



Research Article

The Impact of the Covid-19 Pandemic on Pain Management in the Emergency Department of a University Hospital

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Abstract

Background: Acute pain is the most common reason for Emergency Department (ED) visits, affecting 40-70% of patients; however, several studies have shown that pain is undertreated in EDs. **Objectives:** The aim of the study was to assess treatment of pain in our ED and to gauge whether and to what extent it has been affected by the COVID-19 pandemic. **Methods:** A retrospective observational study was conducted by evaluating 501 patients who accessed the ED in October 2019 and subsequently 495 patients in October 2020, although in 2020 it became necessary to extend the study period to have a comparable number of patients, due to the reduction in ED visits. **Results:** In 2019, 76% of patients that accessed the ED reported pain, while in 2020 only 61% of them reported pain. It was found that both in 2019 and in 2020 the majority of patients had post-traumatic pain, but there was a difference between the other types of pain, with fewer patients complaining of urological pain in 2020. In 2019 and in 2020 there were 36% of patients and 43% of patients who received analgesic therapy respectively. In both 2019 and in 2020 the median time of analgesic administration was 43 minutes and 33 minutes respectively, with a more significant reduction for moderate and mild pain. **Conclusion:** The results suggest that during the COVID-19 pandemic, some patients who reported severe pain decided not to access the ED. Moreover in 2020, when the ED was less crowded in terms of census, pain was managed more effectively, as far as percentage and time-to-analgesia were concerned.

Keywords: Emergency; Pain management; COVID-19

Introduction

Acute pain is the most common reason for ED consultations, affecting 40-70% of patients [1-3]. Emergency departments provide care to a substantial proportion of the population in most countries and the burden of acute pain is significant in this setting. Prompt, safe and effective pain management is therefore a core ED mission [4], because uncontrolled pain has adverse physiological effects such as unstable hemodynamic status, sleep disorders and alterations in the function of the immune system. Moreover, there are a variety of psychosocial effects, including anxiety, post-

traumatic stress disorder, increased delirium and disorientation, as well as an augmented risk of transition to chronic pain [5-7]. However, over the past 40 years numerous studies have shown that pain is repeatedly undertreated in EDs, which is a phenomenon known as oligoanalgesia [8].

A study conducted in the United States and Canada showed that only 60% of patients reporting pain received analgesics, that analgesic therapy was administered with a long delay time, and that 74% of patients were discharged in pain [9]. Additionally, the undertreatment of pain in EDs has been well documented in Italy [10,11].

In 2015 the Italian Intersociety Recommendations on pain management in the emergency setting were published [12] and more recently the European Society for Emergency Medicine established guidelines for the management of acute pain in emergency situations [13].

The barriers to adequate analgesia in EDs are numerous: a lack of training, suboptimal pain assessment, health care professionals underestimating the degree of pain that a patient might be experiencing, opiophobia, the fear that analgesia could mask signs and symptoms and impair diagnostic evaluation, as well as a not recognizing pain as a real emergency and a lack or failure to implement pain management protocols [10-16].

Besides, it should be considered that the constant overcrowding of the EDs often leads to long waiting times, especially for low priority codes, and this can contribute to the management of pain control deteriorating [17-19].

During the COVID-19 pandemic, the utilization of healthcare services within the inpatient, outpatient and ED settings dropped and a wide array of literature reported a reduction in the ED visits, especially during the first epidemic outbreak [20-24]; this occurred in Italy as well [25-29].

The aim of this study was to assess treatment of pain in the EDs and determine whether and to what extent it has been affected by the COVID-19 pandemic.

This is the first study that aims to assess pain management in the EDs during COVID-19 pandemic.

Materials and Methods

This is a retrospective comparative observational study conducted in a university hospital which 65,426 patients were referred to in 2019; there were an additional 40,318 patient hospital referrals in 2020.

Data were extrapolated from electronic medical records of patients who were referred to the ED in two different time periods: between 10/01 and 10/07 in 2019, and between 10/01 and 10/13 in 2020. As there was a reduction of patients accessing ED in 2020 [25-29], it became necessary to extend the study period in order to have a comparable number of patients in both study groups. In October 2020 there was an increased growth of COVID-19 infections, which was the so-called second wave, which led to the national government enforcing a set of social distancing measures which were implemented at a regional level on October 18th, which was after the study period.

The study was approved by the local Ethics Committee, protocol number 23943.

Demographic data (age and sex), the time of presentation at triage, the priority level assigned upon arrival, the type of pain reported (traumatic, urologic, abdominal, thoracic, lumbar pain, headache,

etc.), the time of administration of analgesic therapy and the type of analgesic drug, were collected.

We included adult patients (age $\geq$ 18 years) who reported pain at triage, defined as a Numeric Rating Scale (NRS) value greater than or equal to 1 point. NRS is a 0-10 ED-validated pain scoring system, where 0 meant that there was an absence of pain, whereas 10 was the maximum level of pain. Although translating continuous measures into discrete categories is not straightforward [30], patients were classified as having mild pain (NRS 1-3), moderate pain (NRS 4-6) or severe pain (NRS 7-10).

A priority level was assigned to each patient at triage, ranging from level 1 to level 5. Level 1 is defined as a life-threatening emergency that requests immediate treatment; level 2 is an urgent situation at risk of worsening (that could become life-threatening) that needs evaluation within 15 minutes; level 3 a subacute but stable condition that requires treatment within 45 min; level 4 is a minor condition that needs assessment in 90 min; level 5 is a non-urgency and has to be evaluated in 120 min. Exclusion criteria were the presence of an endotracheal tube (ETT), hemodynamic instability (systolic blood pressure <90 mmHg), Glasgow Coma Scale <13 without presence of ETT, intoxication, self-inflicted injury, cognitive impairment, pregnancy, patients allergic to analgesics or suffering from chronic pain, as well as patients who refused pain treatment and patients transferred from another hospital. In addition, all patients with ophthalmologic, dermatologic and ear-nose-throat conditions were excluded, as the majority of them were referred directly to specialists with a dedicated “fast track”, according to the ED policy. During the COVID-19 pandemic patients with fever, who had a different path of access to the ED, were excluded.

Data analysis

Data was registered on Microsoft Excel electronic sheet and statistically analyzed with the Jamovi v.2.23 software, performing both descriptive and inferential analysis. Absolute frequencies and percentages were calculated for qualitative variables, while for quantitative ones we extracted media and standard deviation. Differences in values obtained in independent groups were inferentially analyzed using the t test parametric test and the non-parametric U Mann-Whitney test. Additionally, with the same software logistic binomial regression, evaluating ROC and AUC, was calculated.

Results

Characteristics of the study population

In the period October 01-October 07, 2019 662 patients in total were admitted to the ED (excluding ophthalmologic, ENT and dermatological patients), and 501 (76% of them) reported pain (Figure 1).

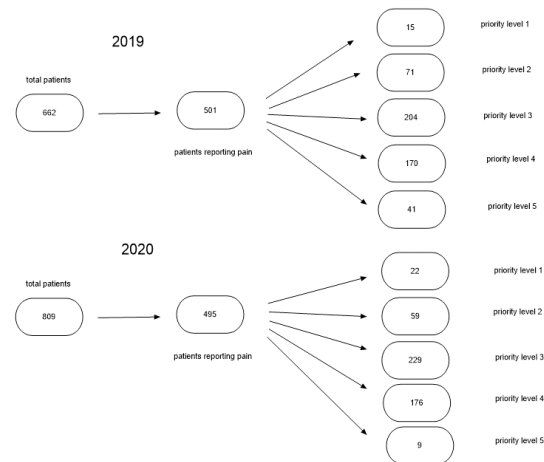


Figure 1: Number of patients enrolled in the study and their priority level.

A similar proportion of men and women (47.6 % and 52.4 % respectively) were observed. The women's mean age (57.4 ± 22.2) was significantly older ($p < 0.01$) than men's mean age (51.4 ± 20.2).

In October 2020 in our ED there was a 34.5% reduction of visits in comparison with 2019. Therefore, it became fundamental to extend our study period to obtain the same number of patients. From October 01- October-13 2020, 809 adult patients in total (excluding ophthalmologist, ENT and dermatological patients) were admitted to the ED: 495 (61% of them) reported pain (Figure 1). The percentage of patients reporting pain in 2020 was lower than in 2019 ($p < 0.001$, Figure 2).

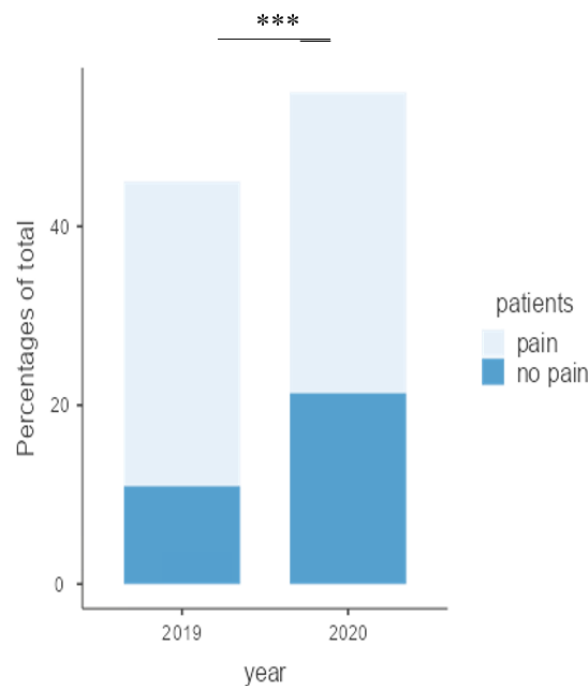


Figure 2: Percent of patients reporting pain in 2019 and in 2020. *** $p < 0.001$.

A similar proportion of men and women were observed (51.9 % and 48,1 % respectively) and women's mean age (56.6 ± 22.2) was significantly older ($p < 0.05$) than the men's mean age (51.9 ± 21.2).

The pain intensity was divided into three categories according to the NRS value reported by patients upon arrival at the ED which was one of the following: mild pain (NRS 1-3), moderate pain (NRS 4-6) or severe pain (NRS 7-10).

When the distribution of the NRS was compared, it was not possible to find any difference between 2019 and 2020 (Table 1).

Pain	2019	2020
	n patients	n patients
Mild (1-3)	330	331
Moderate (4-6)	150	152
Severe (7-10)	21	12

Table 1: Distribution of patients reporting pain according to its severity (NRS score).

The causes of pain were analyzed in 2019 and in 2020: in both years most, patients had post-traumatic pain (Figure 3). However, there was a difference between other types of pain, because in 2020 there were fewer patients complaining of urological pain both as percentages and also as absolute numbers ($p < 0.05$). Moreover, this reduction affected both men and women.

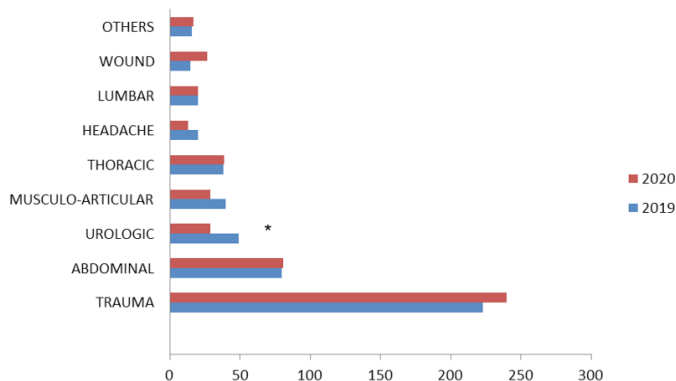


Figure 3: Distribution of patients reporting pain according to its cause. * $p < 0.05$.

In the ED each patient is given a priority level ranging from 1 (the highest) to 5 (the lowest).

Table 2 shows the distribution of our patients according to priority levels in 2019 and in 2020. The number of patients with priority level 5 was significantly lower in 2020 ($p < 0.001$).

Priority level	2019	2020
	n patients	n patients
1	15	22
2	71	58
3	204	229
4	171	177
5	40	9***

Table 2: Distribution of patients reporting pain according to the priority score. *** $p < 0.001$.

We found an inverse correlation ($r = -0.465$; $b = -0.263$; I.C.95% = -0.324, -0.202; $p < 0.01$) between the priority level and the NRS in 2019 (Figure 4). In 2020 (Figure 4) the correlation between priority level and the NRS was still detectable ($r = -0.211$; $b = -0.113$; I.C.95% = -0.177, -0.0481; $p < 0.01$) but significantly weaker than in 2019 ($p = 0.001$).

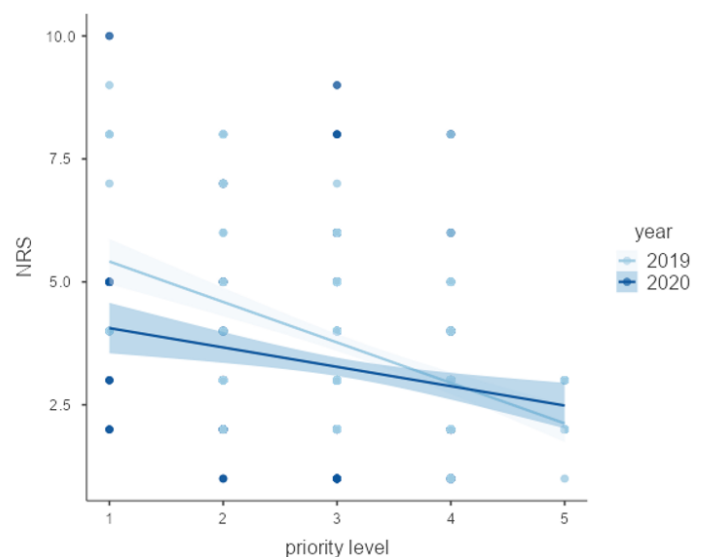


Figure 4: Correlation between NRS and priority level in 2019 and in 2020. $p = 0.001$.

In 2019 the higher percentages of patients complaining of severe pain were detectable in urologic, thoracic and trauma patients, whereas in 2020 the higher percentage of patients complaining of severe pain were found in patients with headaches and lumbar pain.

Pain management

In 2019, out of 501 patients, only 181 (36% of analyzed population) received analgesic therapy, including trauma patients to whom was provided ice, while in 2020 out of 495 patients, 214 (43 % of the population were analyzed) received analgesic therapy ($p < 0.05$ Figure 5).

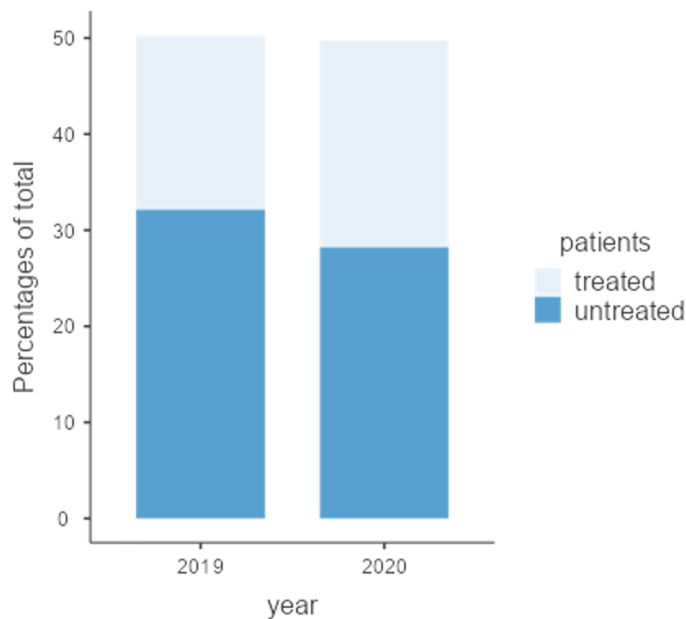


Figure 5: Percent of treated and untreated patients in 2019 and in 2020. * $p < 0.05$.

Table 3 shows the percentages of patients treated and untreated according to the NRS in 2019 and in 2020 (there was no statistical difference).

NRS	2019		2020	
	Treated	Untreated	Treated	Untreated
Mild (1-3)	18.6%	81.4%	19.3%	80.7%
Moderate (4-6)	27.4%	72.6%	36.9%	63.1%
Severe (7-10)	61.9%	38.1%	83.3%	16.7%

Table 3: Percentages of treated and untreated patients according to the severity of pain.

Table 4 shows the percentages of patients treated, according to the main causes of pain in 2019 and in 2020. In 2020 it was found that a higher percentage of patients were treated for all main causes of pain (nevertheless there was no notably statistical difference).

	2019		2020	
	Treated	Untreated	Treated	Untreated
Trauma	35%	75%	53%	47%
Abdominal	42%	58%	48%	52%
Urologic	49%	51%	51%	49%
Musculoskeletal	25%	75%	27%	73%
Headache	35%	65%	46%	54%
Lumbar	45%	55%	75%	25%
Thoracic	20%	80%	31%	69%

Table 4: Percentages of treated and untreated patients according to the cause of pain. Supplementary table Percentages of road injury and domestic injuries in 2019 and in 2020.

Pharmacological analgesia

Both in 2019 and in 2020 the probability of being pharmacologically treated was higher in patients with higher values of the NRS (Figure 6) and there was not any statistical significance between the two years.

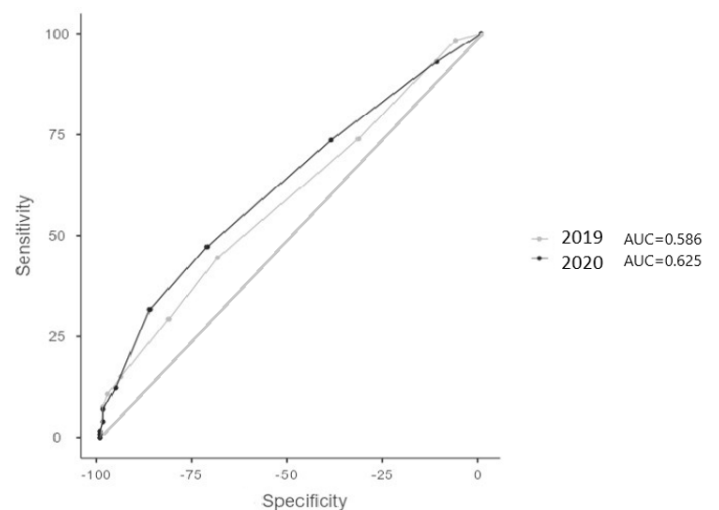


Figure 6: ROC curve of NRS and probability of treatment in 2019 and in 2020. The black line represents the reference line.

In 2019 the median time of analgesic administration was 43 minutes (IQR=102). However, when the median time was analyzed according to the NRS, it was found that patients with severe pain received analgesic therapy after a median of 21 minutes, whereas

patients with moderate and mild pain received analgesic therapy after a median of 44 and 65 minutes respectively. In addition to first line therapy, only 3 patients (2.7%) had to ask for a second treatment due to persistent pain and received rescue analgesic therapy after a median time of 2 hours.

In 2020 the median time of analgesic administration was 33 minutes (IQR=64). When the median time was analyzed according to NRS, it was found that patients with severe pain received analgesic therapy after a median of 15 minutes, whereas patients with moderate and mild pain received analgesic therapy after a median of 34 and 35 minutes respectively. In addition to first line therapy, only 5 patients (3.8%) had to ask for a second analgesic due to persistent pain and received therapy after a median time of 4 hours.

In 2019, among analgesics, the most frequently used were ketorolac (dispensed 41 times through the intravenous route and 22 times through the intramuscular route) and paracetamol (administered 23 times through the intravenous route and 9 times orally). Diclofenac was used once through the intramuscular route, tramadol was administered through the intravenous route in 4 patients, while morphine was given through the intravenous route to 5 patients. The intravenous route of administration for analgesics was the most often used, but it is not possible to determine why, although several patients had their blood drawn in order to check blood tests and in these patients' intravenous route was easily accessible.

In 2020, the most frequently used agents were ketorolac (dispensed 34 times through the intravenous route and 16 times through the intramuscular route) and paracetamol (administered 25 times through the intravenous route and 7 times as an oral drug). Diclofenac was dispensed once through the intramuscular route, tramadol was administered to 7 patients through the intravenous route, morphine was administered to 4 patients through the intravenous route and fentanyl was used through the intravenous route 6 times.

Discussion

The data confirmed that a high proportion of patients consulting the ED reported pain. This was observable in the study population, and pain was the main symptom presented even during the COVID-19 pandemic.

Similarly, to what was observed in other EDs, total admissions decreased in 2020, especially when lockdown measures were established, with delayed healthcare being sought in medical emergencies [25-29,31,32]. In 2020 Italy faced two different COVID-19 outbreaks, during spring and fall season. During the first outbreak, the number of patients presenting to EDs plummeted, together with a significant increase in overall out-of-hospital mortality [28]. During the second wave the reduction in

Eds access was still present but less marked [29]. This was probably both due to a decreased fear of infection and to the implementation of dedicated pathways concerning COVID-19 affected patients. This is the reason why, to obtain a similar number of patients in the 2019 and 2020 population sample, in 2020 we had to extend the retrospective analysis to include more days and to prolong the study period. The reduction of ED consultations during COVID-19 pandemic involved not only patients who accessed EDs inappropriately or consulted them for unjustified medical ailments, where a family doctor could be consulted (as shown by the data where there was a significant reduction of low priority code patients), but also patients affected by serious diseases, who did not seek treatment in EDs [31,32].

The results show that in 2020 the percentage of patients reporting pain was lower than in 2019. This reduction affected both patients with mild, moderate and severe pain, suggesting that even some patients with severe pain decided not to access EDs in October 2020, when a growing number of COVID-19 cases were reported. The data cannot exclude that patients reporting pain have received appropriate treatment from their primary care physician or their pharmacist, even if it seems unlikely as in that same period family doctors started to receive patients on appointment.

Gender distribution in patients reporting pain and coming to our ED was similar in 2019 and 2020, with females having a higher mean age in both, similarly to what was reported in another Italian study [33].

When different causes of pain were evaluated, trauma was the main cause in both study periods, in spite of the fact that many people during the COVID-19 pandemic converted to work by automobile or were simply working at home: actually in 2020 there was a slight reduction of the number of trauma due to road traffic, while there was a slight increase of the number of trauma due to domestic injuries. In 2020 there was a significant reduction in the number of patients presenting with urologic pain. Regarding underlying causes of urological pain, it was found that in 2020 there was a reduction in the number of cases of patients with renal colic and cystitis: this could suggest that some patients affected by these diseases avoided ED access, in spite of the pain, because it seems unlikely that the COVID-19 pandemic reduced renal colics.

In 2020 the correlation between priority code and the NRS was weaker than in 2019: this could be related to the reduced crowding of the ED in 2020, that could have led to a more accurate triage assessment. The data shows that in 2020, when the ED was less crowded in terms of census, the percentage of patients whose pain was treated was higher. Several studies have shown an association between emergency department crowding and the quality of pain care, demonstrating that an increase of census or of boarders, negatively impacts the quality of pain care delivery, with fewer

patients receiving analgesic medication and prolonging times to documented pain care [17, 34,35]. In the ED in 2020 time-to-analgesia, a quality marker for emergency units [36], was reduced in comparison with 2019, almost reaching the target recommended by some studies, that is less than 30 minutes from access to triage [37].

Both in 2019 and in 2020 the most frequently used analgesics were ketorolac and paracetamol, which were administered mainly intravenously. The data shows that morphine was only rarely used, similarly to what was already found in other studies [33,38]. It is not clear why and more patients should be included in the study in order to clarify this point, which could be due to opiophobia, that is the fear of side effects of opioids, (Italy is ranked as the last country for opioid consumption) or to a lack of systematic training of health professionals regarding pain control. It is important to underline that exposure to opioids in the ED has been identified as a possible risk for long term use and many US hospitals have developed appropriate guidelines to minimize the risk for opioid-related consequences [39].

However, although we rarely used morphine, most of the patients did not require a second analgesics, even if cannot exclude that this could be due to a lack of pain reassessment.

In agreement with previous research, the data shows that pain is poorly treated in the ED as well, with excessively long waiting times for analgesic administration in normal crowded conditions. When ED access is reduced, such as during the COVID-19 outbreaks, there appears to be a more effective management of pain. Reducing ED crowding may contribute to improve pain treatment, as well as using a specific protocol for its management: this protocol could start together with the triage assessment. Moreover, increasing physician/patient ratios as well as nursing/patient ratios could significantly improve pain management: even if pain control might not be the first priority of ED physicians, appropriate pain management could significantly improve the quality of patients' experience. In a wider view, strengthening primary care may be an alternative solution to save the precious ED resources for those who really need them.

Limitations

The major limitation of this study is the monocentric, retrospective design, regarding only a small number of patients accessing the ED in 2019 and 2020. Due to the fact that this is a descriptive study, it cannot account for the practice patterns of different physicians, which during overcrowding might have forgotten to write in the electronic data sheet that the patient refused pain treatment. It also excluded all patients with the NRS of zero who might have ultimately received pain medication. Besides, only the initial pain score from triage was documented: as pain may vary

over time, it was not possible to determine whether an evolution of pain influenced the administration of analgesia. Moreover, patient desire for analgesia was not measured and it is also possible that some patients had their pain treated, yet not documented. All these biases may account for the relatively low proportion of patients who received analgesia in the two cohorts.

Conclusions

The results suggest that during the COVID-19 pandemic, even some patients reporting severe pain decided not to access the ED. Moreover in 2020, when the ED was less crowded in terms of census, pain was managed in a more effective manner, in terms of percentage and time-to-analgesia.

Article Summary

Why is this topic important?

Because even if acute pain is the most common reason for ED visits, several studies have shown that pain is undertreated in EDs.

What does this study attempt to show?

It attempts to show that undertreatment of pain was detectable in the ED and that it was affected by the COVID-19 pandemic.

What are the key findings?

Our results suggest that during the COVID-19 pandemic, when the ED was less crowded in terms of census, pain was managed in a better way, in terms of percentage and time-to-analgesia.

How is patient care impacted?

Patient care, in terms of pain management, may be positively impacted by an increased physician/patients' ratio, as well as an increased nursing/patients' ratio.

Declaration of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare the following financial interests/personal relationships which may be considered as potential competing interests.

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