Prescription Of analgesia in Emergency Medicine (POEM): a multi-centre observational study of pain relief in patients presenting with an isolated limb fracture and/or dislocation

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Key words: acute pain, pain, musculoskeletal pain, pain management, pain measurement

Word count: 2879

ABSTRACT

Background

Acute pain is one of the most commonly cited reasons for attendance to the Emergency Department (ED): it is estimated that 7 out of 10 people present to the ED because they are in pain. The Royal College of Emergency Medicine (RCEM) Best Practice Guideline (2014) acknowledged that the current management of acute pain in UK EDs is inadequate and has a poor evidence base.

Methods

The Prescription Of analgesia in Emergency Medicine (POEM) study is a cross-sectional observational study of consecutive patients presenting to 12 NHS EDs with limb fracture and/or dislocation in England and Scotland and was carried out between 2015 and 2017. The primary outcome was to assess the adequacy of pain management in the ED against the recommendations in the RCEM Best Practice Guidelines.

Results

8346 patients were identified as attending the ED with a limb fracture and/or dislocation but adherence to RCEM guidelines could only be evaluated for the 4160 (49.8%) patients with a recorded pain score. Of these, 2409/4160 (57.9%) patients received appropriate pain relief, but only 1347 patients were also assessed within 20 minutes of their arrival in the ED. Therefore, according to the RCEM guidelines only 16.1% (1347/8346) of all patients in the study were assessed and had satisfactory pain management in the ED.

Conclusions

The POEM study has identified that pain relief for patients in the UK with an isolated limb fracture remains inadequate when strictly compared to the RCEM Best Practice Guidelines. However, we have found that some patients receive analgesia despite having no pain score recorded, while other analgesic modalities are provided that are not currently encompassed by the Best Practice Guidelines. Future iterations of these guidelines may wish to encompass the breadth of available modalities of pain relief and the whole patient journey. In addition more work is needed to improve timely and repeated assessment of pain and its recording, which has been achieved better in some EDs than others. Subsequent analysis of secondary outcome measures may provide insight into the reasons why variability exists.

INTRODUCTION

In England last year there were 23.4 million emergency department (ED) attendances: the equivalent of approximately 63,000 attendances each day[1]. Acute pain is one of the most commonly cited reasons for ED attendance: it is estimated that 7 out of 10 patients come to the ED because they are in pain. Good pain management has been shown to correlate with patient satisfaction in the ED[2]. Multiple Royal College of Emergency Medicine (RCEM) national audits of painful conditions have found a wide variation in performance between EDs across the UK and concluded that pain management could be improved[3, 4]. The RCEM Best Practice Guideline published in 2014 described standards for adequate acute pain management and acknowledged that the current management of acute pain in UK EDs is inadequate, with a poor evidence base for best practice of both pain assessment and management[4]. This study was conceived to better understand some of the factors that affect pain management in more detail than that recorded by the RCEM audits. Parallels exist in North America: in the United States (US) the Joint Commission on Accreditation of Healthcare Organizations declared pain as the "fifth vital sign" and required hospitals to make pain control a priority[5]. Whilst it is likely that failure to provide adequate analgesia for a patient is multifactorial, it is important to understand these factors to enable improvements in pain management in the ED.

Socioeconomic factors may affect the delivery of analgesia. An observational study of adults attending the ED after a minor motor vehicle collision used educational attainment as a proxy for socioeconomic evaluation. The study reported that patients with higher educational attainment were three times less likely to receive opioid analgesia than patients with the lowest educational attainment[6].

There is conflicting evidence that race may be relevant. A US multicentre study of 67,000 patients with migraine, back pain or long bone fractures identified that opioid prescription was more common among Caucasians[7]. A subsequent case review in North America concluded that Caucasian patients are significantly more likely to receive an opioid prescription than other ethnic groups[8]. In contrast, a single centre UK retrospective study reviewed 307 patients attending ED with long bone fractures from inner London and concluded that ethnicity was not a risk factor for inadequate analgesia provision[9].

There is also evidence that ED crowding is associated with poor quality pain management. A single centre retrospective cohort study in North America demonstrated that departmental crowding was significantly associated with either a lack of analgesia or prolonged delays in its delivery[10]. Evidence also exists to demonstrate that particular age groups are more at risk of delays in pain management during ED crowding[11].

There can also be discrepancy between the pain reported by a patient using a scoring scale and that same patient's wishes for analgesia. A single centre observational study from Australia has explored the reasons why analgesia was not administered to adult ED patients. They reported

that 26.3% of general ED patients did not receive analgesia, with the most common reason reported by staff and patients being patient refusal of analgesia.

The primary outcome of the POEM study was to assess the adequacy of pain management in the ED against the recommendations in the RCEM Best Practice Guidelines[4]. The secondary objectives were to identify patient and hospital factors that influence adequate acute pain management in the ED.

METHODS

Study design and setting

This is a cross-sectional observational study of patients presenting to 12 NHS EDs in England and Scotland between 2015 and 2017. Five major trauma centres (one adult only, two combined adult and paediatric, two paediatric only) and six trauma units contributed to the final dataset of the POEM study. A list of participating sites can be found in the appendix.

Data collection took place across all sites for discrete time intervals between January 2015 and August 2017. Consecutive eligible patients were entered into the study through retrospective chart review. Asynchronous time periods were deemed acceptable for sites, as pain is not liable to seasonal variations. Patients were screened using the relevant coding and reporting systems.

A custom-built database allowed direct data-entry. Data quality checks were performed at each site for 10% of enrolled patients and an error rate of < 5% accepted. The Berkshire Research Ethics Committee (REC 14/SC/0167) and the Confidential Advisory Group (CAG 3-02(c)/2014) approved the study. All data transfers complied with the conditions imposed upon the study sponsors by the Berkshire REC and CAG.

Study participants

Inclusion criteria

All patients with a new confirmed isolated limb fracture and/or dislocation presenting to the ED.

Exclusion criteria

Patients with limb fractures and/or dislocations not contained between two joints, (e.g. a patient with radius and ulna fractures would be included but a patient with both humerus and radius fractures would be excluded); hand or foot fractures; patients who re-attend the ED with pain from the same injury.

Variables

Both patient and hospital factors were recorded on the database. Patient factors collected were: age, gender, ethnicity, diagnosis, index of multiple deprivation (IMD)[12] time and mode of arrival at hospital and details about the type and mode of delivery of analgesia. Hospital data collected

was: the grade and gender of the clinician seeing each patient, Department of Health Quality Indicators and staffing ratios for each department for the data collection period.

Sample size

The original plan was to run the study at four sites in the Thames Valley. The initial sample size calculation of 2959 participants was based on two factors. We found an 80% data completion rate from pilot data collected on ED opioid prescription only and also used the RCEM 2012 Fractured Neck of Femur Audit which reported a 56% prevalence of adequate pain relief.

We were subsequently approached by other sites to join the study following acceptance onto the NIHR portfolio and reached a total of 12 participating sites. POEM is an observational study therefore the sample size was maximised to allow tighter precision around the confidence intervals and a higher power in the study. Statistical advice was sought and a recalculation was undertaken. Based on the estimated prevalence of the least frequent variable and allowance for up to 20% incomplete data, a new sample size of 9000 was calculated.

Primary outcome definition

Based upon the Royal College of Emergency Medicine Best Practice Guideline,
do patients who present with a (confirmed) isolated limb fracture or dislocation receive the following:
1. a pain score recorded within 20 minutes of arrival in the ED?
2. analgesia appropriate to the pain score?

Pain scores were sought from review of both the medical and the nursing notes. The severity of pain from the injury was initially categorised from the numerical or descriptive pain score into none, mild, moderate and severe using the same criteria as the RCEM audits. This was done for both adult and paediatric pain scores. Local practice was not changed. Analgesia appropriate to each pain score was categorised as per RCEM guidance. However, the guidance has significant crossover in analgesic recommendations between mild and moderate pain, therefore a combined category of “mild/moderate” was created for the analysis. Patients who received stronger analgesia than the guideline advised were classified as receiving appropriate pain management.

Statistical Methods

Descriptive statistics are displayed for the continuous variables as mean and standard deviation (SD) and percentages for the categorical variables. Where the continuous data are not normally distributed, data are presented as medians (interquartile range).

Where the dependent variable was binary, logistic regression was carried out to assess the association with explanatory variables. If the dependent variable had more than two possible discrete outcomes, multinomial logistic regression was performed.

All analyses were performed using the R Statistics program (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Participants

Although twelve sites started recruitment there was an irretrievable loss of a database at one site. Patient characteristics are described in table one.

Table 1. Patient characteristics

Characteristic	Summary value	Interquartile range	Missing data n (%)
Median Age (years)	36	11-70	27 (0.3)
Median Index of multiple deprivation*	12.4	1.0-19.0	78 (0.9)
	No. of patients	**% (of 8346)**	
Gender - Male	3804	45.6	45 (0.5)
Gender - Female	4497	53.9	
Ethnicity - White	6448	77.3	930 (11.1)
Ethnicity – Non-white	968	11.6	
Arrival Mode			105 (1.3)
Self-presenting	5349	64.1	
Ambulance	2892	34.7	
Arrival in ED (day of week)			15 (0.2)
Monday	1176	14.1	
Tuesday	1159	13.9	
Wednesday	1092	13.1	
Thursday	1201	14.4	
Friday	1105	13.2	
Saturday	1215	14.6	
Sunday	1383	16.6	
Arrival in ED (time of day)			14 (0.2)
Midnight to 8am	659	7.9	
8am to 4pm	3976	47.6	
4pm to midnight	3697	44.3	
'Disposal' Location			148 (1.7)
Home	5530	66.3	
Hospital	2668	32.0	
Type of injury			10 (0.1)
Fracture	7600	91.1	
Dislocation	540	6.5	
Fracture/Dislocation	196	2.3	

Bone			23 (0.3)
Sternoclavicular joint	2	<0.1	
Clavicle	653	7.8	
Acromioclavicular joint	40	0.5	
Shoulder joint	331	4.0	
Humerus	1111	13.3	
Elbow joint	72	0.9	
Radius	2316	27.7	
Ulna	191	2.3	
Radius/Ulna	999	12.0	
Hip joint	101	1.2	
Neck of femur	859	10.3	
Femur	307	3.7	
Knee joint	6	<0.1	
Tibia	332	4.0	
Fibula	614	7.4	
Tibia/Fibula	321	3.8	
Ankle	68	0.8	

*IMD is a numerical score whereby a higher score represents greater deprivation

Primary outcome

Data completeness exceeded prior assumptions (missing data <2% against anticipated rate of 20%) and therefore data collection was terminated before 9000 patients on statistical advice. A total of 8346 patients were identified as attending the ED with a limb fracture and/or dislocation, with the most frequently fractured bone being the radius (see table one). Overall 45.6% of patients were male (3804/8346), over a third of patients were under eighteen (38.3% (3196/8346) and 29.3% (2447/8346) were over 65y. The median age of all patients was 36y (IQR: 11-70y).

The proportion of patients who were clinically assessed (triaged) within twenty minutes was 54.1% (4517/8346) and in total 84.2% (7027/8346) were assessed within sixty minutes of arrival in the ED. 49.6% (2240/4517) of the patients seen within twenty minutes had a pain score recorded. Initial clinical assessment times were comparable between those with and those without a pain score (see Figure 1).

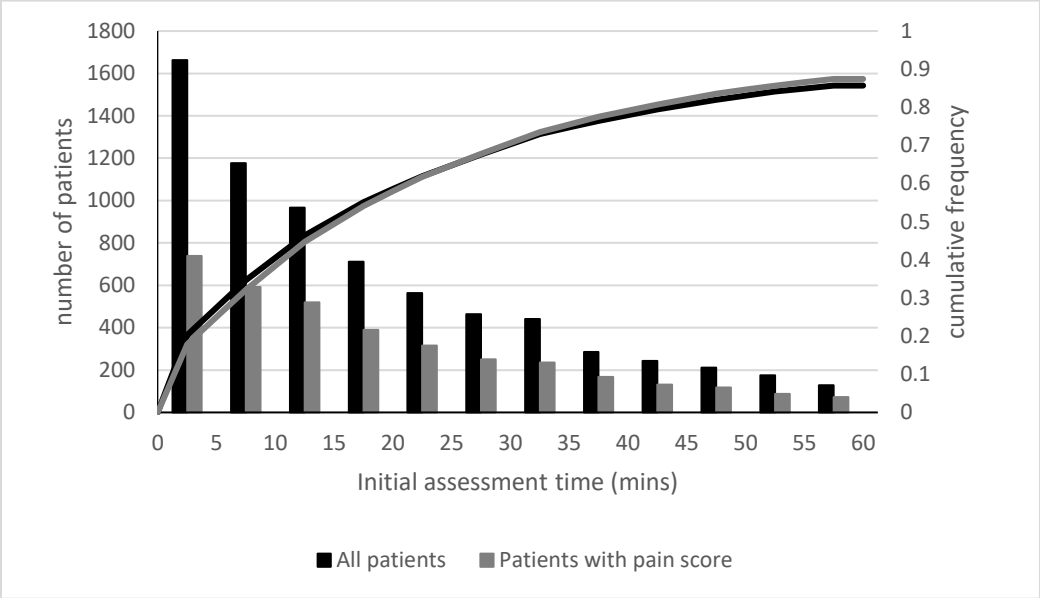

Figure 1: Initial clinical assessment times for those with and without a documented pain score

Irrespective of timings, an initial ED pain score was recorded in 49.8% of patients (4160/8346). Of those with a recorded pain score, 3674 (88.3%) patients reported pain: 20.9% (870/4160) were in severe pain, 67.4% (2804/4160) had mild or moderate pain and 11.7% (486/4160) reported no pain.

Table 2: Pain scores and provision of analgesia

	No pain score (n=4186)	**Pain category "No pain" (n=486)**	**Pain category "Mild/mod pain" (n=2804)**	**Pain category "Severe pain" (n=870)**	**Total n=8346 (%)**
ED analgesia	2327	230	1578	710	4845 (58.1)
Appropriate ED analgesia as per RCEM	n/a	486	1548	375	2409 (28.8)
Any analgesia in patient journey	3196	352	2206	824	6578 (78.8)

No analgesia in patient journey	990	134	598	46	1768 (21.2)

Adherence to RCEM guidelines can only be evaluated for the 4160 patients with a recorded pain score of whom 57.9% (2409/4160) had appropriate pain relief in ED (see table 2). The choice of pain relief has a highly significant (P<0.0001) positive association with the recorded pain score. This indicates that as the pain score increases, the choice of 'strength' of pain relief also increases. Of note, the patients who had a pain score recorded were also more likely to get pain relief (p<0.0001): 61% (2518/4160) of patients with a pain score were given ED analgesia whereas only 56% (2327/4186) of those with no documented pain score received ED analgesia.

Furthermore, of the 2409 patients with appropriate pain relief, 1347 were assessed within twenty minutes of arrival. The numbers of patients with a follow up pain score recorded was 18.5% (768/4160) and in only 40.1% (308/768) of these patients was the follow up performed within the required time frame (see figure 2).

Preliminary analysis revealed that reassessment of pain scores was poorly documented such that the sample size was deemed too small to undergo robust statistical analysis. We therefore used the first two criteria from the RCEM Best Practice Guideline to define adequate pain management in the ED: assessed within 20 minutes of arrival in the ED, and appropriate pain relief given. In total 16.1% (1347/8346) of patients fulfilled both these criteria.

Considering those patients who had a pain score recorded indicating some pain (i.e. any pain score except "0"), 15.5% (644/4160) did not receive any documented analgesia in their patient journey. For those patients who did not have any pain score recorded, 23.7% (990/4186) did not receive any documented analgesia.

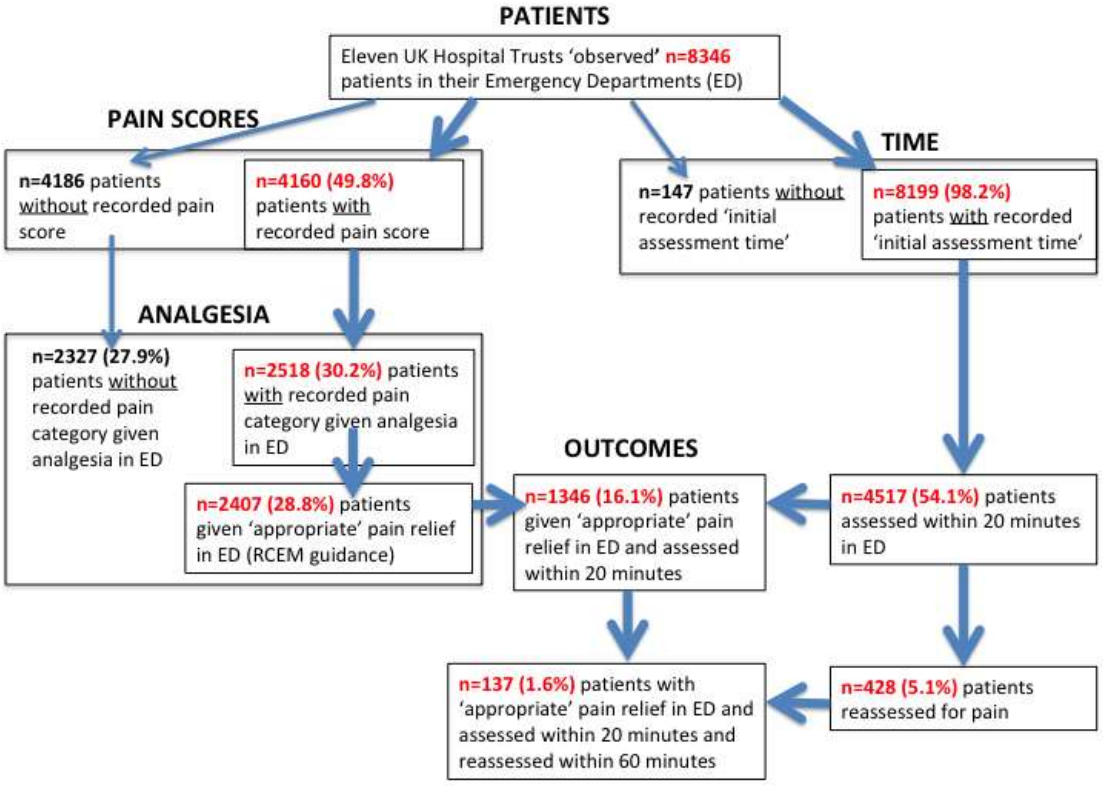

Figure 2: Patient flow diagram

The RCEM Best Practice Guideline acknowledges that patients may also receive pain relief before arrival in the ED. A fifth of our patient group self-medicated before arrival, while a quarter received analgesia from a pre-hospital clinician (table 3). Within ED, 58.1% of patients (4845/8346) were given oral or intravenous analgesia. Additionally, other pain management techniques were also used such that a total of 79% (6578/8346) of patients received some form of analgesia (self-medication, pre-hospital administration, sedation, manipulation or a block). Whilst sedation is not usually categorised as a form of analgesia we have included it because relocation of a fracture/dislocation may contribute to reduction in pain for a patient.

Table 3. Patients who received analgesia or sedation

	Number of patients*		**Missing data**
	n	**%** **(of total 8346)**	**n (%, of total 8346)**
Self-medication with analgesia	1643	19.7	4261 (51.1)

Analgesia given by pre-hospital clinician	2090	25.0	1422 (17.0)
Analgesia (medication) given in ED	4845	58.1	38 (0.5)
Mild or moderate potency	3105	37.2	
Severe potency	1672	20.0	
Manipulation	1297	15.5	55 (0.7)
Sedation	604	7.2	7058 (84.6)
Block	812	9.7	75 (0.9)

* Patients may have received more than one modality

DISCUSSION

8346 patients were identified as attending the ED with a limb fracture and/or dislocation but adherence to RCEM guidelines could only be evaluated for the 4160 (49.8%) patients with a recorded pain score. Of these, 2409/4160 (57.9%) patients received appropriate pain relief, but only 1347 patients were also assessed within 20 minutes of their arrival in the ED. Therefore, according to the RCEM guidelines only 16.1% (1347/8346) of all patients in the study were assessed and had satisfactory pain management in the ED.

The RCEM clinical audit executive summaries in adult and paediatric populations report wide discrepancies in pain management across the UK[3, 4, 13]. The POEM study is representative of UK emergency medicine practice and provides further evidence that the delivery of effective pain relief in the UK is inadequate and remains a challenge although variability persists. For the majority of patients this may represent poor care although a minority of patients may have declined analgesia. We purposefully selected a patient group with a proven injury who would be predicted to have pain and would reasonably expect analgesia. Patient representation on our study steering committee was clear that the basis for the patient-clinician interaction is built on implicit trust and the understanding that clinicians will be compassionate and relieve pain. Our initial primary outcome was to benchmark against the RCEM Best Practice Guideline. Strict application of this guidance in this study has demonstrated adequate pain management in only 16.1% of patients.

A number of commentators have called for pain scores to be added as the fifth vital sign[14]. This is particularly valuable and appropriate in the acute setting to guide analgesic prescribing, but care needs to be taken to ensure opioids commenced for acute pain are weaned in the community as pain subsides with healing. In one study of surgical patients, 6% of patients were still taking post-operative opioids 6 months later.

The majority of patients had an initial clinical assessment (or triage) in less than an hour. Although clinical assessments were undertaken in a timely fashion this did not appear to be consistently accompanied by the recording of a pain score and the prescribing of pain relief. Pain scores were documented in only half of the patients, consistent with previously reported data in both adults and paediatrics[15]. In keeping with previous literature the POEM study demonstrates that the formal documentation of pain scores was significantly associated with an increased likelihood of receiving analgesia ($p<0.0001$)[16]. Reduction in pain scores is associated with improved patient satisfaction in the ED[17]. We are not able to comment on adequacy of pain relief without an associated pain score although we have demonstrated that there was a strong correlation between the recorded pain score and the provision of appropriate analgesia. There were more patients without a recorded pain score who did not receive any analgesia in their patient journey (23.7%; 990/4186) compared to those with a recorded pain score (15.5%; 644/4160). Alongside patient refusal, staff experience and expectation of analgesia requirements are also clearly relevant as alluded to by Kant. Very few patients had a documented reassessment of a pain score.

We chose to use the RCEM guidelines as our standard, and strictly applied them to define appropriate pain management, with their recommendations primarily centred upon drugs given within ED. However, if all types of pain relief are considered, including blocks, manipulations and pre-hospital analgesia, the proportion of patients receiving some form of pain relief rises to 79% (6578/ 8246). Is it time to rethink the RCEM guidance to allow a more accurate reflection of current practice in UK EDs?

Limitations

This study is primarily limited by being reliant on documentation, which may partly explain the poor compliance with the RCEM standard. However, the POEM study provides no evidence to suggest that assessment or treatment of pain occurred without documentation. Mandated pain scoring within electronic patient records will positively impact on documentation. There is evidence that uptake of the electronic scoring systems is beneficial to patient outcomes[18]. The amount of missing data was low (<2%). Data checks occurring at predetermined intervals were also reassuring.

Another potential source of bias is that we deliberately selected a group with a confirmed fracture whereas the RCEM guidance is applicable to the undifferentiated patient population presenting in pain without a diagnosis.

This paper reports the primary outcome. Analysis of the patient and hospital factors in our secondary outcomes may allow further characterisation of the issues affecting good pain management.

Implications for future practice

Pain assessment represents a complex social interaction with more communication than is often acknowledged from a simple pain score. In conscious patients, the assessment of pain incorporates a patient's nociception and tolerance of the pain and their desire for pain relief, which may be at odds with guidelines based on an unqualified numerical score. In addition, this social interaction is occurring in a constantly changing environment. The absence of pain scoring may reflect a lack of formal documentation of pain assessment rather than a lack of assessment, which itself exposes the limitations of simple pain scoring in the ED environment. It is likely that pain is discussed more often than it would appear from our data, as more patients are given analgesia than have had a pain score documented. The challenge is how best to capture that interaction and to compare it against standards, while at the same time ensuring the delivery of adequate pain relief. It may be that ED warrants an area-specific pain measurement tool, as has been developed, albeit for different reasons, in intensive care units.

There are a wide choice of pain management strategies available: however, it can be a convoluted process to provide even simple oral analgesia in some institutions. Recent ED literature supports the concept that simple pain scoring alone is inadequate to guide administration of analgesia[19]. Health care professionals need to be supported to efficiently select, administer and record the most appropriate analgesia for each patient, be it drugs given orally, intravenously or intra-nasally; blocks with or without sedation; or physical stabilisation of a fracture.

In order to help clinicians assess and ultimately manage pain, we need to pay attention to the various aspects of both the patient's experience and the clinician's responses. Future work is required to understand the patient's perspective of good pain management. We also need to develop means of empowering clinicians to assess, document and manage pain in the real-life pressured and complex environment of the emergency department.

CONCLUSION

This multicentre observational study has identified that pain management for patients with an isolated limb fracture/dislocation in the UK appears inadequate when compared to the RCEM Best Practice Guidelines. It was not possible to compare patients without a recorded pain score to the RCEM Best Practice Guidelines. Of note, the initial clinical assessment times were comparable between those with and those without a pain score. Documentation of a pain score in the ED appears to improve provision of appropriate analgesia. There is a strong correlation between pain score and choice of pain relief provided. Future iterations of RCEM Best Practice Guidelines may wish to encompass the breadth of available modalities of pain relief and the whole patient journey.

<u>What is already known on the subject:</u>

Substantial variations exist in the management of acute pain in the ED. The reasons for this are not well understood. A number of patient and hospital variables have been associated with provision of good pain relief. The overall evidence base for the current guidance is weak.

What this study adds:

This is the largest study of pain in UK ED patients to date and confirms that whilst good practice is demonstrated, there is still much variation in recording of pain scores and provision of analgesia. It is worth considering the whole patient journey and non-pharmacological methods of pain relief when defining "adequate". There is a significant association between the recording of a pain score and the provision of analgesia.

Contributors

LK and JQ conceived the study. JS was Chief Investigator. LK, JQ, MD, SW were co-investigators on the protocol. JD performed the statistical analysis. JS wrote the first draft of the manuscript; all authors revised this draft. All authors read and approved the final version. LK is the guarantor for the manuscript. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of Interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: JD reports personal fees from the University of Reading during the conduct of the study. All remaining authors did not declare any interests.

Funding

Initial funding was received from an RCEM research award and the study was subsequently adopted onto the NIHR portfolio.

Acknowledgements

We thank the investigators and participants at the participating sites for their involvement in and support of the study. Particular thanks to David Porter (TVSM CRN) and Carys Jones (RBH) for providing ongoing support and encouragement for the study. After publication of the planned primary and secondary analyses, the trial data can be shared upon reasonable request to the corresponding author. The views expressed are those of the authors and not necessarily those of the RCEM or the NIHR.

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