Original Contribution

Out-of-hospital emergency medicine in pediatric patients: prevalence and management of pain

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Abstract

Introduction: Much less is known about pain prevalence in pediatric patients in an out-of-hospital than emergency department setting. The purpose of this study was to determine pain prevalence in children in a prehospital emergency setting and to identify the factors associated with pain relief.

Materials and Methods: This prospective cohort study in consecutive patients 15 years or younger was conducted by 5 mobile intensive care units working 24/7 (January-December 2005). The presence of pain, its intensity, and alleviation by the administration of analgesics were recorded.

Results: A total of 258 of 433 pediatric patients were included, of whom 96 were suffering from acute pain (37%; 95% confidence interval [CI], 31-43) that was intense to severe in 67% of cases. Trauma was the only factor significantly associated with acute pain (odds ratio, 818; 95% CI, 153-4376). Overall, 92% of the children in pain received at least one analgesic drug; 41% received a combination of drugs. Opioid administration was significantly associated with intense to severe pain (odds ratio, 7; 95% CI, 2-25). On arrival at hospital, 67% of the children were still in pain; but 84% had experienced some pain relief regardless of their sex, age, or disorder.

Conclusion: In a prehospital emergency setting, more than a third of children experience acute pain with a high prevalence of intense to severe pain. Scoring pain in children, and especially in the newborn, is beleaguered by a lack of suitable scales. Despite this, it was possible to treat 90% of children in pain and provide relief in 80% of cases.

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1. Introduction

Acute pain is a common reason for children being taken to hospital emergency departments (EDs). In a study of children older than 4 years, the prevalence of pain was 69%, with 48%
of cases of intense pain, defined by a score of 4/10 or higher with a colored analog scale [1]. The prevalence of pain in out-of-hospital emergency medicine has been studied in adults but, to our knowledge, not in children [2,3].

Pain management in many patients is often inadequate (oligoanalgesia), despite the availability of consensus guidelines on pain management in emergency medicine, pain being considered as the fifth vital sign [4,5]. Guidelines stress the need for prompt management of pain during patient transport [5]. However, physicians do not seem to be at ease with pain assessment and its interpretation, particularly in children [6].

The aim of this study was to measure the prevalence of pain in children in prehospital emergency medicine in an urban setting and to identify the factors associated with pain relief.

2. Materials and methods

2.1. Study design and setting

This was a prospective cohort study conducted between January 1 and December 31, 2005, by 5 around-the-clock mobile units (Service Mobile d’Urgence et de Réanimation) of the emergency services (Service d’Aide Médical d’Urgence [SAMU 93]) of a large suburb north of Paris (Seine-Saint-Denis; >1 380 000 inhabitants).

In France, medical emergencies are dealt with by the SAMU, which has a single nationwide call number (no. 15). Emergency physicians respond to the call and decide on the type of help needed. In the more serious cases, a mobile intensive care unit (MICU) with, on board, a trained ambulance driver, an emergency physician, a nurse anesthetist, and sometimes a medical student, is sent out [7]. There was one special pediatric unit among the 5 units in which the physician is a pediatrician. This unit transfers usually newborns in vital distress from maternity to intensive care unit. However, it also used to make out-of-hospital interventions when available.

2.2. Patients

The study protocol was reviewed and approved by the Committee for the Protection of Persons of R Ballanger hospital (Aulnay-sous-Bois).

We included all consecutive patients 15 years or younger who were taken care of by an MICU (SAMU 93). Noninclusions were cardiorespiratory arrest, age of at least 16 years, vital distress, central neurologic disease, behavioral disorder, upper functional disorder, and home birth.

The age of 16 years was chosen as a cutoff for inclusion because from this age patients are managed in adult hospitals.

2.3. Data collection

Data were collected 24/7. For each patient, the emergency physician completed a form on patient characteristics (age, sex, main distress symptom, presence or absence of pain, and pain intensity if pain is present).

The method used to assess pain was also recorded. The forms were checked daily within 24 hours. If data were inconsistent or missing, the emergency physician was contacted and the form was corrected.

Patients were stratified as follows: big children (≥5 years), small children (2-5 years), babies (29 days to 2 years), and newborn (0-28 days).

2.4. Pain assessment

The methods of pain assessment were those in routine use by care teams because the protocol of the study did not specify any method of assessment. Theoretically, the assessment of children pain and the scale used should be adapted to the age [8]. Children capable of telling whether they felt any pain (from 4 to 5 years old) were first asked if they were suffering from pain. In younger children, pain was determined by the care team. Acute pain was defined as pain of recent onset and probable limited duration (International Association for Study of Pain definition). Pain intensity was graded as weak to moderate, intense, or severe, preferably by using one of the following scales: visual analog scale (VAS), simple verbal rating scale (VRS), or numeric rating scale (NRS). Pain was intense if the VAS or NRS was greater than 3/10 and less than 6/10 or if the VRS was 3/4. It was severe if the VAS or NRS was at least 6/10 or if the VRS was 4. In other cases, it was considered to be weak or moderate [9]. Pain relief was defined as weak or moderate pain in a patient who was initially experiencing intense to severe pain [9].

2.5. Statistical analysis

We used standard statistical tests to analyze demographics, the nature of the pain, and pain management. Means and standard deviations were calculated for continuous variables. Normally distributed variables were compared by Student t test; and other variables, by a nonparametric test. Percentages with 95% confidence intervals (CIs) were given for qualitative data and were compared by a χ² test. Associations between analgesia use and efficacy and the study variables were analyzed first by univariate analysis and then by multivariate logistic regression. The significance threshold was P ≤ .05 in all tests. We used Staview version 5.0 software (SAS Institute Inc, Cary, NC).

3. Results

3.1. Cohort characteristics

The MICU transported 433 children to hospital. Data could be analyzed for 293 of these children (68%), and 140
were not included because the initial pain was not evaluated. Among these 293 children, 35 (8%) could not be evaluated for pain for the reasons outlined in the flowchart of Fig. 1. The 258 evaluable patients comprised 103 big children (40%), 40 small children (15%), 108 babies (42%), and 6 newborn (2%); 184 (71%) were boys. They were suffering from the following disorders: trauma (n = 89, 34%), neurologic disorder (n = 77, 30%), respiratory disorder (n = 45, 17%), and other (n = 47, 18%; digestive, endocrinologic, ENT, intoxication, drowning, malaise, and psychiatric disorder), and were taken to the ED (n = 220, 85%), to the intensive care unit (n = 31, 12%), or directly to the cardiology or pediatric department (n = 7, 3%).

3.2. Pain prevalence and intensity

Of the 258 children, 96 were suffering from pain (37%; 95% CI, 31-43). The potential factors associated with pain are presented in univariate analysis in Table 1. After adjustment for sex and age, the only disorder found to be significantly associated with pain was trauma (odds ratio [OR], 818; 95% CI, 153-4376).

Pain intensity was self-assessed by 47 children (49%), of whom 85% were older than 5 years, using VRS (n = 28), VAS (n = 13), NRS (n = 9), or the faces pain scale (n = 2). It was assessed by the care team in 39 children (41%), of whom 90% were younger than 5 years, using VRS (n = 24), NRS (n = 4), VAS (n = 1), faces pain scale (n = 1), Amiel-Tison scale [8] (n = 2), or no scale (n = 7). Pain intensity was not assessed in 8 children (8%).

Pain was intense to severe in 56 of the 84 children in whom pain was assessed (67%; 95% CI, 57-77). There was no difference in terms of sex, age, or type of disorder when the incidence of intense to severe pain was compared with that of absence of pain.

3.3. Pain management and relief

A total of 88 children suffering from pain received at least one analgesic drug (92%; 95% CI, 86-97). The main drugs

![Cohort flowchart](image-url)
used were paracetamol (n = 43, 45%), morphine (n = 38, 39%), nalbuphine (n = 18, 18%), and a 50:50 mixture of nitrous oxide and oxygen (n = 38, 39%). Forty children received a combination of at least 2 drugs (41%). There was a significant association between morphine prescription and the presence of intense to severe pain after adjustment for sex, age, type of disorder, and physician speciality (pediatrician or not) (OR, 7; 95% CI, 2-25) (Table 2).

On arrival at the hospital, 56 of the 84 children assessed for pain were still suffering from pain (67%; 95% CI, 57-77). Pain relief was experienced by 47 of 56 children who had intensive to severe pain initially (84%; 95% CI, 74-94) but was not significantly related to sex, age, disorder, or combination treatment in either univariate or multivariate analyses.

### 4. Discussion

Our study has shown that pain is a common symptom in children in prehospital emergency medicine. It occurred in 37% of children, was intense to severe in 67% of cases, and was treated in 90% of cases, providing a relief rate of 80%. The prevalence rate was lower than that published for children brought to EDs (69% in 334 children aged ≥4 years) [1]. However, the rate of intense to severe pain was higher (67% vs 48% for a >4/10 score) [1]. This difference is probably explained by the type of disorders encountered. Patients transported by MICU tend to be in a more critical condition than patients arriving at the ED because of triage by the emergency services call center. A recent large-scale study conducted in the same out-of-hospital setting has shown that, in adults (≥16 years old), 48% suffered from pain and that this was intense to severe in 71% of cases [3].

Comparisons between our results and published reports need to be interpreted with care because of differences in the organization of emergency services in different countries. The call center of French emergency services can send out a medical team (MICU) in the most serious cases, whereas most other countries send out ambulances staffed by paramedics or ambulance officers. We have no data on patients not transported by MICU.

The pain management rate in our study (92%) was much higher than in literature reports [11-13]. In a retrospective study of 696 injured children transported by ambulance, pain was undocumented in 18.7% of patients [11]. It was treated in 13.4% of patients only, either by pharmacologic (2.2%) or nonpharmacologic (12.4%) interventions. In a retrospective

### Table 1 Univariate analysis of potential factors associated with pain

<table>
<thead>
<tr>
<th></th>
<th>In pain n = 96</th>
<th>No pain n = 162</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>73 (76)</td>
<td>111 (69)</td>
<td>1.4 (0.8-2.5)</td>
</tr>
<tr>
<td>Age category, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big children (≥5 y)</td>
<td>51 (53)</td>
<td>52 (32)</td>
<td>1.3 (0.5-2.8)</td>
</tr>
<tr>
<td>Small children (2-5 y)</td>
<td>17 (18)</td>
<td>23 (14)</td>
<td>1</td>
</tr>
<tr>
<td>Infants/newborn</td>
<td>28 (29)</td>
<td>87 (54)</td>
<td>0.4 (0.2-0.9)</td>
</tr>
<tr>
<td>Trauma, n (%)</td>
<td>85 (89)</td>
<td>2 (1)</td>
<td>456 (122-1700)</td>
</tr>
</tbody>
</table>

### Table 2 Univariate analysis of potential factors associated with opioids administration

<table>
<thead>
<tr>
<th></th>
<th>Opioids n = 55</th>
<th>No opioids n = 33</th>
<th>OR (95% CI)</th>
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</thead>
<tbody>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>43 (78)</td>
<td>24 (73)</td>
<td>1.3 (0.5-4)</td>
</tr>
<tr>
<td>Female</td>
<td>12 (22)</td>
<td>9 (27)</td>
<td>1</td>
</tr>
<tr>
<td>Age category, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big children (≥5 y)</td>
<td>29 (53)</td>
<td>18 (54)</td>
<td>1.6 (0.5-5)</td>
</tr>
<tr>
<td>Small children (2-5 y)</td>
<td>8 (14)</td>
<td>8 (24)</td>
<td>1</td>
</tr>
<tr>
<td>Infants/newborn</td>
<td>18 (33)</td>
<td>7 (21)</td>
<td>2.6 (0.7-9)</td>
</tr>
<tr>
<td>Disorder, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nontraumatic</td>
<td>3 (11)</td>
<td>5 (9)</td>
<td>1</td>
</tr>
<tr>
<td>Burns</td>
<td>6 (23)</td>
<td>18 (31)</td>
<td>1.1 (0.2-7)</td>
</tr>
<tr>
<td>Trauma</td>
<td>17 (65)</td>
<td>35 (60)</td>
<td>0.5 (0.1-3)</td>
</tr>
<tr>
<td>Intense to severe pain, n (%)</td>
<td>43 (79)</td>
<td>14 (42)</td>
<td>6 (2-17)</td>
</tr>
<tr>
<td>Emergency physician is pediatrician, n (%)</td>
<td>13 (24)</td>
<td>5 (15)</td>
<td>2 (0.5-5)</td>
</tr>
</tbody>
</table>
study of 73 patients younger than 21 years (mean, 12.4 years) with extremity fractures or burns transported by ambulance, only 21.9% of patients received prehospital analgesia, whereas 79.4% received analgesia on arrival in the ED [12]. A third study reported a treatment rate of 53% by narcotics in 99 injured children on combined prehospital and ED care [13].

Administration of analgesia was not related to patient age in our study, although inadequate analgesia tends to be associated with age according to the literature [14-16]. In a prospective study of children with limb fractures or burns, no child younger than 5 years (n = 10) compared with 51% of those between the ages of 5 and 15 years (n = 35) received prehospital analgesia [14]. Intravenous morphine was administered to 70% of those younger than 5 years and to 54% of those older than 5 years on arrival in the ED. In a retrospective study of 96 infants and 84 schoolchildren with a long bone fracture or burns transported to the ED, 64.6% of the 6- to 24-month-old subjects received no analgesia compared with 47.6% of the 6- to 10-year-old subjects, with narcotics accounting for 17% and 44% of the prescriptions [15].

4.1. Limitations

Because the study was conducted in an urban area, we could not make a generalization on all populations of children. This study is an observational survey with all the possible bias. The main bias is related to missed data. The result depends on the quality of information reported by physicians on the scene. Another limitation of our study was the small number of children who were in pain, which meant that the study had insufficient power to analyze factors associated with pain relief. The MICU is called out for far fewer children than adults, and a third of the children did not meet the inclusion criteria. The pain assessment tools we used, especially for the youngest children, were not those recommended by local guidelines [8]. However, among the scales used for infants, only one so far (EVENDOL) has been validated in emergency medicine and not in an out-of-hospital emergency setting [10].

The definition of pain intensity and its evolution with time could be another limitation. Todd et al [17] highlighted the association between the minimal VAS variation (1.3 cm) and the clinical perception of pain intensity modification. However, at the same time, guidelines defined an intensive pain with a score higher than 3/10 and pain relief with a score of 3 or less. So our problem was that if a patient had a score of 4/10, it is an intensive pain; and if the score after treatment is equal to 3/10, it could be considered as a pain relief even though the difference is inferior to 1.3 cm. We followed guidelines about classification of pain in which pain relief was defined as weak or moderate pain in a patient who was initially experiencing intense to severe pain [9].

5. Conclusion

The prevalence of pain in children is high in an out-of-hospital emergency setting. Although the lack of suitable scales, especially for infants, makes pain assessment difficult, pediatric patient management and treatment efficacy were the same across all age groups.

References