not receive analgesia, as well as limit potential bias by mixing different mechanisms, such as falls and motor vehicle collisions. Reproducing this analysis for other mechanisms may provide further information to tailor interventions aimed at increasing analgesia use.

Conclusion

This study sought to quantify oligoanesthesia in the prehospital setting, and to examine the covariates contributing to the provision of pain medication for patients who experienced falls. Analysis indicated that a small percentage of patients actually received pain management, and that race and location of pain were significant indicators of having pain medication administered. Future research should examine the relationship between an administered pain score and the provision of analgesia.

Supplementary Materials

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S1049023X14000594

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