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Original article

Prospective analysis of pain and pain management in an emergency department

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Summary. *Background and aim of the work:* The aim of pain management in the Emergency Department (ED) is to temporarily optimize patient quality of life by reducing acute discomfort. The goals of this study were to evaluate the intensity and location of pain experienced by patients in the ED, the time to analgesia administration in the ED, and the patient's satisfaction so to identify potential useful interventions to improve pain management. *Methods:* We prospectively collected data on the intensity of pain experienced by 137 patients during their ED stays using the Visual Analog Scale (VAS) and the Numeric Rating Scale (NRS). Patients were further stratified by pain intensity according to three categories, and by cause of pain. *Results:* NRS pain measurements were higher than VAS measurements. Patients who took pain medication within a few hours before their ED visit had a higher mean VAS score at arrival in comparison to patients who did not. Patients treated with pain medications, compared to the non-treated, had more pain at arrival; abdominal pain was treated earlier than non-abdominal pain, whereas no difference in timing of medication administration was noted between traumatic and non-traumatic pain. Among the hospitalized patients, the chest was the most common location of pain; these patients had lower NRS scores than non-hospitalized patients. Patients with mild to moderate pain were more satisfied then those with severe pain. *Conclusions:* The discrepancy between NRS and VAS scores suggests that pain intensity cannot be determined accurately according to pain scale data alone but should also incorporate clinical judgment. (www.actabiomedica.it)

Key words: emergency department organization; numeric rating scale; pain management; pain medication; patient satisfaction; visual analog scale

Introduction

Pain management in the emergency department (ED) is challenging. The aim is to achieve patient satisfaction by reducing discomfort. Optimal treatment should reduce pain rapidly, continuously and safely (1).

Several factors have been shown to improve pain management, including more accurate estimation of pain intensity, earlier administration of analgesic medication, and greater use of opioid drugs (2-5). However, recent studies of pain management in the ED have found unwarranted use of opioids (6) and recommend more careful use of narcotics because of the risk of adverse events in patients with concomitant diseases (7). These findings indicate the persistence of suboptimal pain management and the lack of adequate physician

preparation to manage complex pain cases, as those seen with many ED patients (3, 6). Factors contributing to the complexity of pain management are the patient's age, emotional state, comorbidities, trauma type, and pain severity (8, 9). The need for quick resolution of pain complicates treatment further.

The emotional component of pain is complex and difficult to address, especially when the origin of pain is unclear or difficult to investigate, as in many cases of abdominal pain. An inadequate evaluation could cause over- or underestimation of the patient's pain, leading to inappropriate treatment. Several pain scales are used to evaluate pain (10, 11), of which, the most reliable and validated are the visual analog scale (VAS) and the numeric rating scale (NRS). These scales help clinicians estimate the level of pain, its intensity, and response to the therapy (11).

The goals of this study were to evaluate the intensity and location of pain experienced by patients in the ED, the time to analgesia administration, and patient satisfaction to identify potentially useful interventions to improve pain management.

Materials and methods

Study design and setting

We performed a prospective observational study of all patients treated in the ED at our institution on the days of duty of the nurse, who collected the data from March to May 2016. Patients under the age of 18 years were excluded from the study, as were patients who sustained trauma 24 hours prior to ED visit, patients with evident cognitive deficits or language barriers and those who were otherwise unable to describe the intensity of their pain, patients with gynecological pain, and those with life-threatening injuries.

Informed consent was obtained for all patients who agreed to participate to the study. Patients were treated with routine diagnostic, therapeutic, and analgesic interventions. The treating physicians and nurses were blinded to study participation.

The primary outcome of interest was pain intensity, which was measured using the VAS and NRS upon ED arrival and at discharge. The secondary outcome of interest was obtained by having patients completing a questionnaire before leaving the ED, using a 4-point Likert scale (12) ranging from 1 (completely unsatisfied) to 4 (completely satisfied). The dosage and timing of administration of analgesic medication were recorded. All data were collected on case report forms and subsequently transferred into an Excel (Microsoft Corp., Redmond, Washington) database.

Data analysis

A power analysis was performed to determine the adequate sample size. Assuming an estimated incidence of mild/intense pain of 65%, 42 patients were required to obtain a power analysis of 0.8 (80% Error Type II).

Descriptive statistical analysis was performed on the aggregated data of the full sample and on 4 subgroups based on pain location: chest pain, abdominal pain, headache, and musculoskeletal pain. Because of the clinical importance of abdominal pain, and the often high intensity of musculoskeletal pain, these two group were further analyzed vs all other patients.

Patients were further stratified by pain intensity according to the following categories based on VAS and NRS scores: mild (score, 1-3), moderate (score, 4-6), and severe (score, 7-10). We also analyzed data by cause of pain (traumatic vs. non-traumatic), discharge disposition (hospitalized vs. discharged), and a dichotomous pain location category (abdominal vs. non-abdominal).

Statistics

Statistical analysis was performed using MedCalc software, version 12.5.0 (MedCalc software bvba, Ostend, Belgium). Because data were non-normally distributed according to the Kolmogorov-Smirnov test, we used the Mann-Whitney U test to analyze continuous data and the χ^2-test to analyze discrete data. Statistical significance was set at $p< 0.05$.

Results

One hundred thirty-seven patients were seen in the ED of our institution during the study period. De-

Table 1. Characteristics and pain scores of 137 patients on arrival at the emergency department by pain location, March-May 2016

Pain Location	N	No. (%) Women	Median (IQR)			Priority code, green/yellow
			Age, years	NRS Score	VAS Score	
Abdomen	43	23 (53)	45 (35-51)	8 (7-10)	7 (6-9)	32/11
Chest	16	7 (44)	48 (37-68)	6 (5-8)	5 (4-8)	10/6
Headache	6	4 (67)	41 (25-48)	8 (8-9)	8 (6-8)	5/1
Musculoskeletal	72	32 (44)	44 (29-58)	8 (6-9)	7 (5-8)	59/13
All	137	66 (48)	44 (31-57)	8 (6-9)	7 (6-9)	106/31

IQR, interquartile range; NRS, numerical rating scale; VAS, visual analog scale. The priority code identify the level of urgency of the patients' need for medical intervention, green: low priority, yellow: moderate priority

mographic data, priority codes, pain intensity, and pain location for all patients are summarized in Table1.

Pain intensity

The median pain intensity scores at arrival for the entire sample size were 8 (interquartile range [IQR]: 6-9) for the NRS and 7 (IQR: 6-9) for the VAS (p=0.046) (Figure 1A). No significant differences were found between the NRS and VAS scores after the first hour in the ED (median: 7 [IQR: 5-8] for both) or at discharge (median: 5 [IQR: 3-7] vs 5 [IQR: 2-7]) (respectively p=0.309; p=0.340) (Figure 1A).

Thirty-six patients took medications with some sort of analgesic effect within 4 hours before their ED presentation. Two patients with chest pain took nitro-derivatives drugs (nitrate medications), with one receiving also an opioid medication during the ambulance transport. When compared to the 101 patients who did not take any recent analgesic medications, the 36 patients who did, had a higher median VAS score upon arrival. However, no significant differences were found for the VAS (median: 8 [IQR: 7-10] vs 7 [IQR: 6-8]; p=0.071) and NRS scores (median: 8 [IQR: 7-10] vs 8 [IQR: 6-8], p=0.154).

In order to evaluate the efficacy of pain treatment, we compared the changes in NRS and VAS scores, from ED arrival to discharge, with both scales showing a significant difference between the 2 time periods (p<0.0001). The median change in score was -2 for both scales, which was not significantly different (p=0.383) (Figure 1A).

Stratification data of all patients according to pain intensity at arrival and type of treatment received is shown in Table 2. Because of the scores differences at

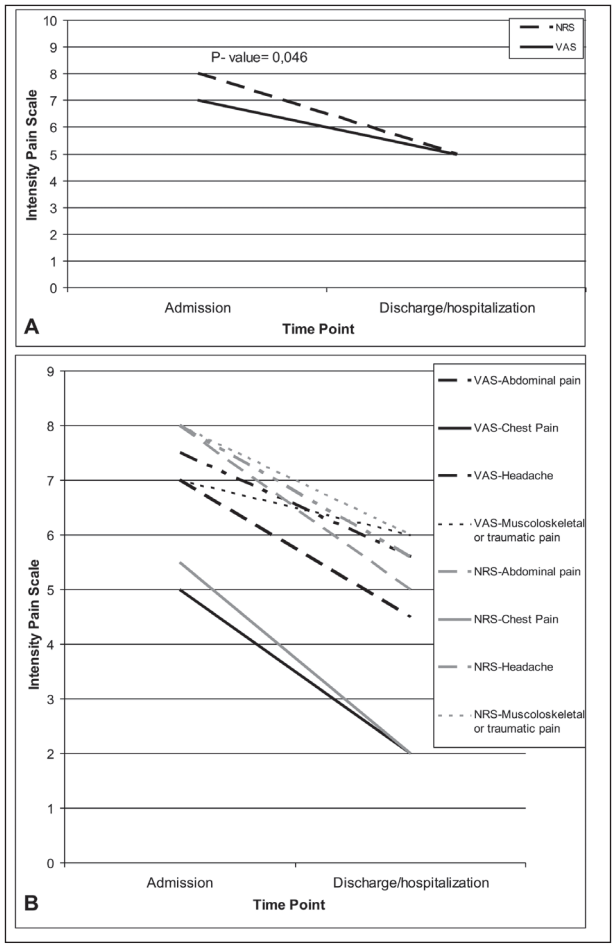

Figure 1. (A) Line graph representing the decrease in NRS (numerical rating scale) and VAS (visual analog scale) score from arrival to discharge from the emergency department (ED) or hospitalization. There was a significant difference between NRS and VAS scores median at arrival at the ED. (B) Line graph representing the decrease in NRS and VAS scores from arrival to discharge from the ED or hospitalization for each pain category. The NRS scores median was higher than the VAS score ones at arrival, whereas at the end of the ED stay, the 2 scales had identical medians in all groups except abdominal pain.

Table 2. Pain intensity (PI) categorization and type of pain treatment for 137 patients in emergency department, March-May 2016

Pain Treatment by PI	Scale Used for PI Categorization, N (% within PI category) of Patients	
	NRS	VAS
Severe pain (score 7-10)		
None	42 (44)	31 (39)
NSAIDs	38 (40)	36 (45)
Weak opioids with or without NSAIDs	7 (7.3)	7 (8.7)
Strong opioids	4 (4.2)	3 (3.8)
Unidentified pain killer	5 (5.2)	3 (3.8)
Total	96 (70)	80 (58)
Moderate pain (score 4-6)		
None	28 (82)	35 (76)
NSAIDs	5 (15)	7 (15)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	1 (2.2)
Unidentified pain killer	1 (2.9)	3 (6.5)
Total	34 (25)	46 (34)
Mild pain (score 1-3)		
None	6 (86)	10 (91)
NSAIDs	1 (14)	1 (9.1)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Unidentified pain killer	0 (0)	0 (0)
Total	7 (5.1)	11 (8.0)
All PI categories		
None	76 (56)	
NSAIDs	44 (32)	
Weak opioids with or without NSAIDs	7 (5.1)	
Strong opioids	4 (2.9)	
Unidentified pain killer	6 (4.4)	
Total	137 (100)	

NRS, numerical rating scale; VAS, visual analog scale; NSAID, non-steroidal anti-inflammatory drugs; Weak opioids: codeine and similar drugs; Strong opioid: morphine and similar drugs.

arrival seen between VAS and NRS scores, patients were assigned to different pain intensity categories depending on the scale used. Severe pain was present at a higher frequency when using the NRS compared with the VAS, whereas the converse was observed for moderate and mild pain ($p<0.0001$).

At discharge, patients who had severe pain at arrival continued to have more intense demonstrate higher pain compared with to patients who had with mild to moderate pain at arrival (median NRS: 6 vs 4, $p<0.0001$; median VAS: 6 vs 5, $p=0.026$). However, the changes observed in the NRS and VAS scores from arrival to discharge were significantly greater in patients with severe pain at admission compared with patients with mild/moderate pain at admission (median change in NRS score: -2 vs. -1, $p=0.041$; median change in VAS score: -2 vs. -1, $p=0.0002$). A reason for this difference might be the larger number of patients included in the severe pain group.

Pain location

Seventy-two patients (53%) reported musculoskeletal pain, 43 patients (31%) reported abdominal pain, 16 patients (12%) reported chest pain, and 6 patients (4.4%) reported headache. At ED arrival there

were no significant differences in pain intensity scores between the two scales for any group (Figure 1B). Contrary significant differences were observed during the ED stay between groups both for VAS score (p=0.044) and NRS score (p=0.025). Patients with abdominal pain experienced greater pain intensity than those with chest pain, and abdominal pain showed also a large difference between VAS and NRS score (Figure 1B). There were no differences in pain intensity between patients with headache versus those with chest pain when comparing VAS vs NRS scores; however, patients with abdominal pain and those with musculoskeletal pain had higher NRS scores vs VAS scores at arrival (Figure 1B). At discharge the abdominal pain group only, continued to show a significant difference between NRS and VAS scores (Figure 1B).

Abdominal vs non-abdominal pain

We further assessed differences between patients with abdominal pain vs pain in other locations (herein, non-abdominal pain) (Table 3) and between patients with traumatic vs non-traumatic pain (Table 4). At arrival, patients with abdominal pain had higher pain intensity according to both the NRS (median: 8, IQR: 7-10) and the VAS (median: 7, IQR: 6-9) compared with patients with non-abdominal pain (median NRS: 8, IQR: 6-8, p=0.030; median VAS: 7, IQR: 5-8; p=0.045). Patients with abdominal pain were treated with pain medications at a higher percentage (p=0.040), thus producing larger variances in NRS and VAS scores (median changes: -4 vs -1, respectively, p=0.0001 for changes in both scales) and lower pain intensity at discharge (median NRS score: 5 for abdominal pain group vs 6 for non-abdominal pain group, p=0.011; median VAS score: 4.5 for abdominal pain group vs 5 for non-abdominal pain group, p=0.007) (Table 3).

Traumatic vs. non-traumatic pain

No differences were observed for the pain intensity at arrival between patients with traumatic and non-traumatic pain (median NRS score: 8 for both groups, p=0.235; median VAS score: 7 for both groups, p=0.242). However, patients with traumatic pain were significantly less treated with pain medications (p=0.001) and had smaller changes in NRS and VAS scores compared to non-traumatic pain (median change in NRS score: -1 for traumatic pain vs -3 for non-traumatic pain, p<0.0001; median change in VAS score: -1 for traumatic pain vs -2 for non-traumatic pain, p<0.0001).

Discharge disposition

Patients who were discharged from the ED had higher pain vs those who were admitted to the hospital from the ED (median NRS scores: 6 vs 5, p=0.0004; median VAS scores: 6 vs 5, p=0.0008) (Table 4).

Treated vs. untreated pain

Only 55 patients (40%) were treated with pain medications in the ED (herein, treated patients) (Table 5). These patients had, at admission, higher NRS and VAS scores vs untreated patients (median NRS: 9 for treated vs 7 for untreated, median VAS score: 8 for treated vs 6 for untreated; p<0.0001 for both). Further, they had greater change in NRS and VAS scores vs untreated patients (median change: -3 for NRS vs -1 for VAS, p=0.0002 for both). Contrary no differences between NRS score (median for both groups: 5, p=0.648) and VAS score (median for both groups: 5, p=0.595) were seen at discharge.

Time to treatment

The median time between patient arrival at the ED and administration of pain medication (herein, treatment) was 62 minutes (range: 3-310 minutes, IQR: 27-164minutes). No significant difference was observed in time to treatment for any patients with moderate or severe pain according to either scale (VAS, p=0.808; NRS, p=0.905). Abdominal pain was treated earlier (median: 34 minutes) than non-abdominal pain (median: 75 minutes) (p=0.040). No difference in time to treatment was observed between patients with traumatic vs non-traumatic pain (p=0.953). The median time to treatment was 34 minutes (IQR: 16-128 minutes) for abdominal pain, 59 minutes (IQR: 15-182 minutes) for chest pain, 75 minutes (IQR: 44-

Table 3. Pain intensity (PI) categorization and type of pain treatment for 137 patients in an emergency department by abdominal vs non-abdominal pain, March-May 2016

Pain Treatment by PI	Scale Used for PI Categorization, N (% within PI category) of Patients	
	NRS	VAS
Abdominal Pain		
Severe pain (score 7-10)		
None	12 (36)	9 (32)
NSAIDs	17 (52)	16 (57)
Weak opioids with or without NSAIDs	1 (3.0)	1 (3.6)
Strong opioids	3 (9.1)	2 (7.1)
Total	33 (83)	28 (70)
Moderate pain (score 4-6)		
None	4 (80)	6 (67)
NSAIDs	1 (20)	2 (22)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	1 (11)
Total	5 (13)	9 (23)
Mild pain (score 1-3)		
None	1 (50)	2 (67)
NSAIDs	1 (50)	1 (33)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	2 (5.0)	3 (7.5)
All PI categories		
None	17 (43)	
NSAIDs	19 (48)	
Weak opioids with or without NSAIDs	1 (3)	
Strong opioids	3 (8)	
Total	40 (31)	
Non-Abdominal Pain		
Severe pain (score 7-10)		
None	30 (52)	22 (45)
NSAIDs	21 (36)	20 (41)
Weak opioids with or without NSAIDs	6 (10)	6 (12)
Strong opioids	1 (1.7)	1 (2.0)
Total	58 (64)	49 (54)
Moderate pain (score 4-6)		
None	24 (86)	29 (85)
NSAIDs	4 (14)	5 (15)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	28 (31)	34 (37)
Mild pain (score 1-3)		
None	5 (100)	8 (100)
NSAIDs	0 (0)	0 (0)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (00	0 (0)
Total	5 (5.5)	8 (8.8)
All PI categories		
None	59 (65)	
NSAIDs	25 (28)	
Weak opioids with or without NSAIDs	6 (6.6)	
Strong opioids	1 (1.1)	
Total	91 (70)	

NRS, numerical rating scale; VAS, visual analog scale; NSAID, non-steroidal anti-inflammatory drugs; Weak opioids: codeine and similar drugs; Strong opioid: morphine and similar drugs.

Table 4. Pain intensity (PI) categorization and type of pain treatment for 137 patients in an emergency department by traumatic vs non-traumatic pain, March-May 2016.

Pain Treatment by PI	Scale Used for PI Categorization, N (% within PI category) of Patients	
	NRS	VAS
Traumatic Pain		
Severe pain (score 7-10)		
None	24 (69)	17 (63)
NSAIDs	6 (17)	5 (19)
Weak opioids with or without NSAIDs	5 (14)	5 (19)
Strong opioids	0 (0)	0 (0)
Total	35 (65)	27 (50)
Moderate pain (score 4-6)		
None	15 (88)	21 (88)
NSAIDs	2 (12)	3 (13)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	17 (32)	24 (44)
Mild pain (score 1-3)		
None	2 (100)	3 (100)
NSAIDs	0 (0)	0 (0)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	2 (3.7)	3 (5.6)
All PI categories		
None	41 (76)	
NSAIDs	8 (15)	
Weak opioids with or without NSAIDs	5 (9.3)	
Strong opioids	0 (0)	
Total	54 (41)	
Non-traumatic Pain		
Severe pain (score 7-10)		
None	18 (32)	14 (28)
NSAIDs	32 (57)	31 (62)
Weak opioids with or without NSAIDs	2 (3.6)	2 (4.0)
Strong opioids	4 (7.1)	3 (6.0)
Total	56 (73)	50 (65)
Moderate pain (score 4-6)		
None	13 (81)	14 (74)
NSAIDs	3 (19)	4 (21)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	1 (5.3)
Total	16 (21)	19 (25)
Mild pain (score 1-3)		
None	4 (80)	7 (88)
NSAIDs	1 (20)	1(13)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	5 (6.5)	8 (10)
All PI categories		
None	35 (46)	
NSAIDs	36 (47)	
Weak opioids with or without NSAIDs	2 (2.6)	
Strong opioids	4 (5.2)	
Total	77 (59)	

NRS, numerical rating scale; VAS, visual analog scale; NSAID, non-steroidal anti-inflammatory drugs; Weak opioids: codeine and similar drugs; Strong opioid: morphine and similar drugs.

Table 5. Pain intensity (PI) categorization and type of pain treatment for 137 patients in 1 emergency department by discharge disposition, March-May 2016.

Pain Treatment by PI	Scale Used for PI Categorization, N (% within PI category) of Patients	
	NRS	VAS
Hospitalized		
Severe pain (score 7-10)		
None	3 (50)	2 (40)
NSAIDs	2 (33)	2 (40)
Weak opioids with or without NSAIDs	1 (17)	1 (20)
Strong opioids	0 (0)	0 (0)
Total	6 (46)	5 (39)
Moderate pain (score 4-6)		
None	5 (100)	5 (100)
NSAIDs	0 (0)	0 (0)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	5 (39)	5 (39)
Mild pain (score 1-3)		
None	1 (50)	2 (67)
NSAIDs	1 (50)	1 (33)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	2 (15)	3 (23)
All PI categories		
None	9 (69)	
NSAIDs	3 (23)	
Weak opioids with or without NSAIDs	1 (7.7)	
Strong opioids	0 (0)	
Total	13 (9.9)	
Discharged		
Severe pain (score 7-10)		
None	39 (46)	29 (40)
NSAIDs	36 (42)	34 (47)
Weak opioids with or without NSAIDs	6 (7.1)	6 (8.3)
Strong opioids	4 (4.7)	3 (4.2)
Total	85 (72)	72 (61)
Moderate pain (score 4-6)		
None	23 (82)	30 (79)
NSAIDs	5 (18)	7 (18)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	1 (2.6)
Total	28 (24)	38 (32)
Mild pain (score 1-3)		
None	5 (100)	8 (100)
NSAIDs	0 (0)	0 (0)
Weak opioids with or without NSAIDs	0 (0)	0 (0)
Strong opioids	0 (0)	0 (0)
Total	5 (4.2)	8 (6.8)
All PI categories		
None	67 (57)	
NSAIDs	41 (35)	
Weak opioids with or without NSAIDs	6 (5.1)	
Strong opioids	4 (3.4)	
Total	118 (90)	

NRS, numerical rating scale; VAS, visual analog scale; NSAID, non-steroidal anti-inflammatory drugs; Weak opioids: codeine and similar drugs; Strong opioid: morphine and similar drugs.

187 minutes) for musculoskeletal pain, and 80 minutes (IQR: 48-207 minutes) for headache (p=0.178).

Hospitalized vs. non-hospitalized patients

13 patients (9.5%) were hospitalized after their ED visit (Table 5) and 118 patients (86%) were discharged, while 6 patients spontaneously left the ED before receiving treatment. Hospitalized patients had a significantly lower NRS score at ED arrival (median: 6) compared to non-hospitalized patients (median: 8) (p=0.012). No significant difference was seen for the VAS score at ED arrival between patients hospitalized (median: 6) and discharged patients (median: 7) (p=0.068). This finding was consistent at the end of their ED stays (median NRS scores: 4 for hospitalized vs 5 for non-hospitalized patients, p=0.017; median VAS scores: 2 for hospitalized vs 5 for non-hospitalized patients, p=0.036).

No statistically significant difference was observed in the treatment rate (p=0.642) or in changes in NRS score (p=0.594) or VAS score (p=0.584) between hospitalized and non-hospitalized patients. The rate of hospitalization reasons differed by pain location (p=0.008) with no patients hospitalized for headache compared to hospitalization rates of 2.7% for patients with musculoskeletal pain, 16% with abdominal pain, and 25% with chest pain.

Patient satisfaction

The Likert (12) satisfaction questionnaire was completed by 105 patients (77%). The absolute and relative frequencies of each answer are shown in Table 6.

When asked about the given care, 62 patients (45%) were partially satisfied and 37 patients (27%) were completely satisfied. When asked about pain management, 67 patients (49%) were partially satisfied and 22 patients (16%) were completely satisfied. When asked about the waiting time until treatment, 53 patients (39%) were partially satisfied and 36 patients (26%) were completely satisfied.

There were no significant differences in the level of satisfaction between patients with severe vs moderate pain, traumatic vs non-traumatic pain, or abdominal vs non-abdominal pain. Patients with severe pain (according to the VAS) tended to be less satisfied with pain management than those with moderate pain (p=0.040).

Discussion

The aim of this study was to evaluate the intensity of pain experienced by patients in our ED and to analyze the effectiveness of used pain management techniques at our institution while identifying critical issues related to pain management in the ED.

Using the VAS and the NRS scores, we found that the pain intensity decreased significantly from arrival at the ED to discharge or admission to the hospital. When comparing the 2 scales, NRS scores were significantly higher than VAS scores, with the difference disappearing after the first hour of observation and no difference at discharge.

Evidence of a substantial similarity in pain evaluation was demonstrated in a systematic review published a few years ago that looked at different pain scales such as VAS and NRS (13). Contrary to this review, Muñoz et al. (14) observed in their controlled study that used auditory stimuli, a small difference between VAS and NRS.

Table 6. Satisfaction with their clinical management in the emergency department of 105 patients. March-May 2016

Item	N (%)			
	Completely Unsatisfied	Partially Unsatisfied	Partially Satisfied	Completely Satisfied
Assistance	1 (0.7)	5 (3.6)	62 (45)	37 (27)
Pain management	1 (0.7)	15 (11)	67 (49)	22 (16)
Waiting time	0 (0.0)	16 (12)	53 (39)	36 (26)

Assistance: patient satisfaction on rapidity of medical intervention and nurse and doctor management of patients discomfort; Waiting time: time to administration of pain medication.

In our results we found an evident discrepancy between the VAS and NRS when used in a selective and controlled situation. Furthermore, we were unable to determine whether the NRS overestimated or the VAS underestimated the pain intensity. This discrepancy was also found to be the cause of the different use of pain treatments, which are usually guided by the World Health Organization (WHO) pain scale (15). Hence, depending on what pain assessment scale was used, a patient could have been treated in two different strategies, with a more aggressive or more conservative approach when using the NRS or VAS score respectively.

We also observed that a higher percentage of patients with severe pain received pain medications in the ED compared with patients with moderate pain, and that patients with severe pain experienced a greater reduction in pain than patients with moderate pain. Nonetheless, patients with severe pain on arrival left the ED with higher NRS and VAS scores than patients with less pain on arrival. This could be explained by the fact that it is not always possible to relieve pain completely when its intensity is high at presentation. Another possibility is that this finding is the result of the high percentage of patients whose pain was undertreated or not treated at all.

We found that patients with traumatic pain had less treatment for their pain and were discharged from the ED with higher pain scores compared with those with non-traumatic pain (16).

When comparing all four patients groups (chest pain, abdominal pain, headache, musculoskeletal pain), the pain intensity at arrival was found to be significantly different for both the NRS and VAS scores between the abdominal and chest pain groups, with the abdominal group having the highest scores. A reason for this substantial difference, might have been the exclusion of patients from the chest group who were red coded due to their need for a higher priority medical intervention.

In order to obtain reliable results we created large patients groups, comparing first patients with abdominal to those with non-abdominal pain and then patients with traumatic to those with non-traumatic pain. Patients with abdominal pain had higher pain intensities, which led to higher treatment rates and larger ΔNRS and ΔVAS, resulting eventually in lower scores at discharge. A reason for this result might be the stronger emotional component and patient's anxiety associated with visceral pain that leads to an increase pain perception and subsequent broader use of pain medications by physicians (17). Subsequently, abdominal pain is usually better treated, with a consistent pain relief reached in a higher proportion of our cases.

Even though pain intensity at arrival was not significantly different patients with traumatic pain were found to be treated less and discharged with higher pain scores compared to those with non-traumatic pain. In our opinion this is a contradictory finding, since traumatic pain has usually an obvious and well described location, and it is therefore easier to treat with the prompt administration of a symptomatic therapy (16, 18).

Based on our findings we believe that the establishment of a pain medication protocol to be used at triage before a physician evaluation, might be a good solution to reduced the wait time to pain medications administration. In this contest patients with moderate-to-severe traumatic pain may benefit the most, since non-traumatic pain usually requires specific diagnostic triage by the emergency physician. If applied to our patients, this might help reducing the observed waiting time of 62 minutes for the whole sample and 75 minutes for the musculoskeletal pain group.

In our group only 40% of patients actually received pain medications, with only few patients being treated with strong opioids during their stay (4.2% of severe pain according to the NRS and 3.8% according to the VAS). When considering the WHO recommendations (11) for pain management we observed that 95.8% (NRS) or 96.2% (VAS) of patients with severe pain, 100% (NRS) or 97.8% (VAS) of patients with moderate pain, 85.7% (NRS) or 90.9% (VAS) of patients with mild pain were undertreated in our ED. Further, under the same recommendations, 70.1% (NRS) or 58.4% (VAS) of the enrolled subjects should have been treated with strong opioids at presentation.

Interestingly of the 55.5% of patients who were not treated at all in our ED, the NRS and VAS scores gradually decreased to almost full relief during their ED stay. When interviewed about the pain management received, only a minority of patients (11,7%) was dissatisfied, with the majority actually being partially (49%) to fully satisfied (16%). A further interesting

finding, was that patients who were eventually hospitalized presented with lower pain scores at ED arrival ($p>0.05$ for NRS only).

Based on these findings we believe that pain intensity and its quantification using the NRS and VAS scale cannot be considered a reliable indicator for a possible hospitalization.

Limitations

Analgesic medication taken before ED arrival (self-administered and/or given by the ambulance staff) have shown not to have a significant impact on the pain intensity evaluation

Variables such as comorbidities, ethnicity, gender, and presence of alcohol or drug use were not considered as possible confounders, because the number of patients included and the different categories of analysis have diluted the effect of confounding variables.

Another potential limitation is of the data recording, which was performed by multiple staff members. However, proper instructions on accurate data recording and updating were given to the involved staff.

Conclusions

Although pain is a subjective experience that requires a subjective treatment, we debate the reliability of standardized pain scales in guiding the approach to pain management. We therefore suggest that the NRS and VAS scales should be used as a support to proper clinical exam and judgment, rather than as the main tool for evaluating patients' pain.

Besides we have revealed substantial under treatment in pain management, especially related to use of opioids, despite the WHO recommendation. Our findings invite to give an impulse to the implementation of a specific protocol for the administration of painkillers after triage evaluation.

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