ORIGINAL ARTICLE

The utilization of pain assessment tools in pediatric emergency for better pain management

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Abstract

Objective: Accurate assessment of acute pain in children is essential for effective emergency care but can be challenging due to varying pain expressions across ages. Our study aims to examine healthcare providers' efforts to enhance assessment using age-appropriate tools.

Methods: Patients were retrospectively selected from the King Abdulaziz University Hospital Emergency records which involved a cohort review of 157 children presented to the pediatric emergency department with acute pain from 2017 to 2018. Routine pain assessment tool grading acute pain as mild, moderate, severe by qualified pediatric emergency doctors, Canadian triage acuity scale (CTAS) and numerical rating scale (NRS) were used to describe pain intensity. Inter-statistical cohort analysis was used.

Results: The mean age of patients were 8±3.3 years (range: 2.5-13.9 years) with 73 girls and 84 boys. About 80% (n=126) of the children presented to the emergency department with acute pain were scored as CTAS 2-3. All triaged patients passed to the emergency department were assessed as mild (n=66, 42%), moderate (n=27, 17%) and severe (n=35, 22%) pain. The NRS scoring was used in only 12 (7.6%) children as NRS only applies to older children. Paracetamol and nonsteroidal anti-inflammatory drug (NSAID) were the most frequent analgesia administered by the health care providers. There was a statistically insignificant relationship between the severity of the pain and the type of analgesia (P value>0.05). Children with mild pain had a significantly higher level of NSAID administration than those with moderate or severe pain (P<0.05). Children with mild pain had a significantly higher level of NSAID administration than those with moderate or severe pain (P<0.05).

Conclusion: Pain assessment with scoring methods like CTAS or NRS in the emergency room (ER) is crucial despite challenges. Inconsistent use affects outcomes, emphasizing the need for research to encourage consistent application in pediatric emergency care.

Key words: Acute Pain; Assessment Tools; Numeric Rating Scale; Pediatric Emergency; Scoring

1. Introduction

Acute pain is frequently reported by pediatric patients in emergency settings (1). Approximately 19 million children seeking care in pediatric emergency departments (ED) in the United States have pain-related issues (2). Despite advancements in enhancing pain assessment and management for children, significant challenges persist in attaining optimal outcomes. The assessment of acute pain in children has been extensively discussed in the literature, including several protocols and guidelines, as it constitutes a major reason for children's visits to the emergency rooms (ER). Health organizations, which seek accreditation, are mandated to have policies for the assessment of acute pain in children at their health care facilities. The global joint commission has established pain score documentation requirements for hospital accreditation. These requirements include: 1- documenting pain scores for all patients to enhance pain detection, and 2- recording pain score reassessments post-analgesic administration to ensure adequate pain management (3). Efforts to enhance pain measurement in pediatric patients have focused on standardizing the use of validated pain assessment tools and promoting a comprehensive evaluation (4). Pain assessment in children encompasses self-reporting, behavioral observations, and physiological responses (5). Self-reporting is commonly recommended as the primary method for assessing pain intensity in children over 3 or 4 years old (6). Infants and young children typically exhibit pain through observable behaviors, while physiological parameters reflect the stress response to pain, leading to changes in vital signs. (7). Pain in children is influenced by developmental factors, and the adolescent's response to certain features of current pain assessment tools is unlike those commonly observed in adults (8).

Assessing a child with acute pain in a chaotic pediatric emergency is truly challenging and should be done as effectively as possible to promote optimal pain management. Thus, inadequate pain management may cause long-term undesirable effects, including pain lenience and altered pain response (9). Emergency triage for pain assessment and management is the first point of interaction with patients to express their pain. Studies have shown that health care providers tend to underestimate the pain experienced by children. Therefore, a pain assessment tool or pain scale should be utilized to provide the practitioner with a more objective method to assess and adequately manage pain in children (10). Many organizations have established policies and laws for pediatric pain to ensure that pain relief is a child's right to health. For children younger than three years of age and patients with developmental delays, the face, legs, activity, cry, and consolability (FLACC) pain assessment tool, with a score from 0-10, is used. (11). For children aged 3 to 12 years, the Wong-Baker FACES® pain rating scale is used. (12) For this scale, 6 faces are shown to the child, each corresponding to a score (0, 2, 4, 6, 8, or 10). For patients aged 13 to 17 years, a 0 to 10 numerical rating scale (NRS) is used, with 0 defined as having ''no pain'', 5 as having ''moderate pain',' and 10 as having the ''worst possible pain" (13). Combining behavioral observation with self-reporting is recommended, especially when reliable self-reporting is not feasible. Nevertheless, there is a common tendency for proxy judgment to underestimate others' pain systematically. Self-report pain scales like the verbal numerical rating scale (VNRS) and the faces pain scale – revised (FPS-R) are commonly employed to evaluate shifts in pain intensity in children experiencing painful conditions (14). To properly use these measures to assess pain in children, it is necessary to identify how changes in the pain score are associated with clinically meaningful outcomes (15). Monitoring variations in pain scores can offer valuable insights for research focused on evaluating various outcomes and can also help evaluate the significant effects of treatment in a clinical setting. Any assessment tool mentioned for pain scoring can be effectively employed to ascertain the efficacy and appropriateness of treatments administered to children.

In evaluating and categorizing pediatric pain, our objective was to outline the endeavors of pediatric healthcare providers in assessing acute pain in pediatric emergency settings through the utilization of existing assessment tools. Additionally, we sought to investigate

the relationship between the initial emergency presentation, administration of analgesics, and the duration of hospital stay.

2. Methods

2.1. Study design

Patients in the study were retrospectively selected from the King Abdulaziz University Hospital emergency records, which involved a cohort review of 157 children presented to a pediatric emergency triage with acute pain from 2017 to 2018. The study was approved by the Biomedical Ethical Committee at Faculty of Medicine of King Abdulaziz University under the reference number (279-20). Due to practical limitations, a power analysis was not performed. The sample size was based on population accessibility, aiming to balance statistical considerations and study feasibility. The study included children aged 3 to 14 years of both genders, who presented with their parents to the pediatric emergency department with acute pain involving any part of the body. It had been evaluated at the time of presentation by the triage nurse practitioner and/or pediatric emergency physicians. Exclusion criteria encompassed children under the age of 3 years. All patients were initially assessed by a triage nurse and, in cases of severe pain, by a pediatric emergency provider. Additionally, data included a subset of pediatric patients registered and initially assessed in triage but did not receive bed-based care due to bed shortages and space limitations. This group, classified as "left without being seen," did not require immediate attention as they presented with mild pain and did not receive on-the-spot medications.

The data samples were collected using the Phenix system (computer-based data recording) and cross-verified with the pediatric emergency logbook, which documents all patients aged 3–14 years presenting to the pediatric emergency triage with complaints of pain. Data collection occurred continuously over the specified period, operating 24 hours a day, 7 days a week.

Initially, the assessment method used to describe the degree of pain in all children was explained to parents and children. The triage system utilized the Canadian triage acuity scale (CTAS), which was employed by nurses at the triage area. Pediatric patients were graded

based on their symptoms as: CTAS 1 (resuscitation), 2 (emergent), 3 (Urgent), 4 (less urgent), or 5 (non-urgent). The pediatric emergency physician used the 0-10 numerical rating scale (NRS) to assess the pain for children aged 7 years and above (16).

The children were provided with information regarding the proper method of describing pain with numbers at the time of their first assessment in the ED, where 0 = no pain and 10 = the most or worst pain/hurt. The pain assessment tool used in younger children who could not understand the self-report scale was an observational/behavioral assessment tool. For these children, pain intensity was simplified and charted as mild, moderate, or severe pain, and was documented for each child who presented to the ED with acute pain. Additional information including the time of admission, length of stay in the ED; pain history (type, site), medications used at home, analgesic(s) used in the ER, length of hospital stay in days, and association between the initial assessment and hospital stay, were all retrieved from the hospital records. Available medications were paracetamol doses at 15 mg/kg or ibuprofen doses at 10 mg/kg, and any medication administered was documented in the electronic triage reports, which appear immediately in the electronic medical record (EMR) system.

Numeric data were presented as mean ± standard deviation (SD), while categorical data were represented as percentages. All demographic information, such as age in years for individuals aged 3 to 14, gender, and CTAS score, was recorded and documented.

2.2. Statistical analysis

Data are described as frequencies and percentages based on standard quantitative analysis. Pearson Chi-Squared test was used to explore the relationship and the proportion between different pain assessment and pain medications. All statistical analyses were performed using IBM SPSS1 ver. 24 statistical software [IBM Corp., Armonk, NY, US].

3. Results

The mean patients' age was 8±3.3 years (range: 2.5-13.9 years), with 73 girls and 84 boys. About 60% (n=94) of the children presented to the ED with acute pain has been scored as CTAS 3 and required an urgent evaluation by the pediatric emergency physicians within 30

minutes, while 20% (n=32) of patients, scored as CTAS 2, classified as "emergent" to be seen by the emergency physicians within 15 minutes (Table 1).

Table 1 Pain assessment using the Canadian triage acuity scale (CTAS) for all 157 children visited the emergency triage service

	Children visiting emergency triage (n=157**)**
Age (years), mean ±SD	8.13±3.3 (range: 2.5-13.9)
Sex (Number)	
Girls	73
Boys	84
CTAS (Number (%))	
CTAS 1	0
CTAS 2	32 (20)
CTAS 3	94 (60)
CTAS 4	31 (19.75)
CTAS 5	0

CTAS: Canadian triage acuity scale

No patients under category CTAS 5 were among the enrolled patients in our study. This emphasizes that all the triaged patients have passed to the ER for further evaluation by the pediatric emergency physician. The pain was initially assessed as simplified as mild, moderate, or severe (Table 2).

Table 2 Pain assessment method in the emergency room reported by the pediatric emergency physicians (n=157).

Pain category	**Number (%)**
Mild	66 (42%)
Moderate	27 (17%)
Severe	35 (22%)
LWBS*	29 (19%)

*LWBS: the patient left the emergency room without being seen

This indicates that mild pain was described in 66 (42%) children, moderate in 27 (17%) children, and severe in 35 (22%) of children. About 19% (n=29) of the patients were left without being seen or whose pain history was not documented. Those patients were seen initially in the triage, given a CTAS score, but did not require any urgent intervention or

medications on the spot**.** Among the 157 children seen in the triage and initially evaluated by the pediatric emergency physicians, the NRS scoring was used in only 12 (7.6%) children. Those children scored between 3-9. Most of these children were 8 years old and above (Table 3).

Table 3 Numeric rating scale (NRS) scoring from (0-10) in children (n=157) who passed the triage and the initial assessment by the pediatric emergency physicians

NRS Scores (0-10)	Number (%)
Not utilized when seen	116 (74%)
3	1 (0.6%)
4	2 (1%)
5	4 (2.5%)
6	4 (2.5%)
9	1 (0.6%)
LWBS*	29 (19%)

*****LWBS: the patient left the emergency room without being seen; NRS: Numeric rating scale

Paracetamol and NSAIDs such as ibuprofen, were the most common pain medications administered at home by parents or caregivers or by the health care providers at the hospital emergency (Table 4)

Table 4 List of frequent pain medications given to the children at home and hospital ER by the caregivers and pediatric emergency physician, respectively (n=157)

Pain medication (analgesia)	Given at home (Number)	Administered at ER (Number)
Paracetamol	64	106
Ibuprofen	02	50
Paracetamol + ibuprofen	0	12
No medication given	50	0
Morphine	0	5

*ER: emergency room; LWBS: the patient left the ER without being seen

In rare instances where severe pain is associated with orthopedic traumas, pediatric emergency physicians needed to escalate the treatment by administering intravenous morphine. This was observed in 5 cases (Table 4). Although there was the statistically

insignificant relationship between the severity of the pain and the type of analgesia (P-value>0.05), our results indicated that treatment rates with NSAIDs and morphine differed with an increasing intensity of pain. Pain medications were administered in about 38% of children suffering from severe pain compared to 58% of the children with mild pain (Table 5).

Table 5 Analgesia administration by the pain severity during the initial assessment – not NRS scoring- by the pediatric emergency physicians (n=157)

	Mild Number (%)	**Moderate Number (%)**	**Severe Number (%)**	**P-value**
Any analgesic	74 (58%)	38 (30%)	49 (38%)	>0.05
	Pain relief based analgesia type			
Paracetamol	54 (42%)	24 (19%)	28 (22%)	>0.05
NSAIDs (ibuprofen)	20 (16%)	13 (10%)	17 (13%)	<0.05
Morphine	0 (0%)	1 (0.8%)	4 (3.1%)	<0.05

Children with mild pain had a significantly higher level of NSAID administration than those with moderate or severe pain (P-value<0.05) (Table 5). There was an insignificant difference between the documentation of higher pain scores and morphine administration (P-value <0.05).

4. Discussion

Pain assessment in pediatric emergency cases is crucial. The international federation of emergency medicine (IFEM) recommends that pain in children should be evaluated and managed within 30 minutes of their arrival (17). Developed countries like the United Kingdom, Italy, and Canada have established clinical guidelines for managing pain in children during emergency visits. Our research aimed to determine the frequency and nature of pain assessment in children during triage, post-triage, and in the ED, as well as to identify effective analgesic interventions for alleviating children's pain. Evaluating pain in children under 18 years old poses challenges due to their varying levels of verbal and cognitive development.

A study conducted in Quebec, Canada in 2020 revealed that only 55% of children were assessed for pain in pediatric emergency settings, highlighting the need to enhance pain assessment practices for this patient population. (18). Poor pain assessment leads to a poor diagnosis and treatment. Assessment can be underestimated if the children or their parents deliver the pain intensity to the health care provider in an inaccurate way. Self-report measures of pain intensity are not sufficiently valid for children below 3 years of age. In addition, many children in the 3 or 4-year age group may not be able to self-report their pain accurately (10). We opted to observe self-reported pain in our study to encourage health care providers to make use of available self-report pain scales that are reliable for those older than 3 years. Self-reporting of pain is generally accepted as the standard method for reporting pain, and young children can provide meaningful self-reports if provided with age-appropriate tools and training. (12,19-20). Healthcare providers' assessment of pediatric patients' pain often shows poor correlation with and tends to underestimate children's self-reported pain (21). There is conflicting evidence regarding the accuracy of parents in estimating their children's pain levels (22). Researchers and clinicians commonly use self-report measures to gauge the intensity of a child's pain and assess the effectiveness of pain management interventions (6). Monitoring changes in pain scores can assist researchers in designing clinical trials focused on meaningful outcomes and aid clinicians in evaluating the impact of administered analgesia on patient well-being. (23,24). Our study included 157 patients aged 3 years or older, who were all verbally able to communicate and describe pain translated as mild, moderate, and severe during triage or in the pediatric ER. The triage was the primary point of pain assessment for children in ED which determines the severity and the importance of the pain in the child. If this pain is taken chaotically, the child may be left without further assessment or treatment.

4.1. Pain assessment using CTAS system

CTAS system established by the Canadian guidelines categorized patients' pain during triage before ER. The CTAS has effectively improved resource deployment, ensuring patients receive care promptly. In our study, we were unable to ensure if pain received by the child or parent was accurate during the initial assessment at the triage. However, all children in our study categorized as CTAS 2-4 were transferred to ER (Table 1). The triage notified the

physicians to physically examine the child at ER. In certain instances, pain medications were given based on the physician's instructions. We propose that the CTAS may not always be applied consistently during triage, potentially impacting the standard assessment tool. In the ER, children evaluated by the pediatric emergency physician were most often assessed using the available pain scale (mild, moderate, severe). However, the NRS scoring system was also utilized. In summary, The CTAS system categorizes pain during triage, ensuring resource allocation, but inconsistencies and varied pain assessment methods impact effectiveness.

4.2. Pain assessment using NRS

About 42% of children in our study were categorized as having mild pain in the ER while 39% of the patients reported moderate-severe pain (Table 2). NRS scoring could not be utilized in 74% of these children, and only 12 patients (their age above 8 years, except two children) were scored (Table 3). NRS is typically used for children 8 years and older who can understand and reliably use a scale from 0 to 10 to indicate their pain level. Children younger than 8 years may struggle with the abstract concept of numeric pain rating. Sometimes, busy emergency shift works against using NRS scoring. Insignificant relationships were observed when we compared the routine pain assessment tool to NRS tool. NRS is a valid self-report scale for children that are 7-8 years and above (4,14). Due to the limited size of our cohort utilizing the NRS in this study, no significant correlations were observed between the length of final hospitalization or emergency stay in days or hours.

The ED frequently becomes a battleground for conflicts between patients and healthcare providers due to several factors. These include challenges such as providers' inability to communicate in the patient's native language, patient unfamiliarity with healthcare system protocols, lack of insurance coverage, and impatience with extended wait times. These issues often lead to patient frustration to the extent that the idea of receiving timely, efficient, and sufficient pain management appears unattainable (25). Various challenges in the ER, such as increasing anxiety in children, contribute to the difficulty in obtaining the most precise pain description, potentially resulting in the under-recognition and insufficient treatment of pain in pediatric patients.

There is a probable notable disparity indicating the underutilization of medication when comparing the group experiencing mild pain to those experiencing severe pain. Kellogg *et al*. found that ibuprofen was the most often used medication for all pain levels assessed (26). Surprisingly, our study found that children with mild pain had a higher level of NSAID administration than those with moderate or severe pain (Table 5). Those patients improved significantly. I did find a significant difference between higher pain scores and morphine administration (Table 5), which was consistent with previous literature. This could be because the classification of pain has yet to be investigated in a larger sample size (13). As the primary aim of our study was to evaluate the physicians' efforts in assessing and reporting pain in all children with acute pain, structured guidelines were not followed. When reviewing other studies, an effort was made to utilize different assessment tools including NRS and Wong-Baker scale. Based on our results, the severity of pain as described (mild, moderate, and severe) is positively correlated with the duration of the hospital stay ($r = 0.357$; P-value < 0.05).

5. Limitations

This study has several limitations. The small sample size from a single medical center may limit the generalizability of our findings. The absence of a power analysis may limit the statistical rigor of the study and increase the likelihood of type II errors, potentially underestimating significant associations. While efforts were made to balance feasibility and statistical considerations, this limitation should be considered when interpreting the findings and applying them to broader populations. Additionally, ER nurses assess both adult and pediatric patients, which could impact CTAS scoring and the administration of analgesics. The underutilization of pain assessment tools and the absence of documented follow-up pain assessments may have affected the accuracy of pain scores. Patients who left without being seen were not analyzed, resulting in fewer acute pain cases during the study period. The data collection was limited to one year to quickly highlight gaps in pain assessment and to support a quality improvement initiative. This project would encourage consistent use of these tools to improve outcomes in the future.

6. Conclusion

Pain assessment using different scoring methods such as CTAS or NRS during triage and in ER is highly encouraged despite the chaotic environment of the ED, in order to classify children pain severity, risk, and management style.

7. Declarations

7.1. ***Acknowledgment***

None.

7.2. ***Authors' contribution***

The corresponding author is the only single author for this study who has critically reviewed and approved the final draft and is responsible for the content and similarity index of the manuscript.

7.3. ***Conflict of interest***

The author has no relevant conflict of interest to disclose.

7.4. ***Funding***

None.

7.5. ***Ethics approval and consent to participate***

The study was approved by the Biomedical Ethical Committee at Faculty of Medicine of King Abdulaziz University under the reference number (279-20).

7.6. ***Informed consent***

Informed consent was obtained from all parents of the children participating in this study.

7.7. ***Availability of data and material***

The datasets generated during and/or analyzed during the current study are available from the corresponding author [SA] on reasonable request.

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