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RESEARCH ARTICLE

The Bone Phone: Improving Time to Pain Medication Administration in Long Bone Patients

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Abstract

Background: Orthopedic complaints are one of the most frequent reasons for presentations to the pediatric emergency department (PED). National metrics have defined that each child should have a pain assessment and/or pain medication administered within one hour of arrival to an emergency department. Patient surges, transfers from referring hospitals, and acuity can affect the ability of a PED to meet this metric.

Objective: To implement a quality improvement process to ensure children presenting to a PED receive a pain assessment and pain medications within one hour of arrival.

Methods: We queried our electronic medical record (EMR) for all patients presenting to our level 1 trauma center PED pain for the 90 days prior to implementation and then for the 90 days post implementation of the quality improvement process. The bundle included nursing, support staff, and physician education to quickly identify children with long bone pain then calling the designated physician carrying the "bone phone." The physician carrying the bone phone then had 15 minutes to complete an assessment, order pain medication and radiographs and document these interventions in the EMR.

Results: During the study period, 553 total fractures were identified with 337 long bone fractures that met inclusion criteria (61%). Of these fractures, 105 required casting and 82 fractures required reduction in the PED, 127 necessitated OR repair, and 23 had a different outcome. Our pre-intervention average time to pain medication was 63 minutes and our time to medication ordered was 45 minutes. Our post-intervention average time to pain medication was 55 minutes and our time to medication ordered was 38 minutes.

Conclusions: Our intervention bundle was successful in reducing our time to assessment and time to pain medication administration. Future studies will look at using template orders and chief complaint driven nursing order sets to further reduce the time to pain medication administration for long bone pain patients. Future studies will also benefit from exploring if opiophobia contributes to delayed pain medication administration in the pediatric emergency department.

Keywords

Children, Fracture, Pain medication, Pain control, Analgesia

Background

Children with orthopedic injuries are common in the pediatric emergency department (PED) and require timely pain assessment and subsequent administration of analgesic medication. However, pediatric pain is often undertreated, and studies have shown that children with long bone fractures often do not receive adequate pain management [1,2]. Due to the need for improvement, national metrics have defined that each child should have a pain assessment and/or pain medication administered within one hour of arrival. Patient volume surges, transfers from referring hospitals, and overall acuity can adversely affect the ability of PED to meet this metric. Along with external factors listed previously, there are well documented aversions to physicians adequately treating pain [3,4]. Factors include internal biases (specifically against extremes of age [5,6],

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and ethnicity [7]), and fears of opiate pain medications, termed opiophobia [3]. Even when we do acknowledge the need for pain medication in children presenting to the PED, we often do not give proper doses of pain medications to alleviate suffering [8-10].

Several authors have reported that using a protocolized approach to assessing, treating, and administering pain medication decreases the time from arrival to delivery of analgesia to patients in pain [11,12]. These studies also demonstrated improved analgesia as reported by patients. One important caveat is that the Somers, et al. study was completed in the United Kingdom and did not show any improvement in time to pain treatment or pain scores for children less than 4-years-old [12]. The various interventions described in the previously referenced studies include implementing an electronic medical record alert that prompts physicians and nurses to give pain medications to patients, and the increased use and standardization of pain scales to drive administration of pain medication to patients. These protocols were found to be highly effective. It was determined that these strategies required that a physician be "found" and then asked to prescribe a pain medication after assessing the patient. It was hypothesized that if the physician asked to assess children who present with long bone fractures were standardized and that same physician were asked to quickly prescribe only one pain medication deliverable through the intranasal route to eliminate the need for intravenous access, that this would reduce the time interval between presentation and administration of pain medication to children with long bone fracture.

The objective of this project was to determine the effect standardized process to contact a designated physician via use of a dedicated "bone phone" in conjunction with standardized medication route and choice upon patient presentation to the PED in triage to improve time to pain medication in children with long bone fractures.

Methods

Data were collected retrospectively with careful attention to methods previously suggested to maximize rigor and generalizability [13,14]. Study was determined to be exempt by the Indiana University School of Medicine Institutional Review Board due to categorization of quality improvement. Children ages 2 to 18 years with long bone fracture who presented to the pediatric emergency department (PED) at a free-standing tertiary care children's hospital were identified retrospectively by query of the electronic medical record, Cerner. Records were searched for long bone fractures from 9/21/2015 - 2/28/2016 following the intervention initiation allowing for several months of intervention education. The comparison population was obtained by similar query from 4/1/2015 - 6/30/2015. Search for ICD-9/ICD-10 codes including "fracture" were identified and limited to long bone fractures. Long bone fractures were those involving the humerus, radius, ulna, femur, tibia, or fibula. Patients were excluded if there was no need for further analgesia as documented by current pain control in the PED, if they had pain medication prior to arrival, or if they had fractures that were not long bones, such as fingers or toes.

Abstracters were physicians or a clinical pharmacist working in the PED who underwent written and verbal training with the PI. The training focused on using written, explicit methods to review each chart for written evidence by care providers for pain control. Patients with long bone fracture ages 2-18 years underwent chart abstraction for baseline demographics, type and severity of fracture, pain scores, type of pain medication and details regarding pre-hospital treatment. Multiple time stamps were also obtained: time of arrival, time to physician ordered pain medication, time to pharmacy approval and time to nurse administered the medication. Patient location and transfer data was obtained to determine location of fracture diagnosis and prior pain medication administration at outside, home or from EMS. All data were de-identified and subsequently collected on a standardized template.

Data was collected pre -and post-intervention to compare time to pain medication for long bone fractures. In addition to education for nurses, residents and faculty working in the PED, a new system was implemented to alert physicians of a patient with suspected fracture. A new dedicated "bone phone" carried by a designated resident or staff physician was introduced to facilitate timely recognition of painful fractures. The triage nurse called the phone when a patient with a suspected long bone fracture was identified. The physician carrying the bone phone then had 15 minutes to complete an assessment, order pain medication, and document these interventions in the EMR. Intranasal fentanyl was standardized as the route and medication of choice. Following implementation, monthly evaluation of data was performed utilizing PDSA methodology (plan-do-study-act) to make changes and improve the intervention. Further interventions included adding intranasal fentanyl to the Pyxis, designating the fast track doctor to hold the phone during fast track hours, and creating a standardized note template.

The primary analysis of clinical characteristics was descriptive or univariate with means compared using an unpaired t-test and proportions compared using 95% confidence intervals for differences. Time stamp analysis was compared using comparisons of medians minute values.

Results

During the study period, 553 total fractures were identified with 337 long bone fractures that met inclusion criteria (61%). Table 1 demonstrates the baseline

demographics of our patient populations. They were not significantly different before and after the intervention with a majority of fractures occurring in males (58-60%) and Caucasians (76-78%). Of these fractures, 105 required casting and 82 fractures required reduction in the PED, 127 necessitated OR repair, and 23 had a different outcome. Table 2 demonstrates multiple time intervals including the time from patient admission to pain medication administration. The average time from the moment the patient was admitted to the Emergency Department to when they received pain medication went from 63 min to 55 min following the initiation of the bone phone. Additionally, there was an improvement in the time to medication being ordered, from 45 minutes to 33 minutes after the bone phone was initiated. There was no difference in time from order to pharmacy verification. The most common medication used was IN fentanyl at 72%. Less commonly used included Morphine, Ibuprofen, Tylenol, and Norco. Morphine or IV fentanyl was occasionally administered if the patient arrived with an IV or we were able to gain access quickly.

Table 1: Baseline patient demographics and characteristics.

	Pre-Bone Phone N (%)	Post-Bone Phone N (%)
Total	181	156
Gender		
Male	108 (60%)	96 (58%)
Ethnicity		
White	142 (78%)	119 (76%)
African American	29 (16%)	31 (20%)
Asian	6 (3%)	3 (2%)
Unknown	3 (2%)	0 (0%)
Refused	1 (1%)	3 (2%)
Definitive management		
Casting	55 (30%)	50 (32%)
Closed Reduction	36 (20%)	46 (29%)
OR Repair	75 (41%)	52 (33%)
Other	15 (8%)	8 (5%)

Discussion

This study showed that through focused staff education and dedicated phone alert for physician evaluation of long bone fracture, time to pain medication can be decreased to under national benchmarks for long bone fractures. Furthermore, patients with fractures requiring OR intervention had a higher likelihood of pain meds being given in a timely fashion. This was likely due to the severity of fractures and subsequently the increased likelihood of receiving pain medications more quickly. Of note, the most common outcome of long bone fractures in the study group was OR intervention. This was likely related to long bone fractures, in general, having more serious consequences and outcomes as opposed to other fractures. Although not statistically significant, the study also found that a decrease in time from admission to the pain medication being ordered subsequently led to a decrease in time of order verification by pharmacy. This was likely related to the heightened awareness of the bone phone and goal to administer pain medications in a timely fashion.

Our study did show that time to pain medication being ordered to time it was administered was 18 minutes pre-bone phone and 17 minutes post-bone phone. There was no statistical difference between these two outcomes. The delay in pain medication administration from the time it was ordered was likely affected by the census of the Emergency Department at that time and acuity of other patients. This number could be optimized by prioritizing pain medication in patients, verbal communication of orders between physicians and nurses, and increased awareness of importance and need of analgesics in long bone fractures.

In comparison to other published studies, this study had a similar outcome to a study performed at West Middlesex University Hospital A&E Department [12].

Table 2: Time to pain medication.

	Pre-Bone Phone N		Post-Bone Phone N	
	Goal	**Delayed**	**Goal**	**Delayed**
Casting	39	16	35	15
Closed reduction	26	10	31	15
OR repair	55	20	37	15
Other	11	4	8	0
Ordered to verified by pharmacy	7 min		6 min	
Admission to ordered	45 min		38 min	
Admission to pain med administration	63 min		55 min	

*Other: Splint, Cam Walker, Knee Immobilizer, Slings, Crutches, No intervention; *Pain medications used included Morphine, Fentanyl, Dilaudid, Norco, Tylenol, and Ibuprofen.

There, they initiated a pediatric pain protocol for children and studied the time taken to deliver analgesia following arrival to the emergency department. There was a separate protocol for children over 4-years-old versus under 4-years-old. In children over 4-years-old, the Wong-Baker faces scale was used. In children under 4-years-old, only points 1 and 3 on the Wong-Baker faces scale were used and nurses were instructed that a 3, 4, or 5 require immediate medical attention. There was a significant increase in the number that received analgesia within 30 minutes of triage (55.3%) post-protocol versus pre-protocol (34.0%) in regard to children aged over 4-years-old. With children under 4-years-old, there was no significant change in proportion to those that received analgesia within 30 minutes of triage (56.7%) post-protocol versus pre-protocol (59.4%). However, this study was for all children entering the department and not exclusive to children with long bone fractures.

IN fentanyl was the most commonly used form of analgesia used in our study. In a study done by Borland, et al. [15] children were randomized to IN fentanyl or IV morphine for the treatment of suspected long bone fractures. There proved to be no statistically significant differences between the two medications with regards to reducing pain as both reduced pain significantly. However, in another study by Furyk, et al. [16], children with clinically suspected extremity fractures were randomized to receive fentanyl 4 ug/KG in or morphine 0.2 mg/kg/IV. There was no statistical significance between the two but the difference in effects did favor IN fentanyl. IN fentanyl, in general, is very well tolerated as it is easy to administer and does not require an IV. For this reason, we were able to give it quickly after the patient was evaluated and determined to need pain medication.

There were limitations surrounding our study. As the bone phone was portable and carried by a staff physician, it was sometimes intermittently lost during shifts and subsequent calls were missed. A majority of the data was also gathered during winter months and not summer months where we typically see an increase in trauma and subsequent fractures. Regardless, we were able to obtain a significant amount of data surrounding long bone fractures to complete the study.

In conclusion, it was found that the bone phone did overall decrease the time to pain medication for patients presenting with long bone fractures. As for future studies, there would be benefit from further work to explore if opiophobia in the pediatric emergency department is a contributing factor to the delay in receiving pain medications in a timely manner. It is not uncommon for physicians to withhold prescribing opioids to pediatric patients in the hopes that their pain can be similarly treated with another medication, even when their mechanism of injury necessitates a stronger pain medication.

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