

Incidence and Management of Acute Pain in Trauma Patients in a Large Trauma Center

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Objective: Trauma is a major cause of acute and intense pain. Inadequate pain control can lead to chronic pain that lessens the quality of life of the patients. The main objective of the present study was to identify the incidence of moderate to severe pain in trauma patients. Moreover, the incidence of neuropathic pain and the factors affecting the pain severity were also identified.

Materials and Methods: A prospective descriptive study was conducted in 150 trauma-related patients admitted to the trauma ward at Siriraj Hospital. The patients' demographic data, pain score at hospital arrival, admission, and every four hours until discharged, time to first analgesia, and type of analgesia were recorded. Neuropathic pain was evaluated by clinical diagnosis together with the scores from the DN4 and painDETECT questionnaires. The information was analyzed using descriptive study statistics.

Results: One hundred fifty patients were analyzed. The incidences of moderate to severe pain on arrival at the trauma unit and at admission were 72.7% and 65.3%, respectively. The incidence of neuropathic pain was 15.3%. Neuropathic pain and multiple injuries were not significantly related to pain severity. In response to pain management, 71 patients (47.3%) had an improved pain score, and the median (IQR) pain score decreased from 7 (3 to 10) to 5 (2 to 8) ($p < 0.001$). Among all the patients, 46.0% were treated with multimodal analgesia. The time to first analgesia for the severe pain patients was four hours (2.0 to 7.0) after arrival and two hours (0.8 to 6.0) after admission.

Conclusion: Most of the trauma patients experienced moderate to severe pain irrespective of the degree of their injuries. Neuropathic pain was found in the acute phase of traumatic pain. Pain management remains a problem that needs more attention and better pain management strategies are needed in trauma settings.

Keywords: Trauma; Acute pain; Neuropathic pain; Pain management; Multimodal analgesia

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Trauma is an important public health problem that also results in both social and economic losses. Trauma in patients is usually accompanied by some degree of pain. Untreated pain can cause acute neurohumoral changes and neuronal remodeling, potentially leading to long-lasting psychological and emotional distress, which can eventually turn into chronic pain⁽¹⁾. Chronic pain worsens the quality of life of the affected person and can have an impact on their ability to work and sleep, as

well as their mental health, and sometimes their relationships⁽²⁾.

Authors have reported a high incidence of untreated pain both in pre-hospital and hospital settings. A previous study reported that 74% of multi-trauma patients reported moderate to severe pain⁽³⁾. In another study, up to 58% of patients reported an impaired quality of life and ongoing pain or discomfort for up to two years post-injury⁽⁴⁾. The prevalence of persistent pain after trauma ranges between 28% and 93%. Moreover, 6.8% of patients with chronic pain have neuropathic pain⁽⁵⁾. Neuropathic pain is often difficult to treat, and usually progresses to chronic pain. In trauma patients, neuropathic pain has been reported to coexist in 50% of patients who have traumatic peripheral nerve injury⁽⁶⁾, 30% of patients with traumatic spinal cord injury⁽⁷⁾, and 42% of second to third degree burns injured patients⁽⁸⁾, thus, making it an interesting factor to be accounted for, yet, it still represents an underdiagnosed and improperly treated pain in many trauma patients.

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Currently, in the trauma unit setting in Thailand, there is no available data on the incidence of pain and the result of pain management. Consequently, the main objective of the present study was to identify the incidence of moderate to severe pain in trauma patients. In addition, the secondary study outcomes were to determine the incidence of neuropathic pain, and the factors affecting the pain severity in trauma patients.

Materials and Methods

The present study was conducted as a prospective descriptive study at Siriraj Hospital, a large referral trauma center hospital in Bangkok, Thailand. The present study was approved by the Institutional Review Board of the Faculty of Medicine Siriraj Hospital (COA: Si 635/2016).

The sample size required for the study was calculated using the Cochran sample size formula⁽⁹⁾ to estimate the proportion of moderate to severe pain in trauma patients with 95% confidence level, rate of proportion 0.7, and allowable error 0.05, resulting in a sample size of 145 patients. All the patients admitted to the trauma ward between November 2016 and June 2019 that had experienced trauma-related pain within six weeks were included. The exclusion criteria were an age lower than 18 or more than 80 years old, patients with confusion, alteration of consciousness, abnormal cognitive function, psychiatric diseases or a tendency to display these problems, and patients who were unable to communicate.

After the patients' informed consents were obtained, their demographic data and the characteristics of their injuries were recorded. Pain severity was assessed using the numerical rating scale (NRS) at the hospital arrival time, ward admission time, and every four hours until discharge. To evaluate neuropathic pain incidence, the DN4 questionnaire and the Thai painDetect questionnaire scores were used to diagnose neuropathic pain. The pain management regimen and timing of any intervention were also assessed.

The data were analyzed using PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA). Quantitative data were expressed as the mean with the standard deviation (SD), or median and interquartile range (IQR), while the percentage was used for the qualitative data. Comparisons between two groups were performed using linear by linear association chi-square test for ordinal data and Wilcoxon signed rank test. A p-value less than 0.05 was considered statistically significant.

Table 1. Study patients' demographic data

Demographic characteristics	Total n=150
Sex: male; n (%)	103 (68.7)
Age (years); mean±SD	46.6±17.9
BMI; mean±SD	24.5±5.2
Length of hospital stay (days); median (IQR)	7 (3 to 13)
Mechanism of injury; n (%)	
Traffic	71 (41.3)
Household	40 (26.7)
Occupational	14 (9.3)
Assault	9 (6.0)
Animal bite	9 (6.0)
Falling	7 (4.7)

BMI=body mass index; SD=standard deviation; IQR=interquartile range

Results

One hundred fifty patients were included in the present study and their data analyzed. Their demographic data are shown in Table 1.

The pain severity scores of the patients at hospital arrival time and ward admission time are shown in Figure 1. The majority of patients (54.7%) had severe pain at hospital arrival time, but this fell to 36.7% by ward admission time. The incidence of patients with moderate to severe pain at hospital arrival time was 72.7% and decreased to 65.3% by the time they were admitted. Neuropathic pain was detected in 23 patients (15.3%), but this was not significantly related to pain severity, as shown in Table 2.

Multiple injuries, defined as injury at two or more areas of the body, were found in 39 patients (26.0%). These multiple injuries were not significantly related to pain severity at both the hospital arrival and ward admission times, as shown in Table 3.

The median (IQR) NRS pain score at the hospital arrival time was significantly decreased from 7 (3 to 10) to 5 (2 to 8) by the time of admission to the ward ($p<0.001$). Overall, 71 patients (47.3%) had reduced pain severity by the time they were admitted to the ward. On the other hand, 37 patients (24.7%) experienced the same pain severity, while 25 patients (16.7%) had worsening pain severity. The remaining 17 patients (11.3%) did not have any pain at either the hospital arrival or at the ward admission time.

A multimodal analgesia regimen was ordered in 69 patients (46.0%), including mild or no pain patients, during their hospital stay (Table 4), among whom 19 patients (44.2%) and 32 patients (58.2%) had moderate and severe pain, respectively. At the

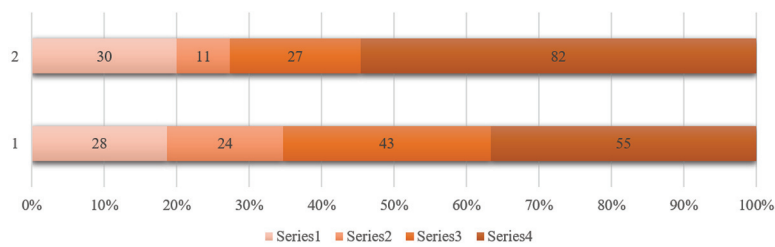


Figure 1. Incidence of pain severity of the patients at hospital arrival time and ward admission time (n=150).

NRS=numerical pain rating scale

Table 2. Incidence of neuropathic pain in each pain severity group at hospital arrival time and ward admission time (n=150)

Time	Pain severity	With neuropathic pain; n (%)	Without neuropathic pain; n (%)	p-value
Hospital arrival	No pain (NRS 0)	6 (26.1)	24 (18.9)	0.896
	Mild pain (NRS 1-3)	0 (0.0)	11 (8.7)	
	Moderate pain (NRS 4-6)	4 (17.4)	23 (18.1)	
	Severe pain (NRS 7-10)	13 (56.5)	69 (54.3)	
Ward admission	No pain (NRS 0)	6 (26.1)	22 (17.3)	0.399
	Mild pain (NRS 1-3)	2 (8.7)	22 (17.3)	
	Moderate pain (NRS 4-6)	9 (23.1)	34 (26.8)	
	Severe pain (NRS 7-10)	6 (26.1)	49 (38.6)	
Total (n=150)		23 (15.3)	127 (84.7)	

NRS=numerical pain rating scale

Table 3. Incidence of single and multiple injuries in each pain severity group at hospital arrival time and ward admission time (n=150)

Time	Pain severity	Single injury; n (%)	Multiple injuries; n (%)	p-value
Hospital arrival	No pain (NRS 0)	22 (19.8)	8 (20.5)	0.859
	Mild pain (NRS 1-3)	8 (7.2)	3 (7.7)	
	Moderate pain (NRS 4-6)	22 (19.8)	5 (12.8)	
	Severe pain (NRS 7-10)	59 (53.2)	23 (59.0)	
Ward admission	No pain (NRS=0)	25 (22.5)	3 (7.7)	0.361
	Mild pain (NRS 1-3)	14 (12.6)	10 (25.6)	
	Moderate pain (NRS 4-6)	32 (28.8)	11 (28.2)	
	Severe pain (NRS 7-10)	40 (36.0)	15 (38.5)	
Total (n=150)		111 (74.0)	39 (26.0)	

NRS=numerical pain rating scale

Table 4. Multimodal analgesia regimen usage in the moderate and severe pain patients

Pain severity (n)	Multimodal analgesia; n (%)	Non-multimodal analgesia; n (%)	No analgesia; n (%)
Moderate pain (43)	19 (44.2)	18 (41.9)	6 (14.0)
Severe pain (55)	32 (58.2)	16 (29.0)	7 (12.7)

same time, six patients with moderate pain severity and seven patients with severe pain severity did not receive any analgesic medication at all during their hospital stay.

The time taken before the patients received analgesic medication are shown in Table 5 as median values together with the 25 to 75 percentiles. The time

taken to receive analgesia after hospital arrival was 5.5 hours (2.0 to 13.3) for the moderate pain patients and 4.0 hours (2.0 to 7.0) for the severe pain patients. Whereas, this time was faster for patients following admission to the ward, being 1.3 hours (0.6 to 6.8) and 2.0 hours (0.8 to 6.0) for the moderate and severe pain patients, respectively.

Table 5. Time to receive analgesic medication in the moderate and severe pain patients from hospital arrival time and ward admission time

Pain severity	From hospital arrival time hours; median (25 to 75 percentiles)	From ward admission time hours; median (25 to 75 percentiles)
Moderate pain	5.5 (2.0 to 13.3)	1.3 (0.6 to 6.8)
Severe pain	4.0 (2.0 to 7.0)	2.0 (0.8 to 6.0)

Discussion

The present study showed that pain is a common complaint in trauma patients. Moderate to severe pain was reported by most of the study patients, from 72.7% on arrival and from 65.3% at admission. Among these patients, the incidence of neuropathic pain was 15.3%. The presence of neuropathic pain or multiple injuries were not statistically significant related to the pain severity. Although the pain scores mostly decreased from arrival to admission, multimodal analgesia was not applied, even in the moderate and severe pain patients. The time to first analgesic drug administration was also delayed. A delay in pain management may be due to the absence of a standard guideline for pain control in traumatic patient, lower prioritization of pain management in traumatic patient, or worrying of analgesic side effect such as sedation from opioids and bleeding from NSAIDs^(10,11).

The incidence of moderate to severe patients in the present study was similar to that found in the previous studies, which such pain reported in up to 70% of patients in pre-hospital settings and 91% in emergency departments⁽¹²⁻¹⁴⁾. With respect to the factors that are associated with pain severity, Atulya et al. found no relation with the mechanism of injury and pain severity⁽¹⁵⁾, whereas Soares et al. found that burn-like lesions were associated with more severe pain upon admission and at discharge⁽¹⁶⁾. In the present study, it was assumed that multiple-injury cases might be related to the pain severity, but no statistical significance was found. Pain is also subjective and has a psychosocial involvement. Therefore, the degree of injury might not be related to the pain severity. In terms of pain management, a previous study by Amare et al. found that 70.4% of emergency patients complained of moderate to severe pain after receiving analgesia. The mean time before the patients receive analgesia was 61.0±34.1 minutes⁽¹⁷⁾. The cause of this long delay might be multifactorial, including the admission or operation process, patients did not ask for a PRN dose, ignorance, or the intention to treat the underlying primary injury.

While studies have reported the benefit of multimodal analgesia⁽¹⁸⁾, the most frequently used

drugs in trauma are non-steroidal anti-inflammatory drugs or paracetamol, opioids, and other therapies, respectively⁽¹⁹⁾. Thus, the present study raised a concern about adequate pain control in trauma patients with multimodal analgesia.

To the best of the authors' knowledge, this is the first study that reports the incidence of moderate to severe pain in trauma patients and the result of pain management in a trauma unit in Thailand. The study patients comprised trauma-related injuries or patients who were attending an appointment for correction of a sequelae when the injury had partly subsided. Some patients underwent an operation immediately after arrival before admission, and with different types of anesthesia. Therefore, the pain scores at admission included postoperative pain in some patients. Another limitation of the present study was the small number of patients, which may not have represented the majority of trauma patients and may have been too small to detect statistical significances to identify the risk factors.

Further high-quality research is required to determine the risk factors for the development of acute severe pain in trauma patients and to enable providing a proper early pain management policy in each hospital.

Conclusion

Most of the trauma patients experienced moderate to severe pain irrespective of the degree of their injuries. Neuropathic pain was found in the acute phase of traumatic pain. Pain management remains a problem that needs more attention and better pain management strategies are needed in trauma settings.

What is already known on this topic?

Pain is recognized as a widespread problem in trauma patients around the world and acute neuropathic pain is also believed to be related to traumatic injury.

What does this study add?

A moderate to severe pain was quite common in trauma patients irrespective of the degree of their injuries in 72.7%. Neuropathic pain was common

in these patients, at a rate of 15.3%. Adequate pain control with multimodal analgesia regimen is still lacking in traumatic patients for 53.7%.

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Conflicts of interest

The authors declare no conflict of interest.

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