PREVALENCE AND MANAGEMENT OF ACUTE PAIN IN PREHOSPITAL EMERGENCY MEDICINE

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ABSTRACT

Background. Less is known about the prevalence of pain in prehospital emergency medicine than about pain in the emergency department. Objectives. To estimate the prehospital prevalence of pain and to identify the factors associated with oligoanalgesia. Methods. The mobile intensive care units of the emergency services of a Paris suburb conducted this prospective study. All consecutive patients aged 16 years or older who were able to self-assess pain were included around the clock over a period of 11 months in 2007. Results. Among the 2,279 included patients, 947 had acute pain (42% [95% confidence interval (CI) 40–44]). Pain was intense to severe in 64% of patients. Factors associated with acute pain were trauma (odds ratio [OR] = 2.9 [1.9–4.3]) and age under 75 years (OR = 2.2 [1.7–2.8]). Intense pain was significantly associated with pain of cardiac or traumatic origin. Among the 1,364 patients transported by the mobile units, 48% experienced acute pain (71% had intense to severe pain). An analgesic agent was administered to 73%. According to multivariate analysis, only gynecologic/obstetric emergencies were associated with inadequate treatment (OR = 0.2 [95% CI 0.1–0.6]). Overall, 51% of patients [46–56] experienced pain relief. The rate of pain relief was lowest in patients suffering from trauma or a gynecologic/obstetric disorder. Conclusion. In our studied population, pain in prehospital emergency medicine affects 42% of patients. However, the rate varies widely according to the origin of the pain. Pain management is inadequate, as only one in two patients experiences relief. Key words: prevalence; prehospital pain; analgesia.

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INTRODUCTION

Acute pain is a common cause of arrivals at the emergency department (ED) and of emergency calls. The prevalence of pain in the ED ranges from 60% to 80%, with a greater than 50% incidence of intense pain among individuals complaining of pain. In over 80% of these patients, the pain was the main reason for the visit to the ED.1–4 However, despite the availability of consensus conference guidelines on pain management in emergency medicine, pain management in EDs is often inadequate and poorly tailored to the individual (oligoanalgesia).5,6 Pain should be considered the fifth vital sign.6

The prevalence of pain is less well known in prehospital emergency medicine than in the ED. Published results are inconsistent and range from 20% to 53%.7–10 In addition, little attention has been given to the efficiency of prehospital pain management. The objectives of our study were to determine the prevalence of pain in prehospital emergencies in an urban environment and to identify the factors that may be associated with poor pain management.

METHODS

Study Design and Setting

This was a prospective cohort study conducted between January 1 and November 30, 2007, by the around-the-clock mobile units (Service Mobile d’Urgence et de Réanimation [SMUR]) of the emergency services (Service d’Aide Médical d’Urgence [SAMU 93]) of a large suburb north of Paris (Seine-Saint-Denis, population >1,380,000). In France, emergencies are dealt with by the SAMU, which has a single nationwide call number (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, staffed by a trained ambulance driver, an emergency physician, a nurse anesthetist, and sometimes a medical student, is sent out.11

Patients

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

We included all consecutive patients, aged 16 years or over, who were able to self-assess pain and who were taken care of by a mobile intensive care unit (SAMU 93). Exclusion criteria were cardiopulmonary arrest, age under 16 years, inability to perform a self-assessment (vital distress, central neurologic disease,
behavioral disorder, upper functional disorder, inability to communicate), and a language barrier.

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

Data Collection

For each patient, the emergency physician completed a form on patient characteristics (age, gender, main distress symptom, presence or absence of pain, and pain intensity if pain present).

The patient was first asked whether he or she was suffering from pain. Acute pain was defined as pain of recent onset and probable limited duration (International Association for the Study of Pain [IASP] definition). Patients then self-assessed pain using a visual analog scale (VAS), a simple verbal rating scale (VRS), or a numeric rating scale (NRS). Pain was defined as intense if the VAS or NRS score was >3/10 and <6/10, or the VRS score was 3. It was defined as severe if the VAS or NRS score was ≥6/10 or the VRS was 4. The emergency physician also recorded the analgesic administered and pain evolution. Pain relief was defined as a VAS or NRS score ≤3/10 or a VRS score <2 in a patient with initially intense to severe acute pain. The forms were checked daily within 24 hours. If data were inconsistent or missing, the emergency physician was contacted and the form was corrected.

We tried as much as possible to obtain reasons why patients could not be evaluated. In some cases, we failed to obtain the information. However, the emergency physicians who included these patients observed that they could not make a self-evaluation. So, although we did not know the reason for this, we considered these patients to be “Patients not evaluated.”

The calculation of inclusion rate took into account the totality of 16-year-old or older patients who were managed by emergency medical services (EMS).

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’s t-test, and other variables were compared by a nonparametric test. Percentages with 95% confidence intervals were given for qualitative data, and were compared by a chi-square test. Associations between analgesia use and efficacy and the study variables were analyzed first by univariate analyses, and then by multivariate logistic regression. The significance threshold was p ≤ 0.05 in all tests. We used StatView version 5.0 software (SAS Institute Inc., Cary, NC).

RESULTS

Cohort Characteristics

The mobile intensive care unit was sent out 3,712 times. A total of 83 calls involved no patient management (road accidents or fires with no victims). Among the remaining 3,629 patients, 3,095 were 16 years old or older. We analyzed results for 2,797 patients (90%), of whom 2,279 met the inclusion criteria. Reasons for noninclusion are given in the flowchart in Figure 1. There was no difference in age or gender between the

![Patients ≥16 years old for whom unit was called out](image)

Patients not analyzed:
- Pain not assessed: n = 252
- Initial intensity of pain not measured: n = 46

Patients not evaluated:
- Impaired consciousness: n = 182
- Impaired upper functions, confusion, or behavioral disorder: n = 74
- Vital distress, respiratory distress: n = 107
- Inability to communicate: n = 41
- Other reason: n = 9
- No reason given: n = 78
- Language barrier: n = 27

Patients included: N = 2,279

![Figure 1. Cohort flowchart.](image)
included and nonincluded patients. Cohort characteristics are summarized in Table 1. The other diseases were neurologic (n = 196), respiratory (n = 219), abdominal (n = 112), psychiatric (n = 98), metabolic (n = 93), due to drug intoxication (n = 133), or due to another cause (allergy, rheumatic disorder, infection, ear, nose, and throat [ENT] condition, cancer, or miscellaneous) (n = 180).

### Prevalence of Pain

Overall, 947 patients were suffering from acute pain (42% [95% confidence interval (CI) 40–44]). The pain was intense to severe in 597 patients (64% [95% CI 60–66]) and severe in 374 patients (40% [95% CI 37–43]). The NRS was used in 374 patients (40%), the VAS in 317 patients (34%), and the VRS in 179 patients (19%). A combination of scales (VAS and/or NRS and/or VRS) was used in 77 patients (8%). Mean scores (± standard deviations) were 4.5 ± 3.2 (VAS), 1.8 ± 1.4 (NRS), and 5.5 ± 2.5 (VRS).

Table 2 gives the factors associated with acute pain and those associated with intense pain in univariate analyses. According to multivariate analysis, the factors associated with acute pain were trauma (odds ratio [OR] 2.9 [95% CI 1.9–4.3]) and age under 75 years (OR 2.2 [95% CI 1.7–2.8]). Cardiac and trauma pain were significantly associated with more intense pain (ORs 1.6 [95% CI 1.1–2.5] and 2.2 [95% CI 1.4–3.7], respectively).

### Pain Management and Relief

The mobile intensive care unit took 1,364 patients on board, of whom 659 had acute pain (48% [95% CI 46–51] and 467 had intense to severe pain (71% [95% CI 68–75]). The percentage of patients with acute pain not taken on board was significantly lower (32% [95% CI 29–35] (p < 0.0001). The mean intervention length was 52 minutes (standard deviation: 23 minutes). Among the 659 patients in pain taken to hospital, 472 received analgesics (73% [95% CI 69–76]) and seven were intubated under sedation (1% [95% CI 0–2]) after the initial evaluation. Table 3 gives the factors that were associated with administration of analgesics. According to a multivariate analysis, only gynecologic/obstetric emergencies were associated with inadequate treatment (OR 0.2 [95% CI 0.1–0.6]; p = 0.003).

Among the 659 patients in pain, 283 received paracetamol [44% [95% CI 40–48] at a mean dose of 14 ± 3 mg/kg, and 190 received morphine (29% [95% CI 26–33]). Morphine was administered chiefly to trauma patients (66%); the adjusted OR was 40.5 [95% CI 29–5] (p < 0.0001). The mean dose of the first morphine bolus was 4 ± 3 mg (i.e., 0.06 ± 0.03 mg/kg). The mean total dose per patient was 9 ± 5 mg (i.e., 0.12 ± 0.07 mg/kg) and was significantly higher in trauma patients than in patients with a medical disorder (0.142 ± 0.074 vs. 0.092 ± 0.051 mg/kg, p < 0.05). Other drugs were used in 44 patients, namely, non-steroidal anti-inflammatory drugs (n = 3), local anesthesia (n = 2),...
Table 4. Factors Associated with Pain Relief in Patients with Severe Acute Pain (n = 135)

<table>
<thead>
<tr>
<th>n (%)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender—male</td>
<td>74 (41%)</td>
</tr>
<tr>
<td>Age ≥75 years</td>
<td>24 (56%)</td>
</tr>
<tr>
<td>Disorder</td>
<td></td>
</tr>
<tr>
<td>Cardiac</td>
<td>71 (59%)</td>
</tr>
<tr>
<td>Gynecologic/obstetric</td>
<td>6 (19%)</td>
</tr>
<tr>
<td>Trauma</td>
<td>32 (33%)</td>
</tr>
<tr>
<td>Disease</td>
<td>15 (35%)</td>
</tr>
<tr>
<td>No diagnosis</td>
<td>11 (65%)</td>
</tr>
<tr>
<td>Analgesia</td>
<td>124 (47%)</td>
</tr>
</tbody>
</table>

CI = confidence interval; OR = odds ratio.

ketamine (n = 3), phloroglucinol (n = 11), and an equimolar mixture of oxygen and nitrogen protoxide (n = 32). A combination of at least two drugs was used in 174 patients, i.e., 39% (95% CI 35–44) of treated patients.

Overall, 51% of patients experienced pain relief (95% CI 46–56). Factors associated with pain relief in patients with initially severe pain are given in Table 4. According to a multivariate analysis, pain relief was significantly less frequent in trauma patients and those with gynecologic/obstetric emergencies (ORs 0.3 [95% CI 0.09–0.8] and 0.1 [95% CI 0.03–0.6], respectively; p = 0.01). The OR for analgesia in patients with severe pain was 1.8 (0.7–4.6).

A total of 28 adverse events (6%) were recorded in patients receiving analgesics: nausea (n = 14), vomiting (n = 3), drowsiness (n = 3), hypotension (n = 2), pruritus (n = 1), dyspnea (n = 1), phlyctena (n = 1), urinary retention (n = 1), and vertigo (n = 1). All of these events occurred in patients who were given morphine.

**Discussion**

Our prospective study has shown that pain is a common symptom in prehospital emergency medicine, with a high rate of intense to severe acute pain. The overall prevalence rate in 2,279 patients was 42%, and can be compared with published rates of 42% in 255 patients and 53% in 3,357 patients. Among our patients in pain, 64% had intense to severe pain, i.e., a prevalence rate of 26%, which is in line with the 28% rate of intense pain (VAS score >40/100) in another study. All these results are below the 70% prevalence rate in EDs.

Pain management in our study was inadequate, as only one in two patients experienced pain relief (51%). It was especially inadequate in trauma patients and patients with a gynecologic/obstetric emergency, who often had severe pain. Pain did not lessen significantly more in treated than untreated patients (OR = 1.8 [95% CI 0.7–4.6]; p = 0.6). This confirms published results in a prehospital setting. In one study, only 49% of patients received effective pain relief, even though the mean pain intensity score was significantly higher in treated than untreated patients, and in another study the relief rate for intense pain was 74%. A question could be raised about intoxicated patients and their ability to evaluate pain. In fact, this last point was one of the inclusion and exclusion criteria. Some patients with intoxication were included (n = 133) and others were not because of an alteration in consciousness. The emergency physician had to assess first the ability of patient self-evaluation. If a patient said that he or she had pain, we considered the patient to have pain, whatever the pathology. The medicine group, in which intoxications were classified, contained few patients with pain.

Inappropriate analgesia often provides no significant benefit as shown by studies in EDs. According to Milojetic et al., the factors for effective analgesia in a prehospital setting are morphine use, treatment within three hours, and a VAS score ≤70. This team divided patients into “medical” and “trauma” groups and found no difference in analgesia efficacy between the two groups. Other factors reported to be associated with poor analgesia are gender (for morphine prescription), ethnic origin, absence of health insurance, or extremes in the age range. A link with the nature of the patient’s disorder has been little investigated. We found no association with either gender or age but observed that treatment efficacy depended on disorder. Two groups of patients tended to experience more intense pain, namely, patients with a gynecologic/obstetric disorder and trauma patients. The former were less likely to receive an analgesic agent. The latter were more likely to be treated (adjusted OR = 7.2), in particular with morphine (adjusted OR = 40.5), but the failure rate was high (66%).

The association between pain and disorder has been investigated in 726 ED patients. The ranking was as follows: disease other than heart disease (46%), trauma (29%), and heart disease (3%). Our results are different no doubt because we sent out a mobile intensive unit only if the emergency call described serious signs. Trauma victims are generally serious or immobile cases, experiencing much pain.

The intervention interval was long enough to obtain the peak of action of the drugs used. For morphine or intravenous paracetamol, the peak of action is 15 minutes. However, half our patients received a paracetamol dose of <14 mg/kg, which is less than the indicated dose of 15 mg/kg. The mean total morphine dose was low (0.12 ± 0.07 mg/kg) but close to published doses. It has been reported that for pain relief in a patient with severe pain (VAS score >7/10), a mean morphine dose of 0.16 mg/kg is required, with trauma patients needing significantly more drug (0.17 ± 0.12 mg/kg) than patients with abdominal pain (0.15 ± 0.09 mg/kg). Titration failure would be due to side effects or protocol deviations. We also found that trauma...
patients need more morphine than other patients, but our mean dose was lower because we did not include only patients with severe pain.

Gynecologic/obstetric emergencies, in particular women in labor, pose a specific problem. Morphine is not recommended in these patients because of the risk of respiratory depression in the newborn. Available guidelines make no specific recommendations. According to a systematic review of the literature, an equimolar mixture of oxygen and nitrous oxide is effective and safe for both the mother and child, but its analgesic potency is low. Continuous inhalation of a 40% nitrous oxide mixture would be more effective than intermittent inhalation (during contractions) of a 70% mixture.

The rate of side effects is in accordance with previous data. Ricard-Hibon et al. studied the epidemiology of adverse effects of prehospital sedation analgesia. They found that side effects related to analgesia were observed in 5.5% of the patients.

Lvovschi et al. found an 11% rate of adverse events with morphine in an ED. But the study design was different since the patients who were included had high level of pain (VAS score >70/100) and received high doses of morphine.

The question could be asked about the nature of the opioid and whether others such as hydromorphone or fentanyl are associated with fewer side effects. Currently there are no clear data in the literature about hydromorphone or fentanyl in the emergency setting. Ricard-Hibon et al. did not find difference between morphine and fentanyl regarding the frequency of side effects. A randomized controlled study in the prehospital setting did not find differences in analgesia or in side effects. Another randomized controlled study during postanesthesia recovery showed these two drugs to be comparable in treating the first 40 minutes of postoperative pain. However, there were more side effects with morphine. On one hand, this situation is not easily extrapolated to the situation of emergency patients. On the other hand, the long duration of action of morphine is more adapted to emergency practice.

Chang et al. compared hydromorphone and morphine use in more than 190 patients in the emergency setting. The incidences of adverse effects were similar in the two groups, with the exception of pruritus, which was more frequent with morphine.

**LIMITATIONS**

Since the study was conducted in an urban area, we could not make a generalization to the population as a whole, particularly in rural patients, because the distribution of the pathology is probably very different.

This was an observational survey with all the possible biases. The main bias is related to missed data. Another one is related to the interference between the patient’s feeling of pain and his or her knowledge of the survey about pain. How much could this information modify the perception of pain? The answer depends on the quality of information reported by physicians on the scene. However, the patient volume and the consistency of data obtained after 11 months allow us to think that the result could be not so far from reality.

One of the positive points of our study was the high rate of analyzed patients (90%). However, the calculation could be discussed. Indeed, our calculation took into account patients who were analyzed for eligibility (3,095). It did not take into account only the patients who were included in the final analysis (2,279). With another calculation, it could be found that 12% (in place of 10%) of the presenting patients were eligible for inclusion but were excluded from analysis (2,279 + 298). The difference is 2%, and we believe that it does not interfere with the definitive results.

**CONCLUSION**

In our studied population, people over 16 years old living in an urban area, pain in prehospital emergency medicine affects 42% of patients. However, the rate varies widely according to the origin of the pain. Pain management is inadequate, as only one in two patients experiences relief.

**References**

4. Chang et al. compared hydromorphone and morphine use in more than 190 patients in the emergency setting. The incidences of adverse effects were similar in the two groups, with the exception of pruritus, which was more frequent with morphine.