



# Nurse-initiated oral opioid pain protocol improves the quality of musculoskeletal pain management in the emergency department

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## 1. Introduction

Pain, due to a wide variety of underlying etiologies, is one of the most common patient complaints, representing up to 80 per cent of emergency department (ED) visits [1]. The early and effective management of acute pain is of critical importance in the short and the long term [2,3]. Although the importance of timely pain management in the ED has been acknowledged, it has also been recognized that there are barriers to effective pain relief, such as inadequate inter- and multi-disciplinary communication, workload and attitude problems, lack of patient input, knowledge deficits, and misconceptions on the need for effective pain management [4–7]. Musculoskeletal injuries are not only highly prevalent in the ED, but they are usually very painful. While acute musculoskeletal pain is a frequent complaint among patients in the ED, its management is often neglected, placing patients at risk of undertreatment of acute pain — a phenomenon that has been referred to in the medical literature as “oligoanalgesia” [8,9].

In order to improve analgesia delivery, pain management policies have been developed and implemented, however, delays in the initiation of analgesia has remained a concern. The provision of effective pain management in the EDs requires systems that would ensure adequate assessment of pain, the provision of timely and appropriate analgesia, with frequent monitoring and reassessment of pain [10]. The use of patient group directions [11] allows nurses to administer medications using their own assessment of patient needs and has shown early, effective, and safely provision of non-steroidal anti-inflammatory drugs [12,13], opioid suppository [14], and intravenous (IV) opioids [15,16].

There is a variety of pain management protocols in the EDs from different countries; most of these use non-steroidal anti-inflammatory drugs or intravenous opioids [17]. Researchers have shown that potent opioid analgesia can be administered orally [18,19]. The oral route of pain relief medication (PRM) is more convenient, noninvasive, and less expensive. Immediate-release oxycodone has rapid onset and prolonged pain relief which is ideal for acute pain treatment [20].

A regimen of oral oxycodone added to paracetamol and ibuprofen needs less personnel resources and is at least as safe as a procedure with nurse-administered IV morphine [21]. Dipyrrone, a non-narcotic analgesic, has an opiate-sparing effect in postoperative pain therapy with morphine and has been used as a substitute for other opioid analgesics [22]. Other researchers have also shown that multimodal analgesia involving several drugs with different mechanisms of action provides an additive effect, allowing improved analgesia with smaller doses of each drug, thereby limiting side effects associated with each class of analgesic medication [19,23].

To ensure the highest level of care for adult patients with isolated musculoskeletal injury, a nurse initiated pain protocol was developed resulting in institutional guideline instructions for pain management in the ED. The aim of this study was to evaluate the effectiveness of this protocol. As a secondary aim, we evaluated patient satisfaction and the occurrence of protocol related adverse events.

## 2. Methods

### 2.1. Study design and setting

We conducted a prospective, comparative pre–post implementation observational study at a community 400-bed hospital, level 3 trauma center with approximately 50,000 annual adult patient visits. The ED is staffed by a mixture of residents and emergency physicians. The ED nurses are predominantly registered nurses, some of whom have completed a 12-month postgraduate emergency nursing certificate.

### 2.2. Study population

Eligible patients were consecutively recruited when admitted to the ED from January to June 2014 (pre-intervention group) and from January to June 2015 (post-intervention group). Inclusion criteria for participation were acute isolated musculoskeletal injury; at least 16 years old; suffering from moderate to severe pain (Numerical Rating

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Scale (NRS) of at least 5); fully conscious with a respiratory rate of at least 12 breaths/min. Exclusion criteria were a known intolerance or allergy towards any of the protocol drugs; treatment for chronic pain; drug abuse; mental illness; antidepressant treatment; history of kidney or liver dysfunction.

### 2.3. Intervention

The nurse initiated pain protocol was developed by a team of experienced emergency physicians and nurses, based on local prescribing patterns, best practices, and local regulations. We used analgesic combinations of oral opioid (Oxycodone) and non-narcotic over-the-counter (OTC) pain relief medication (PRM) and have developed a unique protocol which is easy to read, use, and comprehend.

Oxycod, 0.1 mg/kg (maximum dose of 5 mg in the elderly) together with oral OTC PRM (Dipyrone 1 g) was given after initial pain assessment. If moderate or severe pain was still reported 60 min after the initial dose, the nurse could repeat the dose of Oxycodone.

Before the ED nurses could use the pain-management protocol, they all had to attend a 1-h educational session. The ED staff was informed about the new protocol and operating procedure and a written protocol was available at the ED. After the training period, every nurse received a written hospital permission to provide the drug after passing the exam based on lectures about pharmacokinetics, pharmacodynamics, side effects and emergency actions concerning Oxycodone. The permission was valid only in the ED.

### 2.4. Procedures and data management

The study was conducted in two phases, each designed to collect data on a convenience sample of patients: pre- and post-implementation of the new NIPP into the daily work of the ED.

Upon admission, nurses evaluated the patient's medical status: vital signs, including pain on the NRS score, age, medical treatment, and allergies to medications. The nurse recorded on the research chart initial pain intensity, dose, and time of PRMs provided. Sixty minutes later, pain severity was re-evaluated and each patient was asked to evaluate the satisfaction with pain management.

In the pre-implementation phase, PRMs included OTC medications administered by nurses (Dipyrone/Paracetamol), non-steroidal anti-inflammatory drugs (NSAIDs) and opioids under the physician's order. There was no standardized pain protocol available. In the post-implementation phase, nurses had the autonomy to initiate the protocol as discussed above following their initial evaluation. All patients were offered rescue medications as needed in both phases.

### 2.5. Measures and definitions

Effectiveness of the NIPP was evaluated using two process indicators and two outcome indicators: the use of pain relief medication in the ED, time to pain relief medication in the ED, pain relief, and patient satisfaction.

The use of pain relief medication in the ED was measured by recording all PRM's administered during patient's ED staying.

Time to pain relief medication represents the time recorded from admission to first analgesic administration in minutes. Because the major change after implementation involved opioid provision, time from admission to first opioid administration was also obtained.

Pain relief was defined as the difference between the pain intensity on admission and 60 min after PRM. Pain intensity was measured using the Numerical Rating Scale (NRS), where 0 is "no pain" and 10 "the worst pain imaginable," in response to the questions "How severe is your pain now?"

Patient satisfaction was measured by asking each patient to evaluate the satisfaction with pain management in general on a scale from 0 (not satisfied at all) to 10 (fully satisfied).

Adverse events (respiratory rate < 12 breaths/min; oxygen saturation < 95%; systolic blood pressure < 90 mmHg; nausea, vomiting, pruritus) were recorded and treated as needed.

### 2.6. Data analysis

In order to detect a significant pain intensity difference of 2 on the averaged NRS score [24] between the two groups a sample size of 20 patients in each group was needed (5% two-tailed significance, 80% power). In our opinion, this was a small sample, and thus, we decided to have at least 50 subjects in each group, which resulted in a 99% power, with 5% two-tailed significance.

Descriptive data are presented as means with standard deviations (SD) for continuous variables, as medians with interquartile ranges (IQR, 25th–75th percentile) for time variables, and as frequencies for categorical variables. Comparisons between the pre- and post-intervention groups were made using the Pearson's Chi squared test for categorical variables and the two-tailed Student's *t*-test or non-parametric Mann-Whitney *U* test for continuous variables, depending on whether the data met the assumptions of normality. Differences in pain relief between the pre- and post-intervention period were analyzed using the two-tailed Student's *t*-test. Differences between proportions of analgesic provision and pain relief between the pre- and post-intervention period were analyzed by the Pearson's Chi-squared test. Differences of the median times to analgesics were calculated with the median test. A *P*-value < 0.05 was considered statistically significant. All data were analyzed using the SPSS version 22.0 (IBM Corporation, Armonk, NY).

### 2.7. Ethical considerations

The study was approved by the Institutional Review Board of the Hadassah University Medical Center as a clinical quality improvement project.

## 3. Results

### 3.1. Respondent characteristics

A total of 127 patients took part in the current study, 58 in the pre-implementation period (pre-intervention group) and 69 in the NIPP treatment phase (post-intervention group). The two groups did not differ with respect to age (mean age  $41.7 \pm 19.02$  in the pre-intervention group vs  $43.9 \pm 15.91$  in the post-intervention group) and gender (65.5% and 69.6%, respectively were males). Baseline pain intensity in the pre-intervention group ( $M = 7.95$ ,  $SD = 1.84$ ) was lower compared to the post-intervention group ( $M = 9.04$ ,  $SD = 1.19$ ) ( $t(94) = -3.897$ ;  $P < 0.0001$ ).

### 3.2. Effectiveness of the NIPP

The use of pain relief medication in the emergency department is shown in Table 1, the non-narcotic OTC drug was mostly the first PRM provided to patients upon admission to the ED and more types of analgesics were administered in the pre-intervention group compared to the post-intervention group. Significantly, fewer patients were treated with narcotic PRM during their entire ED stay in the pre-intervention period.

Time to pain relief medication is shown in Table 2. The opioid PRM was provided significantly earlier in the post-intervention than in the pre-intervention phase. Significant differences between the two groups were found in the proportion of patients receiving analgesics within the 30 min and 60 min after ED admission. There was no significant difference in the timing of the first PRM after admission.

Effectiveness, in terms of pain relief, is shown in Table 3. The post-intervention group had a higher absolute and relative difference in pain

**Table 1**  
PRM administered in the ED in the pre- and post-implementation phases.

	Pre-intervention (n = 58)	Post-intervention (n = 69)	P
First PRM, (N, (per cent))			
OTC PRM	50 (86.2)		
Dipyron & Oxycodone	3 (5.2)	69 (100)	
Percocet	3 (5.2)		
Voltaren	2 (3.4)		
One rescue PRM (N, (per cent))	10 (16.9)	9 (13)	
Two rescue PRMs (N, (per cent))	6 (10.2)	1 (1.4)	
Three rescue PRMs (N, (per cent))	4 (6.8)	1 (1.4)	
Opioid PRM (N, (per cent))	6 (10.3)	69 (100)	p < 0.001
PRMs per patient (mean, SD)	1.56 (0.95)	1.2 (0.53)	0.019

PRM-pain relief medication, OTC-“over the counter” medication.

**Table 2**  
Timing of PRM administration from admission to the ED in the pre- and post-implementation phases.

Timing measure	Pre implementation		Post implementation		P
To first PRM, min (Median, IQR)	15	8–29	20	10–28	0.160
To opioid PRM, min (Median, IQR)	83	37–157	20	10–28	0.001
PRM within 30 min (n/N, per cent)	44/58	72	55/69	79.7	0.865
PRM within 60 min (n/N, per cent)	50/58	87.7	66/69	95.7	< 0.05

**Table 3**  
Pain relief (difference between NRS score upon admission and NRS after first PRM) in the pre- and post-implementation phases.

Pain relief measure	Pre-implementation		Post-implementation		P
Absolute difference (mean, SD)	3.34	2.57	5.7	2.33	< 0.001
Relative difference (mean, SD)	42.85	30.89	62.56	24.57	< 0.001
At least 30% reduction (n/N, per cent)	26/58	44.8	47/69	72.1	0.003
At least 50% reduction (n/N, per cent)	23/58	39.7	37/69	56.1	0.068

intensity compared to the pre-intervention group after the first PRM was provided. A significant difference between the two groups was also found for the proportion of patients with at least a 30 per cent reduction in pain intensity after the first PRM was provided.

Patient satisfaction scores are shown in Table 4. It was slightly higher for the post-intervention group than for the pre-intervention group but no significant differences were found between the two

**Table 4**  
Mean, median and interquartile range of patient satisfaction of PRM in the pre- and post-implementation phases.

	Pre-implementation (n = 58)				Post-implementation (n = 69)				P
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Satisfaction	5.83	3.54	7	3–9	6.89	2.61	8	3–8.25	0.06

groups.

### 3.3. Adverse events

No adverse events were recorded in any phases of the study.

## 4. Discussion

One of the primary goals of emergency medicine is to deliver prompt and effective alleviation of pain. Relief of pain is increasingly being viewed as a basic human right, thus, it is an ethical as well as a clinical concern for health professionals [25]. Despite this, evidence indicates that pain in ED is undertreated [9].

The most encouraging intervention of ED pain management is the implementation of nurse-initiated pain protocols, in which the nursing staff is mandated to administer analgesia autonomously [12,17,26]. In order to improve pain management, a nurse-initiated oral opioid multimodal pain protocol was implemented.

Patients in pre-implementation phase received mostly non-opioid PRM as single drug treatment. A review by Parnass et al. [17] also found that the most commonly analgesic treatment in ED patients was oral Paracetamol and intravenous Morphine as single drug analgesia. Patients in post-implementation phase received less types of analgesic medications compare to patients treated in pre-implementation phase. This finding is in concordance with other researches showed that multimodal analgesia resulted in lower pill burden due to broader spectrum of action, greater efficacy and a better efficacy/safety ratio compared to single-medication treatment [27].

In both phases of the study the mean time to analgesia in the ED was as short as 15–20 min, while the median time of the first opioid analgesic was shortened from 83 to 20 min after protocol implementation.

The time from presentation to analgesia in the literature was reported to range from 70 to 75 min [28–30]. Our study shows that even in the pre-intervention period OTC analgesics were administered quickly. NIPP allowed nurses to provide oral opioid PRM which allowed patient to receive potent analgesic shortly after admission.

Different studies also showed that a nurse initiated analgesia protocol allowed patients to receive analgesia within 30 min from presentation, mostly based on IV opioid PRM administration [7,15,26,30,31–33].

A timely access to analgesia is defined as analgesia administration within 60 min from admission [28,29]. There can be a considerable delay between the patient's presentation and being seen by an ED-physician, and even a longer time to analgesic administration [17]. Stang et al. [28] in a meta-analysis found that in 6 of 9 studies, the mean or median time of analgesia administration from the time of presentation was more than 60 min. A NIPP optimizes pain management especially in patients with acute musculoskeletal injuries who are usually assigned into a low triage category.

Greater pain relief was achieved after protocol implementation. The protocol improved mean pain relief of 5.7 points compared to 3.34 points on NRS in pre-implementation phase – a statistically significant and clinically important difference [26]. More than fifty per cent decline in pain intensity is defined as adequate pain relief [28]. The percentage of patients who achieved adequate pain relief increased from 39.7 per cent before protocol implementation to 56.1 per cent after implementation. These findings showed that oral opioid

multimodal analgesia with the synergistic effects of two drugs is effective and achieved a similar effect as the potent IV opioids in alleviating pain [26,34,35].

We found a higher satisfaction after implementation of NIPP when patients were treated timely and efficiently with potent analgesics compared with the pre-intervention period. Recent studies demonstrated that patient satisfaction of pain management was associated not only with pain relief itself, but also with their perceptions of adequate assessment and response to pain by the ED staff [28,31,36].

The safety of opioid analgesia protocols has been questioned. Yet, the absence of adverse events in our study concurs with the findings of larger studies of nurse-managed IV opiates [34,35].

The strength of this study stems from using a homogeneous population of patients with isolated musculoskeletal injuries, the use self-report of patients' satisfaction with pain management along with NRS measures. Moreover, this study includes patients who presented in the ED with severe pain unlike other investigations.

#### 4.1. Limitations

These findings are based on a convenience sample of patients presenting to the ED with pain. The quasi-experimental design used in this pre-post intervention study is not the best design to evaluate the benefits of a pain protocol implementation. A randomized controlled trial is generally considered to have the highest level of credibility with regard to assessing causality.

There are a number of important potential confounding factors, e.g., severity of injury, knowledge and experience of pain management, which were not measured and may have differed in both periods. Yet the pre-intervention period provides data about what pain management would have been had the intervention not occurred.

#### 4.2. Professional implications

Depending on the workload of the ED staff, there can be a considerable delay between the patient's presentation and being seen by an ED-physician, and even a longer time to analgesic administration [17]. Our protocol, based on simultaneous administration of two oral drugs in a liquid form, allowed nurses to administer potent opioid PRM to every adult patient with acute musculoskeletal injuries shortly after admission.

### 5. Conclusion

This study shows that the implementation of a nurse-initiated multimodal pain protocol in the ED appears to lead to timely administration of opioid analgesic, clinically relevant pain relief without adverse events in patients with acute musculoskeletal pain. Experienced nurses demonstrated that they can effectively, efficiently and safely provide Oxycodone to patients experiencing moderate and severe pain. The timely recognition and early relief of pain should be a guiding principle for nurses working in the emergency department.

#### Conflict of interest

We have no conflicts of interest to declare.

#### Ethical statement

We confirm that this manuscript has not been published elsewhere and is not under consideration by any other journal. All of the authors agree with submission to International Emergency Nursing. Appropriate ethical standards were followed in this study.

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