Original Contribution

Triage pain scales cannot predict analgesia provision to pediatric patients with long-bone fracture

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Abstract

Purpose: This study evaluated the effects of pain assessment at triage on analgesia provision to pediatric patients with closed long-bone fractures in the emergency department (ED).

Methods: This was a retrospective cohort study conducted at a university-affiliated teaching hospital. Children who presented to the ED of a teaching hospital with the main diagnosis of a closed fracture of the extremities in 2007 constituted the study cohort. We reviewed the charts and collected the following variables regarding the subjects’ ED visits: patient demographics, pain scale reassessment, category of fracture, associated injuries, time from triage to the first administration pain medication, and the route and type of analgesic. The data were divided on the basis of triage in accordance with pain assessment or other triage modifiers.

Results: In our study, 211 (54.7%) patients enrolled received analgesia. Oral acetaminophen was the most commonly prescribed medication (131 patients, 62.1%), whereas opioids were used in only 24 (11.4%) patients. The average time taken to deliver analgesia to children arriving in our ED was 70 minutes. The logistic regression analysis indicated that enrolled patients triaged based on the pain assessed at triage was not associated with the subsequent provision of analgesia. Analgesia provision was not associated with patients with moderate or severe pain assessed at triage as compared to patients with mild pain.

Conclusion: The pain management of pediatric patients with closed long-bone fractures in the ED was inadequate and delayed. Moreover, the pain assessment at triage did not predict analgesia provision to these patients.

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1. Introduction

In recent years, considerable concerns have arisen regarding the management of pediatric pain in the emergency department (ED) [1,2]. Anand and Carr [3] found that pain management in childhood may affect later pain-related behavior and perception. The effects of pain and stress on the immune system are important [4]. However, pain in the...
ED is commonly undertreated, especially in pediatric or trauma patients [5-8]. One of the factors contributing to oligoanalgesia is the lack of sufficient attention to the patient’s self-report of pain by care providers [9]. To create a pain-free ED, some have proposed that the degree of pain in pediatric patients be screened as a “fifth vital sign” at triage [1]. Measuring pain in all children who are potentially in pain remains an important priority [2].

Triage is the process of sorting patients and classifying them into categories for priority of care. Many countries had adopted national uniform triage system in the ED [10-13]. Pain scales are not absolute but do allow patients to communicate the intensity of a problem from their perspective and act as triage modifier if patients presented with pain complaint in the ED. However, expecting pediatric patients to describe their pain or to quantify their emotional response is unrealistic. Validated pain scales exist, including the numeric rating scale, visual analog scale [14], faces pain scale [15,16], and the nurse-assigned Face, Legs, Activity, Cry, and Consolability score [17]. The application of pain scales requires education and support for nursing and medical staff. The complexity of the ideal multidimensional pain measurement makes it impractical to complete an adequate pain assessment at triage. Even when pain is assessed, health care providers often underestimate it [18,19]. Pain assessment has resulted in better documentation, but not better treatment, of pain [20-22]. Bijur et al [23] suggested that patients’ self-reported pain is not used as the most important measure, as recommended by expert panels, and does not influence the administration of opioids for patients with suspected long-bone fractures.

Therefore, the aim of our study is to identify the role and evaluated the effects of pediatric pain assessment at triage on analgesia provision by pediatric long-bone fracture model in the ED [24,25]. We hypothesized that the pain scale assessment at triage could remind physicians to provide analgesics to pediatric patients with long-bone fractures in the ED.

2. Materials and methods

2.1. Study design and setting

This was a retrospective cohort study conducted at a university-affiliated teaching hospital with an annual ED volume of 227,738 ± 2171 visits, approximately 26% whom are pediatric patients. Our study protocol was reviewed by our institutional review board and deemed exempt from the requirement to obtain informed consent.

2.2. Patient selection

Children less than 18 years of age who presented to the ED of a teaching hospital with the main diagnosis of a closed fracture of the extremities in 2007 constituted the study cohort. Patients with closed fractures of the extremities and International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 812, 813, 820, 821, and 823 were included. Patients with open fractures, out-of-hospital cardiac arrest, already intubated, and documentedprehospital analgesic use were excluded.

2.3. Study protocol

On arrival at the ED, the patients were triaged into 1 of 4 categories: emergency, more urgent, less urgent, and not urgent. The triage decision was based on the critical look, physiologic assessment (vital signs), and other triage modifiers (pain, mechanism of injury, body temperature, etc). Most patients can be assigned a triage level after the utilizations of critical look, history, or measurement of vital signs. Pediatric patients with severe injuries or a high priority of care were usually triaged based on modifiers associated with the need for an airway, breathing support, shock or impending shock, and a decreased level of consciousness. The triage nurse will assign an acuity level that addresses the patient’s priority of care based on the pain assessment or other modifiers at triage when patients enrolled on arrival at our ED with normal critical look and physiological assessments. Pediatric patients presented at our ED without complaints of painful limbs or those with vital sign instability would not have pain scale assessment at triage. Patients enrolled in this study who were categorized based on pain assessments at triage were assigned to group 1, and pain complaint was notified in this cohort. Patients enrolled in this study who were categorized based on triage modifiers other than pain scales were assigned to group 2. Triage nurses who had at least 2 years experience in the ED assessed the pain using a numeric rating scale. Patients were asked verbally to rate their pain from 0 to 10, with 0 equal to no pain and 10 equal to worst possible pain. The nurse-assigned Face, Legs, Activity, Cry, and Consolability score was used for patients who could not describe and quantify their pain [17]. Each of the 5 categories is scored from 0 to 2, which results in a total score between 0 and 10. The nurses were trained in a departmental teaching program on pain assessment techniques. This included a reading of a manual on pain assessment tools and participating in workshops twice a year. All of the triage nurses had completed the program. Pain at triage was categorized as mild (1-3 points), moderate (4-6 points), and severe (7-10 points).

2.4. Measurements

We reviewed the charts and collected the following variables regarding the subjects’ ED visits: patient demographics (age, sex, and triage category), pain scale assess-
2.5. Statistical tests

The data were analyzed using SPSS 13.0 for Windows (SPSS, Chicago, IL). The \( \chi^2 \) test was applied for categorical data, and a 2-tailed \( t \) test was used for continuous variables. The demographic characteristics of the patients were compared between groups. The relationship between the pain scale assessment at triage or pain intensity and analgesia provision was evaluated using binary logistic regression analysis after adjusting for potentially confounding variables, including sex, age, triage category, and fracture site. A \( P \) value less than .05 was considered statistically significant.

3. Results

We reviewed 434 cases and excluded 48 patients based on the exclusion criteria, enrolling 386 patients in this study. Of the patients, 218 (56.5%) were triaged into 1 of 4 categories based on the pain scale assessed at triage, and the other patients enrolled were categorized according to other triage modifiers (Fig. 1).

Patients categorized as mild, moderate, and severe intensity of pain contributed 10.1% (n = 22), 71.1% (n = 155), and 18.8% (n = 41) of the study cohort in group 1, respectively. The chart review indicated that no pain scores were reassessed and recorded by physicians when they treated the patients enrolled in this study. In our study, 211 (54.7%) pediatric patients with closed long-bone fractures received analgesia in the ED. Oral acetaminophen was the most commonly prescribed medication (131 patients, 62.1%), whereas opioids were used in only 24 (11.4%) patients. Nonsteroidal anti-inflammatory drugs (NSAIDs), including intramuscular ketorolac and oral mefenamic acid and ibuprofen, were used in 17.1%, 5.7%, and 3.8%, respectively. However, the pain intensity did not seem to affect physicians’ choice of analgesics when pain scales were categorized as mild to moderate (\( P = .097 \)). Nevertheless, the physicians’ choice of analgesics was preferred NSAIDs and opioids more when managing patients with severe pain as compared to managing those categorized as mild to moderate pain intensity (\( P = .001 \)) (Fig. 2). The average time taken to deliver analgesia to children arriving in our ED was 70 ± 55 (mean ± SD) minutes. No significant difference in demographic variables was documented between groups, except associated injury and triage category (Table 1). Pain was

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434 children less than 18 years of age with major diagnosis of closed fracture of extremities were included*.

84 patients met exclusion criteria.

386 cases were enrolled.

218 patients enrolled who were triaged based upon pain assessed at triage

168 patients enrolled who were triaged based upon triage modifiers other than pain assessment

94 patients had no analgesia.

124 patients received analgesia.

81 patients had no analgesia.

87 patients received analgesia.

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Fig. 1 Study protocol. *Children less than 18 years of age with ICD-9-CM code closed fracture of extremities diagnosis of 812, 813, 820, 821, and 823 were included. Excluding ICD-9-CM code open fracture diagnoses 812.10-19, 812.30, 812.31, 812.50-59, 813.10-18, 813.30-33, 813.50-54, 813.90-93, 820.10-19, 820.30-32, 820.9, 821.10, 821.11, 821.30-39, 823.10-12, 823.30-32, 823.90-92.
assessed less often at triage in patients with an associated injury or for cases categorized as emergency or more urgent \( (P < .05) \). However, analgesia provision did not differ significantly between groups.

Similar proportions of patients assigned to groups 1 and 2 received analgesia (57% vs. 52%, \( P = .319 \); Table 1). The binary logistic regression analysis indicated that the number of enrolled patients triaged based on the pain assessed at triage was not associated with the subsequent provision of analgesia after adjusting for sex, age, triage grade, and fracture site \( (P = .439; \text{odds ratio [OR], 0.840; 95\% confidence interval [CI], 0.540-1.306}) \). The correlation between the intensity of pain assessed at triage and analgesia provision was also low \( (P = .747) \). Furthermore, after a binary logistic regression adjusting for the variables mentioned above, the correlation remained low (Table 2). Analgesia provision was not associated with patients with moderate or severe pain assessed at triage as compared to patients with mild pain (for the moderate pain group: OR, 0.890; 95\% CI, 0.333-2.377; for the severe pain group: OR, 0.474; 95\% CI, 0.067-3.362).

### Table 1 Patient demographics and clinical characters

<table>
<thead>
<tr>
<th></th>
<th>Group 1 ( a ) (n = 218)</th>
<th>Group 2 ( b ) (n = 168)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>.093</td>
</tr>
<tr>
<td>Male patients</td>
<td>160 (73)</td>
<td>110 (65)</td>
<td></td>
</tr>
<tr>
<td>Female patients</td>
<td>58 (27)</td>
<td>58 (35)</td>
<td></td>
</tr>
<tr>
<td>Mean age in years (±SD)</td>
<td>10.0 ± 4.3</td>
<td>10.3 ± 4.6</td>
<td>.507</td>
</tr>
<tr>
<td>Fracture site</td>
<td></td>
<td></td>
<td>.114</td>
</tr>
<tr>
<td>Upper limbs</td>
<td>159 (73)</td>
<td>110 (65)</td>
<td></td>
</tr>
<tr>
<td>Lower limbs</td>
<td>49 (22)</td>
<td>53 (32)</td>
<td></td>
</tr>
<tr>
<td>Multiple</td>
<td>10 (5)</td>
<td>5 (3)</td>
<td></td>
</tr>
<tr>
<td>Triage category</td>
<td></td>
<td></td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Emergent</td>
<td>2 (1)</td>
<td>28 (17)</td>
<td></td>
</tr>
<tr>
<td>Urgent high</td>
<td>45 (21)</td>
<td>54 (32)</td>
<td></td>
</tr>
<tr>
<td>Urgent low</td>
<td>170 (78)</td>
<td>84 (50)</td>
<td></td>
</tr>
<tr>
<td>Nonurgent</td>
<td>1 (0)</td>
<td>2 (1)</td>
<td></td>
</tr>
<tr>
<td>Associated injury</td>
<td>15 (7)</td>
<td>25 (15)</td>
<td>.011</td>
</tr>
<tr>
<td>Yes</td>
<td>203(93)</td>
<td>143(85)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>124 (57)</td>
<td>87 (52)</td>
<td>.319</td>
</tr>
</tbody>
</table>

All data are given as number of patients (percentage) except for mean age in years.

\( a \) Patients enrolled who were triaged based upon pain scale assessed at triage.

\( b \) Patients enrolled who were triaged based upon triage modifies other than pain scale.

### Table 2 The logistic regression analysis of analgesia provision and intensity of pain assessed at triage

<table>
<thead>
<tr>
<th>Intensity of pain</th>
<th>OR (95%CI)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild (1-3), reference</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Moderate (4-6)</td>
<td>0.890 (0.333-2.377)</td>
<td>.816</td>
</tr>
<tr>
<td>Severe (7-10)</td>
<td>0.474 (0.067-3.362)</td>
<td>.455</td>
</tr>
</tbody>
</table>

Adjustment variables: sex, age, fracture site, and triage category. Odds ratio indicated whether patients received pain medications as compared to patients enrolled with mild pain intensity.

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### 4. Discussion

We found that the level of pain assessed at triage was not associated with age, sex, or fracture site. However, pain was less assessed at triage in pediatric patients of a closed long-bone fracture combined with associated injuries or a high priority of care. In fact, severely injured patients were sent to an examination room immediately after the triage nurse quickly checked the vital signs and made a critical assessment, as it is impractical to categorize such patients into a triage level based on pain assessment. Martha et al [26] reported that patients who are more seriously injured are at particular risk for oligoanalgesia. We found no significant difference in analgesia provision to patients with more serious injuries in whom pain was not assessed at triage.

In our series, the management of pain in pediatric patients with closed long-bone fractures in the ED was inadequate and delayed. Physicians preferred acetaminophen for analgesia for fracture pain management and used NSAIDs and opioids sparingly. Several studies have obtained similar results [6,27]. The median time from

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**Fig. 2** The figure clarifies the degree of pain with the choice of analgesics. Patients categorized as mild, moderate, and severe intensity of pain contributed 10.1\% \( (n = 22) \), 71.1\% \( (n = 155) \), and 18.8\% \( (n = 41) \) of the study cohort in group 1, respectively. The pain intensity did not seem to affect physicians’ choice of analgesics when pain scales were categorized as mild to moderate. Acetaminophen was still the commonest pain medication. The physicians’ choice of analgesics was preferred NSAIDs and opioids more when managing patients with severe pain as compared to manage those categorized as mild to moderate pain intensity.
tiation to the first administration pain medication was 74 minutes in Jesse and Judd [28] and 95 minutes to the first dose of opioids in Martha et al [26]. Brown et al [29] noted that 36% of patients with closed extremity or clavicle fractures received no analgesics, and the proportion was even higher in children. Compared to adults, the use of narcotic analgesics in children was also low [29]. Physicians frequently express concern about adverse reactions to NSAIDs, and “opiophobia” contributes to inadequate analgesia.

Bijur et al [23] addressed the lack of influence of patient self-reported pain intensity on the administration of opioids for suspected long-bone fractures [25]. We found that pain assessment at triage and pain intensity were not associated with analgesia delivery in pediatric patients with closed long-bone fractures. Several explanations may be valid. First, pain has psychological, behavioral, physiological, and emotional components [27,30]. It is a subjective multifactorial experience. An adequate assessment of pediatric pain should be individualized, measured comprehensively, monitored continuously, and documented. The complexity required for the ideal dimensional measurement makes it impractical to complete an adequate pain assessment in the ED. Even when pain is assessed, health care providers often underestimate it [18,19]. Second, although pain assessment has resulted in better documentation of a patient’s pain, it has not resulted in better treatment of pain [20-22]. We found that 56.5% of the pediatric patients with long-bone fractures were triaged based on the pain assessed at triage. A chart review showed that the physicians who treated these patients never documented a reassessment of the fracture pain. Evidence indicates a lack of the assessment and management of pain by health care providers in many settings [27,31]. A pain scale assessed at triage might not be an appropriate reminder for physicians and might be ineffective at raising the issue of pain management. Several guidelines have been published for the assessment and management of pediatric pain [20,32,33], although guidelines and continuing medical education do not necessarily alter health care provider behavior [34,35]. Third, analgesia provision might be individualized. No universal protocol was applied for pediatric pain, and no definite form or route of analgesia was indicated according to a specific intensity of pain during our study period. Physicians responded differently to specific intensities of pain assessed at triage. A previous study revealed that the introduction of a pediatric analgesia protocol increased analgesia provision and reduced the length of time to analgesia delivery in children arriving in the ED [36]. In addition to injected analgesics, oral, anal, and nonpharmacologic interventions were also used. However, the nonpharmacologic interventions were not recorded on the chart, and we might have underestimated their use.

However, it was not reassessed whether adequate or appropriate analgesics provision were applied. The results of this study suggest that physicians’ choice of analgesics for treating patients with mild or moderate pain intensity was similar. The pain scales categorized as severe intensity seemed to affect physicians’ choice of analgesics with NSAIDs and opioids more as compared to managing those categorized as mild to moderate pain intensity. Because limited study patients were categorized as mild and severe pain and acetaminophen was still the commonest pain medication, the effect of pain scales on physicians’ choice of analgesics clearly needs further exploration.

Therefore, we propose that instead of a pediatric pain scale assessment, documentation of the patient’s or family’s desire for immediate analgesia as part of the chief complaint at triage may be more appropriate in the ED. Further analgesia should be given according to the patient’s or family’s wishes. Instead of taking the degree of pain as a fifth vital sign, which is considered an objective measurement, it should be viewed as a part of the subjective chief complaint. A pain scale assessment based on comparing the initial painful events and post analgesia delivery during reassessment may be more reliable and appropriate in the ED. The introduction of a pediatric analgesia protocol, including nonpharmacologic interventions, that concurs with patients’ desires should be considered. A further prospective randomized control study should be conducted to verify this proposal.

This study has several limitations. The first limitation is that our study was retrospective, and the data were collected from a computer database and chart review. Although we made every effort to remain objective, possible errors may have been introduced. Although the pain scale was assessed at triage, pain assessment by physicians and the reason for the delay or failure to provide analgesia were not recorded in the charts directly. In addition, we did not collect data on nonpharmacologic interventions and the reassessment of pain. Therefore, we might have underestimated the pain management of pediatric patients with closed long-bone fractures in the ED. As a second limitation, the experience of the nurse and the number of patients in the ED might have affected the quality and intensity of pain measured at triage. In addition, no notation of the nurse-assigned scoring system was seen in the chart review that suggested how it affected the pain intensity measured at triage. A third limitation of our study is that it was conducted in 1 hospital only, which limits the generalizability of our findings. The physicians’ habitual practices regarding analgesics, which could not be controlled, might have contributed to the oligoanalgesia.

5. Conclusions

The pain management of pediatric patients with closed long-bone fractures in the ED was inadequate and delayed. Moreover, the pain assessment at triage did not predict analgesia provision to these patients.
References