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Pediatric emergency department triage-based pain guideline utilizing intranasal fentanyl: Effect of implementation ☆

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ABSTRACT

Background: Pain management guidelines in the emergency department (ED) may reduce time to analgesia administration (TTA). Intranasal fentanyl (INF) is a safe and effective alternative to intravenous opiates. The effect of an ED pain management guideline providing standing orders for nurse-initiated administration of intranasal fentanyl (INF) is not known. The objective of this study was to determine the impact of a pediatric ED triage-based pain protocol utilizing intranasal fentanyl (INF) on time to analgesia administration (TTA) and patient and parent satisfaction.

Methods: This was a prospective study of patients 3–17 years with an isolated orthopedic injury presenting to a pediatric ED before and after instituting a triage-based pain guideline allowing for administration of INF by triage nurses. Our primary outcome was median TTA and secondary outcomes included the proportion of patients who received INF for pain, had unnecessary IV placement, and patient and parent satisfaction.

Results: We enrolled 132 patients; 72 pre-guideline, 60 post-guideline. Demographics were similar between groups. Median TTA was not different between groups (34.5 min vs. 33 min, $p = .7$). Utilization of INF increased from 41% pre-guideline to 60% post-guideline ($p = .01$) and unnecessary IV placement decreased from 24% to 0% ($p = .002$). Patients and parents preferred the IN route for analgesia administration.

Conclusion: A triage-based pain protocol utilizing INF did not reduce TTA, but did result in increased INF use, decreased unnecessary IV placement, and was preferred by patients and parents to IV medication. INF is a viable analgesia alternative for children with isolated extremity injuries.

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1. Introduction

Acute pain is a common complaint among patients who present to the pediatric emergency department (PED) with concerns of extremity injury and numerous organizations have issued policy statements to promote improvements in analgesia administration [1-4]. Failure to treat pediatric pain may result in subsequent heightened physiologic and psychologic responses to pain and posttraumatic stress disorder [2, 5, 6]. In addition, disparities exist in analgesia provision for children regardless of provider training [5, 7-10]. Reported barriers to adequate treatment of pediatric pain include underestimation of pain, lack of knowledge of pain assessment tools and, fear of oversedation or other analgesia complications [5, 8, 11].

To overcome these barriers, many institutions have initiated analgesia administration guidelines that include pain assessment scales, weight-based medication dosing, and options for medications and routes of delivery [12, 13]. Traditional routes of analgesia administration have disadvantages including diminished bioavailability due to first pass metabolism of oral medications and iatrogenic risk and pain with intravenous (IV) catheter placement. Intranasal (IN) administration offers analgesia delivery for a broad spectrum of clinical indications including pediatric pain associated with fractures [14-26].

Prior studies show that the use of pain management guidelines may reduce time to analgesia administration (TTA) and increase the percent of patients receiving analgesia medications.[18, 27-30] The goal of this study was to compare median time to analgesia administration (TTA) before and after the implementation of a triage-based, nurse-initiated pain guideline for patients presenting with suspected orthopedic extremity injury. We also sought to examine patient and parental

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satisfaction with the route of delivery and timeliness of analgesia as well as the potential decrease in IV catheter placement.

2. Methods

2.1. Study design and setting

This was a prospective observational clinical study conducted at a tertiary care children's hospital ED with an annual census of approximately 42,000 patients. Prior to initiation of the guideline, a physician order was required for opiate analgesia administration and providers routinely ordered opiates to be given either via IV or IN routes. In July 2011, we implemented a triage-based, nurse-initiated pain treatment guideline with standing orders for opiate analgesia delivery. We prospectively collected data on a convenience sample of patients before (February–June 2011) and after (August–December 2011) implementation, allowing a 2-month washout period for post-guideline subject enrollment.

2.1.1. Guideline development and implementation

The pain guideline was developed by a multidisciplinary group of ED physicians, nurses, a nurse educator, and an ED pharmacist. The group reviewed the available literature to determine proper medication dosing, and pain scale choice. Ultimately the guideline provided standing orders for triage nurses to administer INF (2 μg/kg, max 100 μg, concentration 50 μg/mL) to patients with a suspected isolated orthopedic injury, a qualifying level of pain as assessed on a pain score and normal mental status as defined as a Glasgow Coma Scale of 15. INF was administered via a mucosal atomizer device (LMA Nasal™, LMA Inc. La Jolla, CA) and the patient was placed on a continuous pulse-oximetry monitor for at least 1 h. Current practice mandated that the treating physician order all IV catheter placements. However, per the guideline, if IV access was anticipated, it was at the nurse's discretion to request an IV order from the provider.

The guideline recommended use of the Wong Baker Faces (WBS) pain assessment scale for ages 3 to 8 years and the numeric rating scale (NRS) for ages 9 to 17 years. Patients with a self-reported pain score of ≥3 faces on the WBS or a pain score of ≥4 on the NRS were eligible to receive INF per the guideline. Repeat pain score and vital signs (BP, HR, O2 sat) were to be assessed 20 min after INF administration. After the guideline was developed and prior to study initiation, both nursing staff and ED physicians were trained on the guideline specific recommended interventions.

2.2. Participant selection criteria

Patients were eligible for the study if they were between 3 and 17 years of age with a clinically suspected isolated extremity injury and had a caregiver who spoke either English or Spanish and met criteria for treatment by the guideline as described above.

Patients were excluded if they had a pre-existing IV catheter, were unable to provide a self-reported pain score, had suspected or clinically-apparent multisystem trauma, were hemodynamically unstable, had a history of loss of consciousness associated with the current trauma, obvious airway compromise, oxygen saturation <94% on room air, severe nasal congestion, active epistaxis, a history of allergy to any opiate medication, or a history of complex medical problems (including muscular dystrophies and congenital heart disease).

2.3. Study procedures

The local institutional review board approved this study. Eligible patients were screened for enrollment by a research assistant or physician during the hours a research assistant was present in the emergency department (15 h/day) and invited to participate in the study. Consent was obtained from parents and assent from patients >7 years. Research assistants obtained consent following completion of the triage process. A data collection form was completed for each study subject during the ED visit. Pain management satisfaction questionnaires were distributed to patients and parents and completed prior to patient discharge from the ED. Patients and families were asked whether the child received any form of pain medication while in the ED. Those that received any analgesia were then asked: 1) if analgesia administration was timely (yes, no), 2) the amount of discomfort with medication delivery, if applicable [using a 100 mm Visual Analog Scale (VAS)], and 3) their preferred route of analgesia administration for the future (IN vs. IV).

2.4. Outcomes

Our primary outcome was to compare median time to analgesia administration (TTA) before and after guideline implementation. We defined TTA as the time from ED arrival to time that any analgesic medication was administered. We also compared the difference in the proportion of subjects that received any form of analgesia (including oral acetaminophen or nonsteroidal anti-inflammatory), any form of opiate (IV morphine, IV fentanyl, IN fentanyl, or acetaminophen/hydrocodone) and any unnecessary IV catheter placement. We defined unnecessary IV catheter placement as any catheters placed only for administration of analgesia administration and not used for procedural sedation or other medications. Lastly, we compared the frequency of post-analgesia pain score documentation, change in pain score, and difference in patient and parent satisfaction with analgesia provision. Given that INF was in use with some frequency before guideline implementation and to better examine the association of route of medication administration with certain outcomes, we also analyzed TTA and satisfaction data by route of medication delivery with a separate category for patients that received both IV and IN medications.

2.5. Statistical methods and data analysis

Sample size was calculated a priori to detect a 15-minute difference in TTA (between the pre- and post-guideline groups), with a standard deviation of 25 min. For a power of 90% with a 5% significance level, the study required 60 patients per group. Statistical analyses were performed using the *JMP* program (Cary, NC; Version 10.0) and SPSS (Chicago IL, Version 24.0). The Mann-Whitney-Wilcoxon rank sum test (Mann-Whitney U test) was used to compare TTA between groups and by route of analgesia administration. The Fisher's exact test was performed to analyze dichotomous data and proportions among cohorts. The t-test was used to compare normally distributed continuous outcomes between groups.

3. Results

During the study period, we enrolled a total of 132 patients, 72 patients before and 60 patients after guideline implementation. One patient in the pre-guideline group was excluded due to lack of available information on TTA. Overall, groups were similar with regard to sex, age, median pain score, diagnosis, and proportion of patients undergoing operative repair (Table 1).

We found no difference in overall TTA between the pre-guideline group compared to the post-guideline group (35 min vs. 33.0 min; $p = .7$) as shown in Table 2. In addition, there were no observed differences between groups in proportion of patients receiving any form of analgesia including opiate and oral analgesia (Table 2). Utilization of INF increased from 41% to 60% in the post-guideline group. The frequency of post-analgesia pain score documentation (84.5%, 91.7%; $p = .3$), and the median change in pain score were similar for both groups (4, 5; $p = .7$).

Comparing IN and IV routes of opiate analgesia administration over both the pre- and post-guideline period, we found that the median TTA was shorter for INF compared to IV opiate administration (−8.5

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