The Journal of Emergency Medicine, Vol. 32, No. 1, pp. 19–22, 2007

0736-4679/07 $–see front matter

ELSEVIER

doi:10.1016/j.jemermed.2006.05.029

Original Contributions

CHANGES IN HEART RATE DO NOT CORRELATE WITH CHANGES IN PAIN INTENSITY IN EMERGENCY DEPARTMENT PATIENTS

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□ **Abstract—The objective of this study was to determine the correlation, if any, between change in heart rate (HR) and change in pain in Emergency Department (ED) patients. This was a prospective, observational study of a convenience sample of patients presenting to an academic ED with pain. Heart rate and pain intensity (using a 100-mm visual analog scale) were determined at time of triage, 30 min post pain treatment, and at discharge. The correlation between change in HR and change in pain was determined using the Pearson correlation coefficient. Nine hundred seventy-five patients were enrolled in the study. The Pearson rho for 1143 correlations between change in HR and change in pain was 0.08 (95% CI 0.03–0.13). This study suggests that there is a poor correlation between change in pain intensity and change in heart rate among ED patients with acute pain.** © 2007 Elsevier Inc.

□ **Keywords—Pain measurement; heart rate; emergency department; analgesics; pain scales**

INTRODUCTION

Acute pain increases heart rate via autonomic nervous system stimulation and catecholamine release in both animal and human study populations (1–3). However, pain is a subjective experience, influenced by many psychologic and sociologic factors including past experience, cultural learning, anxiety, and depression (4,5). Patient-reported pain intensity scales are limited by these subjective factors. In addition, many factors besides pain, such as medications, illnesses, and cardiovascular conditioning, may affect heart rate (5,6). Increased heart rate may be useful in clinical practice to indicate the presence of pain in patients unable to communicate secondary to age or cognitive impairment (7–11). Although heart rate response to painful procedures has been studied, no study has been published on heart rate response to the relief of acute pain in the Emergency Department (ED) setting (10,12,13). Relief of acute pain may be associated with a decrease in heart rate in an ED population. Such a correlation, if it exists, may provide an objective measure of pain relief. The purpose of this study is to evaluate the correlation between change in heart rate and change in pain intensity in ED patients with pain.

METHODS

Study Design

This was a prospective, observational study of a convenience sample of patients who presented to a university ED with a chief complaint of pain from September 2000 to December 2000. Patients were included in this study whether they had recent onset of a new pain or they had a recent worsening of a longstanding pain. Patients were enrolled in the study 7 days a week between the hours of 8:00 a.m. and midnight when trained research associates were available.

RECEIVED: 10 May 2004; FINAL SUBMISSION RECEIVED: 18 October 2005;
ACCEPTED: 31 May 2006

Study Setting

This study was performed at a university hospital ED with an annual patient volume of 27,000 visits.

Study Protocol

Patients were excluded from the study if they were under 18 years of age, if they were unable to complete the survey due to language or other communication barriers, or if they had severe, multi-system trauma.

At triage, patient pain intensity was measured using a 100-mm visual analog scale (VAS). The VAS used was a previously validated 100-mm horizontal line with the words "least possible pain" on the left border and "worst possible pain" on the right border (14,15). At this same time, patients had their pulse rate measured by trained research associates. Patients receiving pain medication had a second pain intensity VAS score and pulse rate determined approximately 30 min after the administration of analgesics. A final pain intensity VAS and pulse rate were recorded on all patients at the time of discharge from the ED. Other information recorded included chief complaint, age, gender and race.

Trained research associates who were blinded to the study objective collected all of the data. The ED personnel caring for the patients were aware of the data collection process but were blinded to the study objectives. The research associates provided no clinical information to caregivers.

Outcomes Measured

The primary outcome measured was the correlation between changes in pain intensity and changes in heart rate for each patient using the Pearson correlation coefficient. Secondary outcomes included the correlation between changes in pain intensity and changes in heart rate for:

1. Patients younger than 40 years of age who had pain for less than 48 h
2. All patients based on chief complaint
3. All patients based on gender

All data were entered into a Microsoft Access (Microsoft, Redmond, WA) database and exported into SPSS (SPSS, Chicago, IL) for data analysis. This study was approved by the Institutional Review Board at the University of Utah.

Table 1. Mean Heart Rate and Pain Intensity (VAS score) for all Patients Measured at Triage, after Analgesics and at Discharge

Time	Mean pain intensity (VAS) (95% confidence interval)	Mean heart rate (95% confidence interval)
Triage (n = 975)	63 (61–64)	86 (85–87)
30 min post analgesic (n = 386)	42 (40–45)	78 (76–79)
Discharge (n = 757)	58 (55–61)	78 (77–79)

RESULTS

There were 975 patients enrolled in the study over a 4-month period. Each patient had either two or three determinations of pulse and VAS score. There were 386 correlations of change in pain intensity and heart rate between triage and 30 min after analgesics were administered. There were 589 correlations of change in pain intensity and heart rate between triage and discharge and 168 correlations between analgesic treatment and discharge. This provided a total of 1143 correlations of change in heart rate and change in pain intensity.

The mean age for all patients was 36 years (95% confidence interval [CI] 35–37). There were 507 (52%) men. The mean duration of pain was 33 h (95% CI 29–36). Table 1 shows the mean heart rate and mean pain intensity measurements (VAS score) at the time of triage, 30 min post-analgesic treatment, and at the time of discharge.

The Pearson rho for the change in heart rate with the change in pain intensity (VAS score) for all patients (n = 1143) was 0.08 (95% CI 0.03–0.13) The Pearson rho for changes in heart rate and changes in pain intensity was 0.15 (95% CI 0.08–0.23) for females and 0.02 (95% CI −0.06–0.09) for males.

For the subgroup of patients under age 40 years with pain duration < 48 h, the mean age was 24 years (95% CI 23–25) and the mean duration of pain was 13 h (95% CI 11–14).

The Pearson rho for change in heart rate with change in pain intensity for this subgroup of young patients with short duration of pain (n = 416) was 0.14 (95% CI 0.05–0.23).

DISCUSSION

Pain is the most frequent complaint that motivates people to seek care in an ED (4,5,16). An objective measure of the presence and intensity of pain in ED patients would be clinically valuable. Unfortunately, common tools for measurement of pain intensity are subjective and no