Analgesia for extremity fractures in the paediatric emergency department

Siew Ming Tan¹, Yong-Kwang Gene Ong² and Jen Heng Pek¹

Abstract

Background: Extremity fractures are an important and common presentation at the Paediatric Emergency Department (PED). Provision of analgesia is a key management principle, but it is often suboptimal. Although there is an increase in awareness of this issue, the impact on current practice is not known. We aimed to review the current practice of providing analgesia for extremity fractures in the PED.

Objective: Our objective was to determine the utilisation, adequacy and timeliness of analgesia provided for these patients.

Methods: A retrospective study was carried out from November to December 2017. Patients with a diagnosis of extremity fracture involving the upper or lower limb were included. Information about patient demographics, diagnosis, pain score, analgesia use and clinical progress were collected for analysis.

Results: There were 101 cases. The mean age was 8.5 ± 4.2 years old, and 62 (61.4%) patients were male. There were 76 (75.3%) cases of fractures involving the upper limb, and 25 (24.7%) cases of fractures involving the lower limb. The mean pain score at presentation was 3.3 ± 2.3. Analgesia was administered to only 10 (9.9%) patients, with oral paracetamol (n=5; 5.0%) being the most common medication administered. The median time between arrival in the PED to analgesia administration was 69 minutes (range 25–328 minutes).

Conclusions: Despite the increase in awareness, analgesia for these patients remains underutilised, inadequate and delayed. Further efforts at pain assessment, analgesia selection and administration are necessary to improve the provision of analgesia for these patients.

Keywords

Analgesia, emergency department, fracture, orthopaedic, paediatric

Introduction

Analgesia at the Paediatric Emergency Department (PED) is often suboptimal, as it is often underutilised, delayed and underdosed.¹ Although the paediatric nervous system is immature and incompletely myelinated, they experience pain similar to adults.²,³ However, paediatric patients often do not receive analgesia for similar conditions compared to adult patients.⁴ Inadequate analgesia can lead to suboptimal health outcomes, patient discomfort and fear, as well as parental and provider dissatisfaction.⁵,⁶

Factors which contribute to this undertreatment of pain in the PED include: poor pain assessment; communication gaps between the patient, parents and staff; unfamiliarity at prescribing and administering analgesia; and fear of an adverse reaction to medication.⁷,⁸ The American Academy of Paediatrics have therefore recommended for the provision of effective analgesia to be an important health objective for hospitals, and the World Health Organization (WHO) has recommended treatment where the pain score is ≥4.⁹,¹⁰ Although a few direct comparisons of analgesia regimens have been performed, there is still a lack of consensus on the ideal pharmacological option, resulting in a wide variation in pain-management practices at different PEDs.¹¹ Extremity fractures are an important and common childhood injury which often presents to the PED for evaluation and treatment.¹² This is among the most painful paediatric emergencies, and provision of analgesia is a key management

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principle. However, studies have demonstrated that patients often receive suboptimal analgesia for their condition.\textsuperscript{13,14} The growing body of literature on this issue may have led to an increase in awareness among clinicians, but the impact on current practice is not known. Therefore, we aimed to review the current practice of providing analgesia for extremity fractures in the PED. Our objective was to determine the utilization, adequacy and timeliness of analgesia provided for these patients. We hypothesised that there was still a gap in the provision of analgesia for extremity fractures in the PED. By describing our experience, we hope to aid clinicians in providing better pain control for these patients.

**Methods**

**Settings**

This study was conducted in the PED of a tertiary paediatric hospital in Singapore with an attendance of more than 170,000 per year. One per cent of patients are of the high-priority emergent category.

In our PED, the pain score was recorded at triage by the nurse using an age appropriate pain scale. This pain score was entered into the electronic medical record of the patient. The doctor who attended to the patient subsequently offered and ordered analgesia. A nurse then administered the analgesia to the patient. There was no departmental guideline on what pain score would warrant administration of analgesia and what analgesia would be administered.

**Design**

A retrospective study was carried out from November to December 2017. Patients with a diagnosis of extremity fracture involving the upper or lower limb in the PED record were included. Information about patient demographics, diagnosis, pain score, analgesia use and clinical progress were collected for analysis.

This study was approved by Institutional Review Board at SingHealth, Singapore (CIRB Reference Number 2018/2254).

**Statistical methods**

Statistical analysis was performed using IBM SPSS Statistics for Windows v22 (IBM Corp., Armonk, NY). Categorical and continuous data are presented as frequency with percentage and mean with standard deviation, respectively. The association between categorical variables was assessed using the chi-square test, while the association between continuous variables was assessed using the Wilcoxon rank-sum test. Comparison of means was assessed using a paired-samples \( t \)-test.

**Results**

**Patient characteristics**

There were 101 cases during the study period. The mean age was 8.5±4.2 years old, and 62 (61.4%) of the patients were male. Six (5.9%) patients were brought to the PED by the emergency medical service. There were 76 (75.3%) cases of fractures involving the upper limb, and 25 (24.7%) cases of fractures involving the lower limb (Table 1).

**Severity of pain**

The mean pain score at presentation was 3.3±2.3. Thirty-four (33.7%) patients had a pain score of \( \geq 4 \). None of the patients received analgesia prior to arrival at the PED. Pain was not assessed in 10 (9.9%) cases, and it was not reassessed in 43 (47.3%) cases.

**Analgesia**

Analgesia was administered to only 10 (9.9%) patients, with oral paracetamol (n=5; 5.0%) being the most common medication administered. Five patients with a pain score of \( \geq 4 \) were given analgesia. Among all patients who were given analgesia, the mean reduction in pain score was 2.0±0.8 (\( p=0.001 \)). The median time between arrival in the PED to analgesia administration was 69 minutes (range 25–328 minutes). Among those who were not given analgesia, the mean reduction in pain score was 2.0±1.2 (\( p<0.001 \); Table 2).
Discussion

The provision of effective pain management is an important component of emergency care, especially in the management of extremity fracture. Optimal analgesia can improve clinical outcomes, satisfaction with care and the patient–doctor relationship. However, despite the increase in awareness, analgesia for these patients remains underutilised, inadequate and delayed.

In order to manage pain successfully, first it needs to be assessed. This should be done at the initial presentation, followed by serial assessments to monitor for pain relief. While the initial pain score was assessed in >90% of patients, serial assessments were only carried out in <50% of patients in our study. Compared to an earlier work by Drendel et al., which reported assessment of initial pain score in only 44.5% of patients, the higher proportion in our study was likely a reflection of pain being established as the fifth vital sign and the subsequent processes developed to incorporate assessment and documentation of pain during triage at the PED. However, the change in pain score is more important than a single absolute value, as a change reflects the effectiveness of interventions in the PED. Serial assessments are important to help clinicians titrate analgesia to optimise pain relief. Therefore, further efforts focusing on serial assessments are necessary, with emphasis on the need for reassessment and not the time interval between each assessment, as the latter would be dependent on each patient’s characteristics, the underlying condition and the analgesia used.

Another important consideration in paediatric pain management is how to assess pain accurately. An objective assessment using available scales is fraught with difficulties in the paediatric population. For instance, an infant may be crying due to pain from a fracture or to being in a foreign environment, but this crying may be wrongly interpreted by the PED staff, thus affecting pain-management decisions. Self-report provides the most reliable assessment, but paediatric patients are less articulate than adults in expressing their pain experience and may thus underreport their pain. In the absence of an ideal assessment tool, clinicians would actively need to exclude and address pain as a cause for discomfort or distress in child with an extremity fracture.

The assessment and documentation of pain can lead to an improvement in analgesia use. Therefore, pain assessment for patients with extremity fractures must be enforced, and the documented outcome must be communicated to the clinician. However, there is controversy over what degree of pain should warrant analgesia. Although the WHO recommends treatment if the pain score is $\geq 4$ and the American Academy of Paediatrics recommends the use of systemic opioids for severe pain defined as a pain score of $\geq 8$, these recommendations serve only as a guide to the clinician. It is important to base the decision to provide analgesia on the patient’s report of pain and not the clinician’s opinion of threshold for treatment. If in doubt, analgesia should always be offered to patient. The patient can refuse analgesia if offered, but they should not be denied access to analgesia.

There is an ongoing debate about the most efficacious analgesia for fracture pain. However, treatment options vary according to patient characteristics and fracture location, and there is therefore no single best analgesia option. In our study, oral paracetamol was most commonly prescribed. We postulated that this could be due to its familiarity among clinicians, accessibility within the PED and minimal side effects, making it a well-accepted and popular analgesia of choice. However, oral ibuprofen has been identified to be more effective than oral paracetamol for extremity fracture, although monotherapy with ibuprofen alone may still be inadequate.

Other agents which should be considered include oral oxycodone and intra-nasal fentanyl, which provide effective analgesia effect without significant risk of sedation and adverse effects. Intravenous opioids such as fentanyl and morphine should be considered for severe pain and can be titrated to the desired end point. Intramuscular medication should be avoided, as it can cause further distress, and titration can be difficult. Education on analgesia options in paediatric patients is necessary to improve clinicians’ knowledge and confidence in selecting an appropriate analgesia.

Further efforts are necessary to minimise delay in the administration of analgesia. Early recognition of pain is essential and should take place at triage so that analgesia can be prescribed early. Instead of waiting for the clinician, nursing-driven protocols can further reduce the time to analgesia. Every PED should carry out an internal audit to identify bottlenecks and carry out quality-improvement initiatives to address these. By optimising processes in the department, patients can then receive analgesia in a timely manner.

In order to address analgesia being underutilised, inadequate and delayed for paediatric patients with extremity fractures in the PED, we propose that analgesia should be offered to every patient, and this should be initiated early in triage by a nursing-driven protocol. As the optimal analgesic choice is still controversial, a serial assessment of pain scores should be performed to ensure that pain relief has been achieved. Non-pharmacological methods can act as adjuncts to optimise pain control.

Limitations

This study was carried out to review the current practice of providing analgesia for extremity fractures following the increase in awareness of inadequate pain relief in patients at the PED. The information provided by this study not only sets the future direction for our department, but also provides...
insights on the current gap in the provision of analgesia for extremity fractures in the PED which is relevant to other departments. Therefore, we only had a small sample size. Despite this, our study’s findings were concerning and demanded further attention so that the utilisation, adequacy and timeliness of analgesia can be improved for these patients. This study thus allows for further work to be carried out in order to bridge the current gap.

Given the retrospective nature of the study, we could not elucidate the exact reasons why patients in pain were not administered analgesia. We postulate that this observation could be due to nurses at triage not being able to administer analgesia for patients in pain without consent from a doctor; a lack of communication about pain scores between nurses at triage and doctors at consult; doctors overlooking and not acting on the pain score documented, or patients and caregivers rejecting the analgesia offered by doctors. Furthermore, we were only able to determine changes in pain score and not in other outcomes which were not documented in the clinical records such as the short- and long-term impact of inadequate analgesia on patients and their family, as well as their satisfaction with the provision of care. We were also unable to determine the exact bottlenecks which resulted in the delay in the administration of analgesia. Finally, process factors such as workload, experience and turnover of staff can impact findings, but we were unable to comment on these.

In conclusion, effective pain management is a foundation of care in the management of extremity fracture. Clinical practice may not have improved, despite the increase in awareness of suboptimal analgesia at the PED. It is paramount for clinicians to consider patient characteristics, clinical conditions and degree of pain in order to formulate an effective strategy for analgesia. Further efforts at pain assessment, analgesia selection and administration are necessary to improve the utilisation, adequacy and timeliness of analgesia for extremity fractures in paediatric patients.

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None

Authors contributions
Siew Ming Tan was responsible for the data collection, statistical analysis and manuscript preparation. Yong-Kwang Gene Ong interpreted the results and helped to prepare the manuscript. Jen Heng Pek was involved in the study design, data collection, statistical analysis, interpretation of the results and manuscript preparation.

Availability of data and materials
The data of this study are not available in accordance with approval from the Institutional Review Board at SingHealth, Singapore.

Ethical approval
This study was approved by Institutional Review Board at SingHealth, Singapore (CIRB Reference Number 2018/2254).

Informed consent
Waiver of consent was granted by Institutional Review Board at SingHealth, Singapore.

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