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Research article

A prospective study to compare serial changes in pain scores for patients with and without a history of frequent ED utilization

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ABSTRACT

Background: In the face of the opiate addiction epidemic, there is a paucity of research that evaluates limitations for our current pain rating methodologies for patient populations at risk for drug seeking behavior.
Objective: We hypothesized that VAS scores would be higher and show less serial improvement for patients with a history of frequent ED use.
Methods: This was a prospective, observational cohort study of a convenience sample of adult ED patients with chief complaint of pain. Initial VAS scores were recorded. Pain scores were subsequently updated 30–45 min after pain medication administration. ED frequenter defined as having >4 ED visits over a 1-year time period. Categorical data analyzed by chi-square; continuous data analyzed by t-tests. A multiple linear regression performed to control for confounding.
Results: 125 patients were enrolled; 51% ED frequenters. ED frequenters were similar to non-ED frequenters with respect to gender, mean age, Hispanic race, educational level, chief complaint type, and initial pain medication narcotic. ED frequenters more likely to have higher initial VAS score (9.17+/-1.25 vs. 8.51+/-1.68; $p = 0.01$) and higher second VAS scores (7.48+/-2.56 vs. 5.00+/-3.28; $p < 0.001$) and significantly lower mean change in first to second VAS scores (1.69+/-2.17 vs. 3.51+/-3.25; $p < 0.001$). Within our multiple linear regression model, only ED frequenter group ($p < 0.001$) and private insurance status (0.04) were associated with differences in mean reduction in pain scores.
Conclusion: We found that ED frequenters had significantly less improvement between first and second VAS measurements.

1. Introduction

Pain is one of the most commonly encountered chief complaints in the emergency department [1]. In 2015, the Center for Disease Control identified abdominal pain as the leading cause of emergency department (ED) presentation (8.8%), followed by chest pain (5.3%) and headache (2.8%), with painful conditions in aggregate comprising nearly 20 percent of all ED visits [2].

With this backdrop, regulatory agencies including the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) and Centers for Medicare and Medicaid (CMS) have increasingly emphasized pain management in their assessment of health facility and provider competence. In 2012, CMS created an "Incentive Fund" which partially based hospital reimbursement off of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) patient satisfaction survey which directly asks patients how well their pain was controlled [3].

While attempting to improve the comfort of patients in pain, it is less clear what role regulatory forces may have unwittingly served in leading physicians to overprescribe narcotics. Unintentional opioid overdoses have now become a national epidemic with the majority being related to prescription oral forms, surpassing motor vehicle crashes as the leading cause of death in the United States [4]. In 2008, drug overdoses were responsible for 20,044 deaths, and 73.8% of those involved opioids [4].

Competing pressures to control pain in the face of a growing opioid addiction epidemic place emergency physicians in a precarious position for many of the patients treated in the ED. Oligoanalgesia may lead to diminished reimbursement and lower satisfaction scores with potential

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administrative ramifications, while overly generous prescribing may have regulatory consequences for the physician [5, 6]. Emergency physicians are hampered further in balancing this dilemma by the fact that pain/pain reporting is a subjective experience, and we are currently lacking well-developed tools to identify patients with reported acute pain who are abusing the ED for secondary gain/exhibiting drug seeking behavior. Current approaches to evaluate physicians and institutions for satisfactory pain management do not take such factors into account.

Relevant to this concern, investigators have previously described that there are significant pain score reporting differences between subsets of ED patients [7, 8]. For example, Raftery et al. described gender differences for reporting of pain and physician perception of pain [8]. Likewise, utilizing a post-care survey instrument, Todd et al. found that there were disparities for reported pain levels between patients with chronic pain patients as compared with those experiencing acute recurrent pain [9]. Although the survey investigated the overall adequacy of pain relief reported by the patients, the investigators did not attempt to specifically measure and assess initial vs. subsequent scoring of pain in the ED.

As a consequence of poor access to alternative sites for pain and other medical care, emergency physicians encounter a large number of patients who utilize the emergency department frequently. Our literature search did not reveal prior studies that evaluate whether or not frequent users of the ED are a higher risk to have poor response to analgesic therapy. In view of this knowledge gap, we initiated a prospective study to examine the relationship between frequent ED utilization and patients' reports changes in pain score during serial assessments.

We hypothesized that VAS scores would be higher and show less serial improvement as reported by patients with a history of frequent ED use.

2. Methods

2.1. Study design

We conducted a prospective, observational cohort study during a nine-month period from January 5, 2017 through September 28, 2017.

2.2. Setting

The study was based in the ED of a 275-bed community hospital with an annual census of approximately 45,000 patient visits. The study was approved by our hospital's Institutional Review Board prior to the initiation of data collection.

2.3. Study population

Patients presenting with a chief complaint of abdominal pain, back pain, flank pain, or headache were consented for enrollment at point of care by emergency physicians with the aid of trained research associates (convenience sample). We excluded pregnant females, prisoners, patients less than 18 years old, or any patient that ultimately was admitted and required a surgical intervention for their condition. Consistent with the methods of Locker et al., we defined an ED frequenter as a patient who within a 1-year period look-back from the current visit was found to have greater than or equal to 4 visits to any one of the 6 EDs within our southern Texas hospital system [10]. Prior ED utilization was determined by structured review of our electronic medical record that catalogs all system encounters by type of setting.

2.4. Study protocol

Consenting participants completed a brief survey providing demographic, chief complaint and historical information. We recorded pretreatment pain scores that were reported by patients to their treating physician based on a 0–10 visual analog scale (VAS). Pain medication was administered at the discretion of the treating physician, and, within 30–45 min of medication administration another pain score reported to the treating physician was recorded on the same scale previously utilized. If subsequent VAS scores were taken during the patients stay in the ED, these were also recorded.

2.5. Statistical analysis

The Anderson-Darling test was utilized to assess the data for normality. Continuous data are presented as frequency of occurrence and were analyzed by t-tests (parametric data) or the Wilcoxon rank sum test (non-parametric data). Categorical data are presented as a means +/- standard deviation and were analyzed using chi-square. Alpha was set at 0.05. JMP v14 SAS Institute software was utilized for the analysis. We performed a multiple linear regression to control for possible confounding. The dependent variable was the change in initial VAS scores, and we included in the multiple regression model 7 main factors (patient characteristics/demographics in Table 1) and two cross effects. The method used was backwards elimination and the criteria was minimizing BIC.

The primary outcome parameter was to compare the serial improvement in pain scores between ED non-frequenters and frequenters. For the study to have 80% power with alpha set at 0.05, we calculated an a priori sample size of 46 in each comparison group assuming a 2.5 mean change in pain score for non-frequenters vs. 1.5 mean change for frequenters.

3. Results

125 patients were enrolled from January 5, 2017 through September 28, 2017. We identified 51% of our patients as ED frequenters. The most common chief complaint was abdominal pain, which accounted for 81% of ED visits in our study. Table 1 summarizes the characteristics of the study group that was predominantly Hispanic and from lower socioeconomic and educational status.

Table 2 summarizes characteristics of ED frequenters vs. non-ED Frequenters, and, for most variables the two groups were similar. ED frequenters were more likely to have an income of <$20,000 when compared to non-ED frequenters (84% vs 62%, $p = 0.01$) and less likely to have private insurance when compared to ED non-frequenters (14% vs 36%, $p = 0.01$). The two groups were similar with respect to the distribution of chief complaint types ($p = 0.68$), and there was no statistical difference in the frequency for which they received an initial dose of narcotics (71% vs. 79%; $p = 0.26$).

ED frequenters were more likely to have higher initial VAS scores (9.17 +/- 1.25 vs 8.51 +/- 1.68; $p = 0.01$), higher second VAS scores (7.48 +/- 2.56 vs 5.00 +/- 3.28; $p < 0.001$), and lower mean change from 1st to 2nd VAS scores (1.69 +/- 2.17 vs 3.51 +/- 3.25; $p < 0.001$) compared to patients who did not frequently visit the ED. 32 patients (22 frequenters) received a second dose of analgesic. There were no significant differences in mean pain score change for ED frequenters vs. non-frequenters (2.6+/-3.1 vs 1.8+/-3.1; $p = 0.28$).

To control for possible confounding, we performed a multiple linear regression that included all clinical and historical variables collected for the study. Within our model, the association between ED frequenter status and mean pain score reduction remained significant ($p < 0.001$). With respect to other patient characteristics, only private insurance status was associated with differences in mean reduction in pain scores ($p = 0.04$).

4. Discussion

In this prospective, observational cohort study, we sought to determine if patients that frequently utilize the ED (ED frequenters) had less serial change in their VAS scores after pain management when compared to patients without a pattern of high ED utilization. We found that ED frequenters were significantly more likely to have higher initial VAS

Table 1. Study group characteristics.

Male	40% (75)
Hispanic	81% (101)
Household Income <20K	73% (90)
Less than High School Education	33% (41)
Private Insurance	25% (31)
ED Frequenter	51% (64)

scores, higher second VAS scores, and less serial improvement in their VAS scores following analgesic administration.

Our findings raise some new concerns for regulators and administrators who wish to assess the adequacy by which emergency physicians treat their patients reporting pain. If our results are validated in other populations, we have identified a subset of patients for which there is lower likelihood that the provision of analgesics will result in end-of-visit improvements. Unfortunately, current evaluation methods do not control for such variables both within institutions and between institutions respectively. Thus, EDs with higher recidivism rates may be at risk for scoring poorly on key pain control and patient satisfaction metrics based on census characteristics that are, clearly, outside the sphere of physician influence.

Investigators previously have evaluated the assessment and treatment of pain in the ED from a variety of perspectives [1, 5, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56] Several have evaluated serial assessments of pain and noted a frequent lack of improvement and/or satisfaction despite treatment [11, 12, 13] Todd et al. conducted a telephone survey of 500 adult patients with either chronic or recurrent pain who reported an ED visit within the past two years [11]. Less than half the patients in both groups reported following treatment that they felt "complete" or "a great deal" of pain relief. While analogous to our study for evaluating patient subgroups that would appear to be at risk for poor treatment response, the authors did not compare those patients to a subgroup that would appear to be at less risk for poor treatment response such as the non-frequenter group we considered. Further, the retrospective method of the survey, well after the point of actual care, provides risk of recall bias by the patient that our prospective, serial reassessment/recording of pain scores avoids.

Noting the poor treatment improvement in our ED frequenter study group and that observed by Todd et al. for chronic and recurring pain sufferers, we can speculate that these and other patient subgroups likely contribute significantly to the observations by other investigators that interventions to improve pain management often do not result in increasingly satisfied patients [12, 13]. In the context of acute musculoskeletal injury, Sturesson et al. surveyed 80 patients before and 80 patients after the implementation of mandatory pain documentation in their ED [12]. They found that, while there was a significant difference in the number of patients receiving analgesics (41% pre-intervention vs 68% post-intervention; ($p < 0.003$)) as well as reduced reported pain intensity at discharge ($p < 0.03$), patients did not provide improved satisfaction scores post-intervention.

As much as patient characteristics may play a role in ED pain management challenges, Sampson et al. explored ED staff factors that might contribute to poor satisfaction reporting by patients despite recorded serial pain score improvements [13]. They collected data from 3 case study EDs including 143 h of non-participant observation, 37 ED staff interviews, and 19 patient interviews. They observed differences between EDs and staff as to whether the pain score was documented directly by the patient or formulated by the clinician. Often the staff were reluctant to accept patient-reported scores if inconsistent with their own assessment of the patient pain level, and this was particularly exacerbated when the score was used as a tool for auditing appropriate pain management.

Our findings and the aforementioned reports outline significant challenges for emergency physicians when one considers the significant potential for patient and staff factors outside of the physician domain of control to influence pain score reporting and satisfaction. We believe additional research is warranted to validate our findings and to identify additional patient characteristics that may be associated with low likelihood of serial pain score reporting improvement.

5. Limitations

Our study has several limitations that warrant discussion. First of all, we did not enroll patients consecutively, and we did not track patient refusals to participate, which raises concern for selection bias. We attempted to mitigate this risk by utilizing research associates who had highly varied service hours that crossed all days and times of the week. ED frequenter and non-frequenter groups within our study sample were found to be similar across most characteristics. We acknowledge that our patient population, which has a high proportion of Hispanics from lower socioeconomic status, is dissimilar from that observed in other settings/regions of the country, thus, raising external validity concerns. However, in our regression model to attempt to control for confounding, we did not find any association between our primary outcome parameter and the variables race, income, and educational level.

Another limitation of our investigation was the lack of a standardized treatment protocol for patients in the two comparison groups. Physicians, at their discretion, treated patients with analgesics and chose the type of medication provided. Fortunately, we found that patients in the two groups were provided narcotics with similar frequency suggesting some degree of uniformity in therapy. Physicians and patients alike were not blinded to the medication administered, but it is unclear how blinding might have impacted our outcome parameter when such a high percentage of patients in both groups received narcotics.

We also allowed for a broad array of patients with a variety of chief complaints to be enrolled. However, we note that the distribution of chief complaints was not significantly different between ED

Table 2. Comparison of ED Frequenter vs. non-ED Frequenter Patients.

	ED Frequenters	Non ED Frequenters	P value	95% CI difference for Frequenters vs non Frequenters
Male	42%	38%	0.61	Males Fr – Males NFr (-13%, 22%)
Female	58%	62%	0.61	
Hispanic	77%	85%	0.22	Hisp Fr – His NFr (-22%, 5%)
Non-Hispanic	23%	15%	0.22	
Household Income <20K	84%	62%	0.01	HI <20k Fr – HI <20k Nfr (6%,37%)
Household Income >20K	16%	38%	0.01	
Private Insurance	15%	36%	0.01	PI Fr – NPI NFr (-36%, -7%)
No Private Insurance	85%	64%	0 .01	
Less than High School Education	31%	36%	0.52	LHs Fr – LHs NFr (-22%, 11%)
At least High School Education	69%	64%	0.52	

frequenters and non-frequenters. Thus, we do not believe that inclusion of a diverse group of patients with pain confounded our results. We do think future investigators should consider larger studies that focus on patients solely with a specific type/location of pain (e.g. musculoskeletal back pain) to evaluate whether our findings are consistent across chief complaints.

Finally, while our results seem to support a widely held belief by emergency physicians that patients who frequently visit the emergency department are more likely to not improve with initial analgesic administration, our study does not specifically identify factors that contribute to this phenomenon. Grover et al. observed, "drug seeking patients exhibit classically described drug-seeking behavior (e.g. requesting refill of an analgesic prescription) with only low to moderate frequency [57]. Thus, it may be difficult for future investigators to attribute frequent visits necessarily with patients who are drug seeking.

6. Conclusion

We found that ED frequenters had significantly less improvement between first and second VAS measurements than those observed for patients who had prior history of infrequent visits. Future investigators should conduct studies to confirm our findings in other settings as well as to identify other high-risk groups/patient characteristics for poor reported pain treatment response.

Declarations

Author contribution statement

Ryan Joseph and Peter Richman: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Alainya Tomanec and Thomas McLaughlin:Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Jose Guardiola: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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