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A nurse-initiated pain protocol in the ED improves pain treatment in patients with acute musculoskeletal pain

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ABSTRACT

While acute musculoskeletal pain is a frequent complaint, its management is often neglected. An implementation of a nurse-initiated pain protocol based on the algorithm of a Dutch pain management guideline in the emergency department might improve this. A pre–post intervention study was performed as part of the prospective PROTACT follow-up study. During the pre- (15 months, $n = 504$) and post-period (6 months, $n = 156$) patients' self-reported pain intensity and pain treatment were registered. Analgesic provision in patients with moderate to severe pain (NRS ≥4) improved from 46.8% to 68.0%. Over 10% of the patients refused analgesics, resulting into an actual analgesic administration increase from 36.3% to 46.1%. Median time to analgesic decreased from 10 to 7 min ($P < 0.05$), whereas time to opioids decreased from 37 to 15 min ($P < 0.01$). Mean pain relief significantly increased to 1.56 NRS-points, in patients who received analgesic treatment even up to 2.02 points. The protocol appeared to lead to an increase in analgesic administration, shorter time to analgesics and a higher clinically relevant pain relief. Despite improvements, suffering moderate to severe pain at ED discharge was still common. Protocol adherence needs to be studied in order to optimize pain management.

1. Background

While acute musculoskeletal pain is a frequent complaint among patients in the emergency department (ED), its management is often neglected, placing patients at risk of oligoanalgesia.

During the past decade, there has been an explosion of research on both acute and chronic pain, with significant advances in understanding its etiology, assessment, and treatment. Improvements in pain assessment and management have facilitated care improvements in the ED (Thomas, 2013). However, inadequate pain management has still not been fully eliminated. Although pain is the most prevalent and chief complaint for visiting the ED (Berben et al., 2008; Johnston et al., 1998; Tcherny-Lessenot, 2003), acute pain appears undertreated worldwide, which is reflected by the high prevalence of moderate to severe pain at discharge and the low percentage of patients receiving analgesics. The proportion of adults receiving analgesics for painful conditions varies between 19% and 64% (Berben et al., 2008; Bhakta and Marco, 2014; Brown et al., 2003; Ducharme et al., 2008; Todd et al., 2007). Moreover, the percentage of patients discharged with moderate to severe pain ranges from 52% to 74% (Berben et al., 2008; Johnston et al., 1998; Todd et al., 2007).

Adequate pain management is important, not only from the perspective of good patient care and patient satisfaction, but also from a physiologic point of view. Adverse physiological effects can result from unrelieved acute pain, such as cardiovascular side-effects and negative effects on respiratory function (Lewis et al., 1994; Liu and Wu, 2008). Failure to relieve acute pain may also result in increasing

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anxiety, inability to sleep, demoralization, a feeling of helplessness, loss of control, and inability to think and interact with others, and therefore it is likely to result in longer rehabilitation, decreased productivity and diminished quality of life (Cousins et al., 2004). The early and effective management of acute pain is obviously of critical importance in the short term, but also important in the long term: unrelieved pain is associated with the likelihood of developing chronic pain (Pierik et al., 2015; Williamson et al, 2009).

Although the importance of timely pain management in the ED is acknowledged, it is also recognized that there are barriers to effective pain relief, such as inadequate inter- and multidisciplinary communication, workload and attitude problems, lack of patient input, knowledge deficits, and misconceptions on the need for effective pain management (Berben et al., 2012; Sinatra, 2010). Different strategies to enhance pain management have been developed in response to inadequate pain relief, such as pain management protocols or clinical guidelines and staff educational interventions (Decosterd et al., 2007; Finn et al., 2012; Fosnocht and Swanson, 2007; Fry and Holdgate, 2002; Fry et al., 2004; Jackson, 2010; Kelly et al., 2005; Zohar et al., 2001). Pain management protocols have been shown to be useful. Studies indicate that a pain protocol shortens the time to analgesic administration (Finn et al., 2012; Fosnocht and Swanson, 2007; Fry and Holdgate, 2002; Kelly et al., 2005), improves the percentage of patients who received analgesics (Decosterd et al., 2007; Fosnocht and Swanson, 2007), increases pain relief (Decosterd et al., 2007; Fry et al., 2004) and shortens ED length of stay (LOS) (Sokoloff et al., 2014). Despite these efforts to increase awareness of the importance of timely and adequate pain management, inadequately managed pain is still a persistent problem.

With the implementation of a nurse-initiated pain protocol, emergency nurses are allowed to administer analgesics, including opioids, according to a pre-defined protocol, without the patient being first assessed by an ED-physician. This is important because 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 (Hoot and Aronsky, 2008). Timely analgesic administration is required because patients become increasingly more sensitive to painful stimuli if pain is uncontrolled for a longer period of time.

Musculoskeletal injuries are not only highly prevalent in ED, they are usually very painful (Berben et al., 2008). Especially in patients presenting to the ED with minor acute musculoskeletal injuries, a nurse-initiated pain protocol might be useful to optimize pain treatment. These patients are usually triaged to a low (semi-urgent) triage category, which typically results in an extended waiting time for pain relief or even oligoanalgesia (Tanabe et al., 2001).

The aim of this pre–post intervention study is to evaluate the effect of implementation of a nurse-initiated pain protocol based on the Dutch evidence-based guideline regarding analgesic provision, actual administration, time to first analgesic or opioid, ED LOS, and patient satisfaction in patients with acute musculoskeletal pain. Second, effectiveness of pain management will be determined in terms of clinically relevant pain relief. Finally, protocol deviation will be assessed.

2. Patients and methods

2.1. Study design and setting

A pre–post intervention study was performed as part of the prospective "PROgnostic factors for the Transition from Acute to Chronic pain in Trauma patients" (PROTACT) follow-up study. Adult patients with musculoskeletal isolated extremity injury attending the ED of the level one trauma center Medisch Spectrum Twente in Enschede, The Netherlands, were invited to participate. The ED functions continuously 24 hours a day, 7 days a week (24/7 ED), has a catchment area of 264,000 individuals and treats approximately 27,000 patients annually. Ethical approval for the PROTACT study was obtained from the regional Medical Research Ethics Committee on Research Involving Human Subjects (CCMO No. NL368.38044.11). All participants provided written informed consent.

2.2. Study population

Eligible patients between 18 and 70 years were consecutively recruited when admitted to the ED between September 2011 and July 2013. Inclusion criteria for participation were (i) musculoskeletal isolated extremity injury caused by blunt trauma; and (ii) sufficient communication skills and a basic knowledge of the Dutch language. Exclusion criteria were (i) life or limb threatening conditions; (ii) documented cognitive disability; (iii) suffering from hallucinations, delusions or suicidal ideation; and (iv) alcohol or drugs intoxication. For the purpose of this study, patients who did not provide pain scores on both ED admission and discharge were excluded.

2.3. Intervention

The pain protocol, an algorithm for pain assessment and pharmacological treatment in the ED (Fig. 1), was implemented in January 2013. The protocol was based on the Dutch evidence-based guideline 'Pain management for trauma patients in the chain of emergency care', which was developed to provide pain management recommendations for trauma patients (Berben et al., 2010). The new protocol leads to an important change in the current operating procedure of the ED. The structural measurement and registration of a pain score was not yet standard procedure. Major change for pain management in the ED is that with the implementation of the protocol, nurses are allowed to administer analgesics, including opioids, without the patient being first assessed by a physician. Paracetamol is the treatment of first choice, if necessary with additional use of non-steroidal anti-inflammatory drugs (NSAIDs) or opioids. Because of the implementation, this study was divided into two data collection periods separated by a one-month interval. In the pre-period from September 2011 until December 2012 (15 months) there was no standardized pain protocol available, so nurses were not allowed to give opioids on their own initiative. Paracetamol was provided by nurse's own judgment. There was no structural measurement and registration of pain in this period. In the one-month interval, time was allowed for the active and passive distribution of the protocol among ED staff. The staff was informed about the new protocol and operating procedure, and the protocol and relevant important leaflets were available at the ED. During the intervention period from February 2013 until July 2013 (6 months), patients should be given analgesics according to the algorithm of the implemented protocol.

2.4. Procedures and data management

Patients who met the study criteria were informed by the nurse about the purpose of the study. Participants were asked to provide informed consent and to complete a questionnaire. The questionnaire included a validated tool to measure pain intensity and questions about educational level, pre-hospital analgesic use and patient satisfaction (yes or no). Additionally, data from the ED patient registration system were used. The registry is a fully electronic emergency medical record registry where each entry, order, or activity is automatically time-stamped for pre-specified ED events. The registry includes patient demographics (date of birth, sex), urgency level, medical diagnoses (e.g. injury type), type of analgesics, type of

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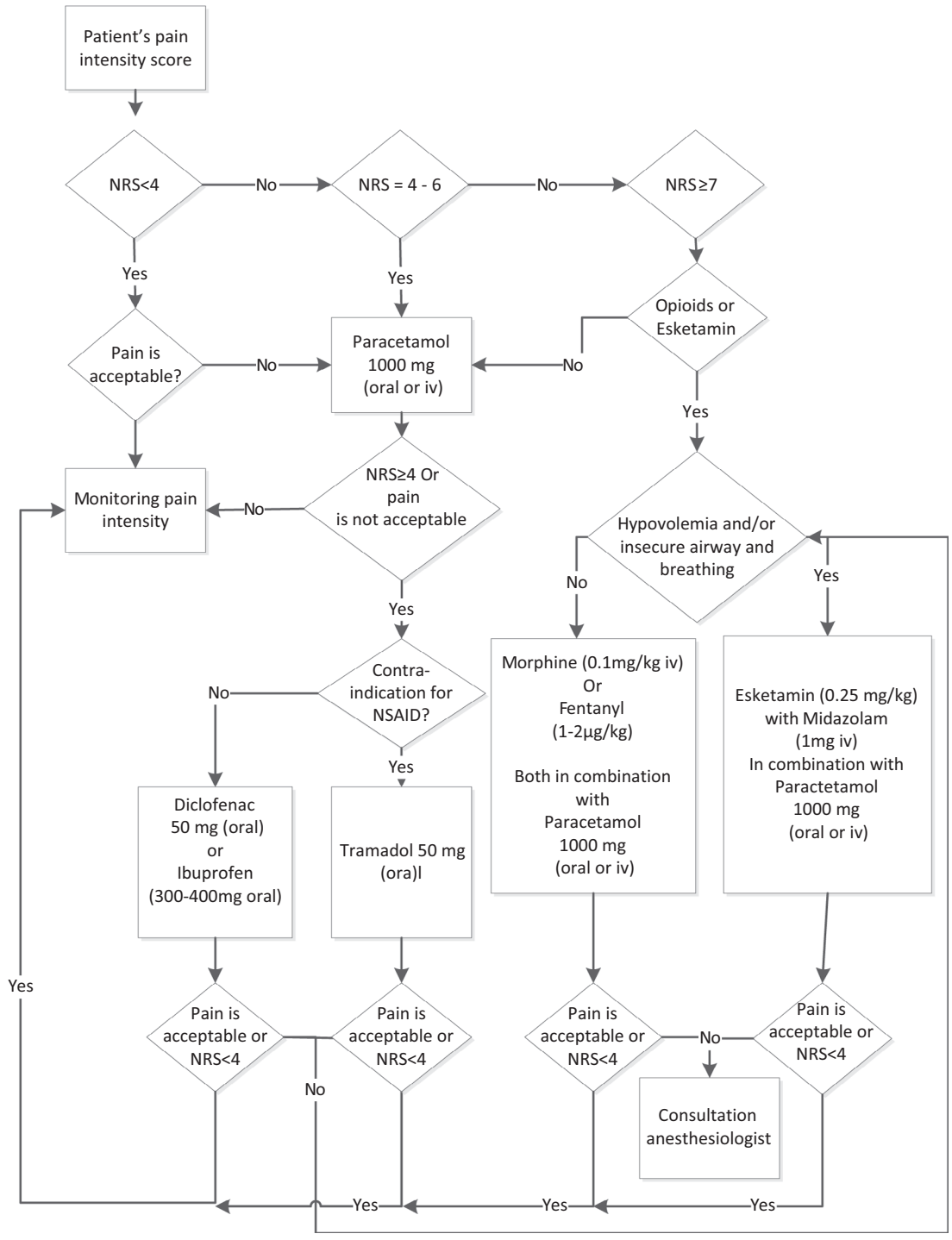

Fig. 1. Algorithm for analgesic pain management in the ED.

non-pharmacological injury treatment, time of providing pain management and analgesic refusal. If patients arrive by ambulance, data on pre-hospital analgesic use were retrieved from the regional emergency medical service (EMS) registry.

2.5. Measures and definitions

2.5.1. Pain intensity in the ED

Pain intensity was measured using the Numerical Rating Scale (NRS). The NRS of acute pain was validated for use in the ED (Bijur et al., 2003; Mohan et al., 2010). Patients were asked to fill in a number from 0 to 10 to represent their pain severity, where 0 is "no pain" and 10 "the worst pain imaginable," in response to the questions "How severe was your pain on ED admission?" and "How severe was your pain at ED discharge?" NRS scores were converted to categorical groups in line with the algorithm of the protocol: (i) no pain to mild pain (NRS <4); (ii) moderate pain (NRS 4–6); and (iii) severe pain (NRS ≥7).

2.5.2. Analgesics in the prehospital phase and ED

Data regarding the prehospital analgesic use were collected by questionnaire and from the EMS registry. Analgesic administration

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Table 1
Baseline characteristics of the pre- and post-intervention groups.

	Pre ($n = 504$)	Post ($n = 156$)	Difference (95% CI)	*P*-value
Age, median (IQR)	44.2 (28.7–56.6)	50.6 (37.8–60.6)	+4.4 (0.7↔8.2)	0.05
Sex (women)	276 (54.8%)	87 (55.8%)	+1.0% (–8.0↔10.0)	0.84
Educational level*				0.41
High	135 (27.6%)	50 (32.5%)	+4.9% (–3.4↔13.1)	
Medium	285 (57.1%)	80 (51.9%)	–5.2% (–14.1↔3.9)	
Low	78 (15.3%)	24 (15.6%)	–0.2% (–6.8↔6.3)	
Injury type (fracture)	344 (68.3%)	113 (72.4%)	+4.2% (–4.1↔12.5)	0.32
Analgesic use before ED presentation	187 (37.1%)	69 (44.2%)	+7.1% (–1.6↔15.9)	0.11
Pain intensity at admission, mean (SD)	6.4 (2.4)	6.5 (2.6)	+0.0 (–0.5↔0.4)	0.91
NRS <4 at admission	72 (14.3%)	28 (17.9%)	+3.6% (–1.6↔15.9)	0.42
NRS 4–6 at admission	136 (27.0%)	36 (23.1%)	–3.9% (–11.8↔4.0)	
NRS ≥7 at admission	296 (58.7%)	92 (59.0%)	+0.2% (–8.9↔9.1)	

* 6 missing.

in the ED was obtained from the electronic patient registry. The type of analgesic administered (if any) was categorized as follows: (i) no analgesics; (ii) paracetamol; (iii) non-steriodal anti-inflammatory drug (NSAID) such as diclofenac; (iv) mild opioids such as tramadol; (v) major opioids such as morphine and fentanyl; and (vi) others including esketamine. Analgesic provision means either administration or refusal of offered analgesics occurred.

The time of analgesic administration was obtained from the ED registry. Time to analgesic represents the time recorded from triage to administration of the first analgesic and was reported in minutes. Because a major change after implementation involves opioid provision, time from triage to first opioid administration was also obtained.

2.5.3. ED LOS

Patients' length of stay was obtained from the ED registry. The duration represents the time recorded from admission to discharge and was reported in minutes.

2.5.4. Pain relief during ED-stay and clinically relevant pain relief

Pain relief was defined as the difference between the NRS scores on admission and discharge. Clinically relevant pain relief was defined as 33% or more decrease in NRS score of an individual patient during ED-stay (Farrar et al., 2003) or when the patient was discharged with NRS <4.

2.6. Data analysis

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 Pearson's Chi-squared test for categorical variables and 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 and corresponding 95% confidence intervals (CIs) in pain relief between the pre- and post-intervention period were analyzed using two-tailed Student's *t* test. Differences between proportions of non-pharmacological use, analgesic use and analgesic provision and pain relief between the pre- and post-intervention period were analyzed by Pearson's Chi-squared. Differences and corresponding 95% CIs of the median times to analgesics were calculated with the median test. A *P*-value < 0.05 (95% CI does not include *zero)* is considered statistically significant. Based on a pilot study with an analgesic administration of 35%, at least 134 patients are needed in the post-intervention period to detect an increase in analgesic administration of 50% or more with a power of 80% at the 5% significance level. All data were analyzed using SPSS version 21.0 (IBM Corporation, Armonk, NY).

3. Results

In total 660 patients were included in this pre–post intervention study with the aim to evaluate the effect of the implementation of a nurse-initiated pain protocol on pain management in patients with acute musculoskeletal pain. Patients enrolled during the pre- ($n = 504$) and post- ($n = 156$) intervention period were similar with regard to pain intensity at admission (Table 1). The majority of patients suffered a fracture, most frequently in the ankle ($n = 148$) and wrist ($n = 104$). Almost 85% of the patients had moderate to severe pain (NRS ≥4) on admission. These patients should receive analgesics after protocol implementation.

3.1. The provision, refusal and actual administration of analgesics in the ED

Before protocol implementation, 46.8% of the patients with moderate to severe pain were offered analgesics. This percentage increased after implementation to 68%, a difference of 21.2% [95% CI 11.5–30.9, $P < 0.01$] (Table 2). Analgesic refusal increased after implementation from 10.2% to 21.9%, resulting into an actual analgesic administration increase from 36.6% to 46.1%, a difference of 9.5% [95% CI 0.0–19.1, $P = 0.05$].

In the subgroup of patients with severe pain (NRS ≥7), the percentage of analgesic provision increased with 18.0% from 52.7% to 70.7% ($P < 0.01$). Moreover, analgesic provision increased with 27.3% from 33.8% to 61.6% ($P < 0.01$) in patients with moderate pain (NRS 4–6). In the subgroup of patients with no to mild pain (NRS <4), the percentage of analgesic provision increased with 18.1% from 31.9% to 50.0% ($P = 0.09$).

3.2. Time to analgesics

Before protocol implementation, the median time to analgesics in patients with moderate to severe pain was 10 minutes (IQR 3–48.5). After implementation median time decreased to 7 minutes (IQR 2–17) ($P < 0.05$) (Table 2). A high percentage of patients were administered analgesics within 10 minutes after triage, 51.9% before and 66.1% after protocol implementation. In patients with no to mild pain median time to analgesics decreased from 7 (IQR 4–33) to 6 (IQR 4–61) minutes ($P = 0.92$). The median time to first opioid

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Table 2
Differences in pre- and post-intervention outcomes by severity of pain.

	Pre ($n = 504$)	Post ($n = 156$)	Difference	(95% CI)
	N	N		
Moderate to severe pain (NRS ≥4)	**432**	**128**		
Offered analgesics, N (%)	202 (46.8%)	87(68.0%)	+21.2%*	(11.5↔30.9)
Refused analgesics, N (%)	44 (10.2%)	28 (21.9%)	+11.7%*	(5.1↔18.2)
Received analgesics, N (%)	158 (36.6%)	59 (46.1%)	+9.5%	(0.0↔19.1)
Time to analgesic, median (IQR)	10.0 (3.0–48.5)	7.0 (2.0–17.0)	−4.0*	(−9↔−1)
Time to opioid, median (IQR)	37.0 (23.0–71.0)	15.0 (9.0–34.0)	−22.0*	(−38↔−5)
Pain relief during ED-stay, mean (SD)	−1.00 (1.77)	−1.56 (1.91)	−0.56*	(−0.92↔−0.21)
With analgesic treatment	−1.46 (1.90)	−2.02 (2.22)	−0.55*	(−1.20↔−0.09)
Clinically relevant pain relief N (%)	91 (21.1%)	40 (31.3%)	+10.2%*	(1.8↔18.5)
With analgesic treatment	42 (26.6%)	21 (35.6%)	+9.0%	(−5.3↔23.3)
ED LOS (min), mean (SD)	111.2 (52.0)	104.8 (53.4)	−6.5	(−16.8↔3.8)
Nonpharmacological pain interventions N (%)	337 (78.0%)	107 (83.6%)	+5.6%	(−2.4↔13.6)
Severe pain (NRS ≥7)	**296**	**92**		
Offered analgesics, N (%)	156 (52.7%)	65 (70.7%)	+18.0%*	(6.4↔29.5)
Refused analgesics, N (%)	26 (8.8%)	16 (17.4%)	+8.6%*	(1.3↔15.9)
Received analgesics, N (%)	130 (43.9%)	49 (53.3%)	+9.3%	(−2.3↔−21.0)
Paracetamol	75	28		
Paracetamol + NSAID	13	1		
Paracetamol + tramadol	2	1		
NSAID	13	3		
Paracetamol + opioid	2	7		
Opioid	23	7		
Paracetamol + NSAID + opioid	2	2		
Time to analgesics, median (IQR)	10.0 (3.0–51.5)	7.0 (2.0–17.0)	−4.0*	(−11↔ 0)
Time to opioid, median (IQR)	35.0 (23.0–67.0)	15.0 (9.0–34.0)	−20.0*	(−35↔3)
Pain relief during ED-stay, mean (SD)	−1.22 (1.79)	−1.74 (1.98)	−0.52*	(−0.95↔−0.09)
With analgesic treatment	−1.58 (1.92)	−2.20 (2.28)	−0.62*	(−1.36↔−0.10)
Clinically relevant pain relief, N (%)	55 (18.6%)	24 (26.1%)	+7.5%	(−2.6↔17.7)
With analgesic treatment	22.3%	34.7%	+12.4%	(−3.1↔27.9)
ED LOS (min), mean (SD)	109.1(51.3)	107.7 (54.0)	−1.4	(−13.6↔10.7)
Nonpharmacological pain interventions N (%)	226 (76.4%)	75 (81.5%)	+5.1%	(−4.6↔15.0)
Moderate pain (NRS 4–6)	**136**	**36**		
Offered analgesics, N (%)	46 (33.8%)	22 (61.1%)	+27.3%*	(9.6↔45.0)
Refused analgesics, N (%)	18 (13.2%)	12 (33.3%)	+20.1%*	(6.3↔33.9)
Received analgesics, N (%)	28 (20.6%)	10 (27.8%)	+7.2%	(−8.2↔22.6)
Paracetamol	19	8		
Paracetamol + NSAID	3	2		
Paracetamol + tramadol	1	0		
NSAID	1	0		
Paracetamol + opioid	1	0		
Opioid	3	0		
Time to analgesics (min), median (IQR)	10.0 (3.3–45.0)	5.0 (1.5–29.3)	−4.0	(−19↔4)
Time to opioid, median (IQR)	66.0 (38.0–78.0)	-		
Pain relief during ED-stay, mean (SD)	−0.52 (1.56)	−1.11 (1.55)	−0.59*	(−1.16↔−0.01)
With analgesic treatment	−0.92(1.78)	−1.10 (1.66)	−0.17	(−1.48↔−1.14)
Clinically relevant pain relief, N (%)	36 (26.5%)	16 (44.4%)	+18.0%	(−0.6↔36.5)
With analgesic treatment	13(46.3%)	4(40%)	−6.4%	(−44.5↔31.7)
ED LOS (min), mean (SD)	115.9 (53.4)	97.3 (51.6)	−18.6	(−38.2↔1.0)
Nonpharmacological pain interventions, N (%)	111 (81.6%)	23 (88.9%)	+7.3%	(−6.6↔21.2)
No to mild pain (NRS <4)	**72**	**28**		
Offered analgesics, N (%)	23 (31.9%)	14 (50.0%)	+18.1%	(−3.1↔39.3)
Refused analgesics, N (%)	14 (19.4%)	7 (25.0%)	+5.6%	(−12.5↔23.7)
Received analgesics, N (%)	9 (12.5%)	7 (25.0%)	+12.5%	(−3.6↔28.7)
Paracetamol	8	5		
Paracetamol + NSAID	0	1		
Opioid†	1	1		
Time to analgesics (min), median (IQR)	7.0 (4.0–33.0)	6.0 (4.0–61.0)	−2.0	(−54↔5)
Time to opioid, median	61	47	−14	
Pain relief during ED-stay, mean (SD)	+0.44 (1.72)	+0.21 (0.96)	−0.23	(−0.77↔0.31)
ED LOS (min), mean (SD)	108.3 (48.3)	107.8 (51.4)	−0.5	(−22.2↔21.2)
Nonpharmacological pain interventions, N (%)	76.4%	78.6%	+2.2%	(−16.6↔21.0)

* $P < 0.05$.
† Patients were administered esketamine and the short-acting opioid fentanyl in ambulance prior ED admission.

administration improved from 37 minutes (IQR 23–71) to 15 minutes (IQR 9–34) ($P < 0.01$).

3.3. Clinically relevant pain relief

Mean pain relief in patients with moderate to severe pain increased after implementation from 1.00 to 1.56 point on NRS, a difference of 0.56 [95% CI (0.21–0.92), $P < 0.01$] (Table 2). In patients with no to mild pain there was no pain relief, but in both periods there was a slight increase in mean pain intensity. In patients who received analgesic treatment mean pain relief increased from 1.46 to 2.02 points, a difference of 0.55 [95% CI (0.09–1.20), $P < 0.05$]. In patients who received only nonpharmacological injury treatment, pain relief increased from 0.74 to 1.26, a difference 0.52

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Table 3
Pain management and (clinically relevant) pain relief in patients with moderate to severe pain (NRS ≥4).

	Pre ($n = 432$)	Post ($n = 128$)	Difference	(95% CI)
	N	N		
Pain management, N (%)				
Analgesic treatment	158 (36.6%)	59 (46.1%)	+9.5%	(0.0↔19.1)
Analgesic only	42 (9.7%)	10 (7.8%)	−1.9%	(−7.7↔3.8)
Analgesic and nonpharmacological	116 (26.9%)	49 (38.3%)	+11.4%*	(1.9↔20.9)
Nonpharmacological injury treatment only	221 (51.1%)	58 (45.3%)	−5.8%	(−15.7↔4.0)
No pain treatment	53 (12.3%)	11 (8.6%)	−3.7%	(−9.5↔2.1)
Pain relief during ED-stay, mean (SD)	−1.00 (1.75)	−1.56 (1.89)	−0.56*	(−0.92↔−0.21)
Analgesic treatment	−1.46 (1.90)	−2.02 (2.22)	−0.55*	(−1.20↔−0.09)
Analgesic only	−1.69(2.34)	−2.10(2.28)	−0.41	(−2.14↔1.32)
Analgesic and nonpharmacological	−1.37(1.72)	−2.00 (2.22)	−0.62	(−1.33↔0.09)
Nonpharmacological injury treatment only	−0.74 (1.66)	−1.26 (1.48)	−0.52*	(−0.98↔−0.04)
No pain treatment	−0.68 (1.34)	−0.73 (1.27)	−0.05	(−0.93↔0.86)
Clinically relevant pain relief N (%)	91 (21.1%)	40 (31.3%)	+10.2%*	(1.8↔18.5)
Analgesic treatment	42 (26.6%)	21 (35.6%)	+9.0%	(−5.3↔23.3)
Analgesic only	10 (23.8.4%)	2 (20%)	−3.8%	(−34.1↔26.5)
Analgesic and nonpharmacological	32 (27.6%)	19 (38.8%)	+11.1%	(−5.1↔27.5)
Nonpharmacological injury treatment only	39(17.6%)	17(29.3%)	+11.7%	(−1.3↔24.7)
No pain treatment	10 (18.9%)	2 (18.2%)	−0.7%	(−27.0↔25.6)

* $P < 0.05$.

[95% CI (0.04–0.98), $P < 0.05$] (Table 3). Mean pain relief did not change between pre- and post-period in patients who did not receive any pain treatment.

Before implementation, clinically relevant pain relief (33%) was achieved in 21.1% of the patients. After implementation, this percentage increased to 31.3%, a difference of 10.2% [95% CI (1.8–18.5), $P < 0.05$] (Table 2). In patients who received analgesic treatment, this percentage increased from 26.6% to 35.6% ($P = 0.16$). In patients with only nonpharmacological injury treatment, this increased from 17.6% to 29.3% ($P = 0.08$) (Table 3).

Moreover, before protocol implementation 77% of the patients suffered moderate to severe pain at discharge. After implementation this percentage decreased by 7.8% [95% CI (0.0–15.5), $P < 0.05$] to 69.2%.

3.4. ED LOS

Mean ED LOS in patients with moderate to severe pain decreased by 6.5 minutes [95% CI (−3.8 – 16.8), $P = 0.22$] from 111.2 to 104.8 minutes (Table 2). In patients with no to mild pain mean ED LOS did not change after implementation ($P = 0.97$).

3.5. Patient satisfaction

The percentage of patients with moderate to severe pain who were satisfied with their treatment increased with 4.0% from 92.0 in the pre-period to 96.0% after implementation ($P = 0.11$). In patients with analgesic treatment these percentages increased from 92.4% to 95.7% ($P = 0.44$).

3.6. Protocol deviation

Of all patients with moderate to severe pain who according to the protocol algorithm should receive analgesics, 68% were offered analgesics, resulting in a protocol deviation of 32%. The type of analgesic administered was consistent with the protocol for the specific pain score in 83% of the patients. The other 17% of the patients received opioids or NSAIDs without paracetamol. Out of the 49 patients with severe pain who received analgesics, 7 patients received only opioids and 3 patients received only NSAIDs. Moreover, 30 patients received paracetamol with or without NSAID or tramadol instead of an opioid in combination with paracetamol, which should have been given according to the protocol.

4. Discussion

This pre–post intervention study shows that the implementation of a nurse-initiated pain protocol in the ED appears to lead to an increase in analgesic provision, a shorter time to analgesics and a higher clinically relevant pain relief in acute musculoskeletal patients. However, adequate pain management remains a major challenge. Despite improvements in pain management, a high percentage of patients did not receive analgesics while in pain and a high percentage was still discharged with moderate to severe pain.

In order to improve pain management, a nurse-initiated protocol based on the algorithm of the Dutch evidence-based guideline for pain management in trauma patients was implemented. Before protocol implementation a pain protocol was lacking in half of all Dutch EDs (Gaakeer et al., 2010). The absence may not necessarily imply there was no care for pain relief and the other way around; the presence of a protocol does not mean that a protocol is used accordingly.

In this study there is a discrepancy between the content of the protocol and modus operandi. Although the analgesic provision was highly improved after implementation, only 68% of the patients with moderate to severe pain, who should receive analgesics according to the protocol, were offered analgesics. Actual analgesic administration increased from 36.6% to 46.1%. Also other studies have shown that pain protocols improve analgesic administration, even more than in our study. A Swiss study showed an increase in analgesic administration from 40% to 63% in patients with acute pain by any cause (Decosterd et al., 2007). Furthermore, a study in the US showed an improvement from 45% to 70% in patients with extremity and back pain (Fosnocht and Swanson, 2007).

The type of analgesic administered was consistent with the protocol in 83% of the cases. Remarkably, more than three-fifths of the patients with severe pain were downgraded to use paracetamol or NSAIDs instead of opioids. Yet the reluctance of nurses to use opioids could also be partly explained by the study population, patients with musculoskeletal injury, who often will be discharged home. The use of more potent analgesics could result in longer ED LOS and the inability to be discharged home safely. Another reason for protocol deviation might be due to discrepancies in pain assessment between patients and emergency nurses. These discrepancies were identified as the most powerful predictor for poor pain management (Curtiss, 2001).

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Furthermore, it is notable that a relatively high percentage of patients refuse to take analgesics. Of course patients may decline analgesics, but physicians and nurses should make sure that analgesic refusal is only made after the patient has had the opportunity to comprehend the possible consequences. Explanation regarding harmful effects of prolonged, untreated pain and side effects of analgesics leads to a decrease in analgesic refusal (Wilder-Smith and Schuler, 1992).

The protocol improved mean pain relief in patient with moderate to severe pain from 1.00 to 1.56 points on NRS, a statistically significant difference. In patients who received analgesic treatment, mean relief increased even up to 2.02 points. Because a statistically significant difference in pain relief is mostly a matter of sample size, it is more important to know whether this difference is clinically relevant. A pain relief of 2 points on NRS or 33% decrease in pain is defined as clinically important changes (Farrar et al., 2003). In patients treated with analgesics this clinically important change of 2 points was achieved. Furthermore, the percentage of patients who achieved clinically relevant pain relief during ED-stay increased from 21.0% before protocol implementation to 31.3% after implementation.

Especially in patients with minor acute musculoskeletal injuries, a nurse-initiated pain protocol might be useful to optimize pain management. These patients are usually triaged to a low triage category, which results in an extended waiting time for assessment by an ED-physician. This study confirms the protocol shortens the time to analgesics; the median time to analgesics significantly reduced from 10 to 7 minutes. In both periods, before and after protocol implementation analgesics were given relatively quickly after triage. Remarkable is the high percentage of patients who received analgesics within 10 minutes of triage. Even before protocol implementation this percentage was 51.9%, suggesting that nurses routinely provided over-the-counter analgesics during triage in the pre-intervention period. After implementation nurses were allowed to give opioids according to the pre-defined protocol. This shortened the median time to first opioid from 37 to 15 minutes.

Moreover, the pain protocol seemed to lead to a reduced ED-stay especially in patients with moderate pain, which is in line with a Canadian study which revealed that reduced time to analgesics was associated with a shorter duration of ED-stay (Sokoloff et al., 2014).

The strength of this study is its prospective design in a relatively large homogeneous population of patients with isolated musculoskeletal injuries. Furthermore, pre- and post-intervention periods were separated by a one-month interval to be able to implement the pain protocol in daily practice before measuring the potential effects. During the study period no other programs for improved pain management were distributed in the Netherlands or in the hospital, which may have had an effect on study results. Another strength is the use of patients' self-reporting pain intensity instead of the documented pain scores assessed by nurses. A potential bias in data collection was limited by giving patients a written questionnaire as opposed to a verbal one.

The quasi-experimental design used in this pre–post intervention study is not the best design to evaluate the benefits of an implementation of pain protocol. A randomized controlled trial is generally considered to have the highest level of credibility with regard to assessing causality. However, randomization was not logistically feasible. Hence, the statistical association found in this study does not directly imply 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. No adjustments could be made. Yet the pre-intervention period provides data about what pain management would have been had the intervention not occurred.

Another possible limitation is the Hawthorne effect, alteration of behavior of ED-staff as a response to their awareness of being observed. This may well surface in this kind of study design and is difficult to avoid. However, this effect would have been present during both study periods because the staff was subject to observation in both periods. This supports that the observed beneficial effect is the result of the intervention.

Pain management involves assessment, documentation, treatment, and evaluation. Reassessment of pain following analgesic administration and checking if the right analgesic doses were given was not part of this study. Because acute pain is dynamic, frequent assessment over time is necessary to make adjustments in analgesic doses or multimodal analgesic treatment strategies. In this study pain intensity was measured only twice, at ED admission and discharge, without additional assessments that might more accurately reflect the impact of analgesic treatment.

The percentage of patients who were actually administered analgesics might be underestimated. Even though the ED staff was instructed to list all medications, some may have neglected to do so, especially for over-the-counter analgesics. Moreover, prehospital analgesic use might have influenced the use and choice of analgesics by the nurse and may improve pain relief. However, no difference in pain relief in patients who used prehospital analgesics between the two periods was found.

5. Conclusion

The implementation of a nurse-initiated pain protocol in the ED appears to lead to an increase in analgesic provision, a shorter time to analgesics and a higher clinically relevant pain relief in acute musculoskeletal patients. Adequate pain management remains a major challenge for ED staff. Despite improvements in pain management, many patients did not receive analgesics. Moreover, the percentage of patients with moderate to severe pain at ED discharge is still high. The adherence to the protocol, especially in terms of analgesic doses and reassessment of pain after analgesic administration, needs to be studied in order to further optimize pain management.

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Conflict of interest

None declared.

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