



## Original Contribution

## ED treatment of migraine patients has changed☆

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## ABSTRACT

**Study objectives:** Numerous studies have shown benefits of nonnarcotic treatments for emergency department (ED) migraine patients. Our goal was to determine if ED treatment of migraine patients and the rate of return within 72 h have changed.

**Methods:** Design: Multi-hospital retrospective cohort. Population: Consecutive ED patients from 1-1-1999 to 9-31-2014. Protocol: For determining treatments, we examined charts at the beginning (1999–2000) and end (2014) of the time period. We combined similar medications into the following groups: parenteral narcotics, oral narcotics, antihistamines and dopamine receptor antagonists prochlorperazine/metoclopramide (DRA). We calculated the percent of migraine patients given each treatment in each time period. We identified those who returned to the same ED within 72 h, and calculated the difference in annual return rates between 1999–2000 and 2014.

**Results:** Of the 2,824,710 total visits, 8046 (0.28%) were for migraine. We reviewed 290 charts (147 in 1999–2000 and 143 in 2014) to determine migraine treatments. The use of IV fluids, DRA, ketorolac and dexamethasone increased from 1999–2000 to 2014, whereas narcotic use and discharge prescriptions for narcotics decreased. Of the 8046 migraine patients, 624 (8%) returned within 72 h. The return rate decreased from 1999–2000 to 2014 from 12% to 4% (difference = 8%, 95% CI 5%–11%).

**Conclusion:** For ED migraine patients, the use of IV fluids, DRA, ketorolac and dexamethasone increased whereas the use of narcotics and discharge prescriptions for narcotics decreased. The return rates for migraines decreased. We speculate that the increased use of non-narcotic medications contributed to this decrease.

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## 1. Introduction

Migraine is a common presenting emergency department (ED) complaint. The number of visits to EDs in the US exceed 1 million per year with associated costs over 700 million dollars per year [1,2]. The goals of migraine treatments should be symptom relief with minimal side effects, maintenance of the treatment effect after discharge to prevent the need to return, and prevention of the inadvertent “side-effect” of long-term drug dependence [3].

In the past, narcotics have been widely used for the treatment of migraines in the ED [4,5]. Besides their known side effects [6] and decreased therapeutic effectiveness over time, [7] narcotics also have a significant morbidity [8,9] and mortality [10] risk. This is particularly

unacceptable since alternative effective treatments are available [11,12]. The public, government agencies and the medical community are becoming increasingly aware of these problems and the “opioid epidemic” has caught their attention [13,14]. Many reference a letter to the editor by Jane Porter and Dr. Hershel Jick published in the New England Journal of Medicine in 1980 as contributing to the early misconceptions about the safety of opiate use in the medical setting [15]. This letter concluded that despite widespread use of narcotic drugs in hospitals, the development of addiction is rare in medical patients with no addiction history. We have now learned this to be false. Drug overdose deaths nearly tripled from 1999 to 2014 [16]. In 2014, among 47,055 drug overdose deaths, 61% involved an opioid [16]. Further, in a retrospective cohort study Hoppe et al. [17] reported that of opioid naïve patients who were given a narcotic prescription in the ED, 12% went on to recurrent use. A recent New England Journal of Medicine study [18] showed an association between prescription of narcotics in the ED and subsequent continued use of narcotics.

Many non-opioid medications, such as prochlorperazine, metoclopramide and ketorolac, have been found to be effective in the treatment of migraines in the ED [11,12]. In a 1989 article in JAMA Jones et al. [19] found that prochlorperazine is effective for treating

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migraines. In the systematic review by Orr et al. [12], of 68 randomized controlled trials, metoclopramide, prochlorperazine, and sumatriptan each had multiple studies supporting efficacy, as did dexamethasone for preventing headache recurrence. They recommended that because of lack of evidence demonstrating efficacy and concern about sub-acute or long-term sequelae, injectable morphine and hydromorphone are best avoided as first-line therapy. A 2017 randomized controlled trial by Friedman et al. [20] found in direct comparison that prochlorperazine is more effective than hydromorphone in treating ED migraine patients. In a retrospective cohort study, Griffith et al. [21] reported that metoclopramide, compared to hydromorphone, resulted in less use of rescue medications, faster times to discharge, and no difference in the frequency of adverse reactions.

The increasing evidence for the efficacy of non-narcotic treatments and dangers of using opioids should have resulted in ED physicians reducing their use of opioids for migraines. The goal of this study was to determine if the ED treatment of migraine patients has changed in recent years. Our secondary goal was to ascertain if there was a change in the rate of return to the ED within 72 h.

## 2. Methods

### 2.1. Study design and setting

Multi-hospital retrospective cohort of consecutive ED visits. Setting: Four New Jersey suburban EDs with annual visits from 27,000 to 84,000, all staffed by board-certified emergency physicians. None of the hospitals had a protocol for treating migraines.

### 2.2. Population

For determining differences in treatments, we examined charts at the beginning and end of the time period from 1999 to 2014. For the beginning of the time period, we chose two years, 1999–2000, because there were an insufficient number of charts available for review in 1999 alone. To find charts of patients, we searched the electronic medical record (EMR) using the ED physician diagnosis of migraine. Based on a power calculation to detect a 10% difference with alpha set at 0.05 and beta at 0.8 we needed 141 patients in each group. We therefore examined 35–40 patients at each hospital. We included only initial visits for migraine and excluded revisits. In order to exclude revisits, we arranged the charts alphabetically by patient name, then examined charts in order until we reached the required number. The EMR and templates did not change over the course of the study. The charts were templated, so every chart had treatment and discharge medications documented. Three investigators reviewed a random sample of charts together and by consensus developed an abstraction form to guide data collection. After developing the form three investigators independently examined 20 charts. Agreement among the three was 100% (Kappa = 1). The data from the chart was collected using accepted guidelines [22] except that the abstractor was not blinded to the hypothesis of the study; however, there were well-defined objective data that were present in all charts as the charts were templated.

For determining differences in revisit rates we identified migraine visits using the *International Classification of Diseases, Ninth Revision*

(ICD-9) codes for migraine (Table 1) using the billing database which was common to all the hospitals. The ICD-9 codes used were the only codes used by our coders and likely captured all patients with the ED physicians' diagnosis of migraine. We used the billing database since it had the 72 h return visit rate data readily available. The local institutional review board approved the study.

### 2.3. Protocol

For determining differences in treatments, we tallied and compared the drugs given in the ED, the use of IV fluids and prescriptions given at discharge in the two time periods. We combined similar medications into the following groups: parenteral narcotics, oral narcotics, antihistamines and the dopaminergic receptor antagonists prochlorperazine/metoclopramide (DRA). We analyzed only treatments given in at least 20% of the visits in one of the time periods. We arbitrarily chose "20%" to focus on those medications that would have the greatest impact on patient care. We calculated the percentage of migraine patients given each treatment in each time period and the 95% confidence interval (CI) for differences in these percentages between the time periods.

For determining differences in revisit rates, we calculated the annual revisit rates for each year of the study. We calculated the difference in annual revisit rates and the 95% CI between the years 1999–2000 and 2014. We also calculated the linear regression coefficient  $R^2$  for the graph of annual revisit rate versus year.

## 3. Results

Of the 2,824,710 visits in the database, 8046 (0.28%) were for migraine. The average age of these 8046 patients was  $38 \pm 13$  years and 84% were female. We reviewed 290 charts (147 in 1999–2000 and 143 in 2014) to determine migraine treatments. For these 290 patients, the mean age was  $38 \pm 12$  years; 89% were female; and there was no significant difference in the mean age or percentage female between the two time periods.

As seen in Table 2, the use of IV fluids, DRA, ketorolac and dexamethasone in the ED increased significantly from 1999–2000 to 2014, by 74%, 58%, 34% and 22%, respectively. Parenteral narcotics given in the ED and narcotic prescriptions given at discharge decreased by 56% and 22%, respectively.

Of the 8046 migraine patients, 624 (8%) revisited within 72 h. The revisit rate decreased from 1999–2000 to 2014 from 12% to 4% (difference = 8%, 95% CI 5%–11%). There was little difference in age and gender between patients at the beginning and end of the study and between patients who did and did not revisit the ED. The  $R^2$  of the linear regression for the graph of annual revisit rate versus year = 0.60 ( $p < 0.001$ ) (see Fig. 1).

## 4. Discussion

We found that treatment of migraines changed significantly from 1999–2000 to 2014. We found a decreased use of narcotics and

**Table 1**  
Migraine ICD-9 codes

ICD9	Description
34600	MIGR W AURA NOT INTRACT NO SM
34610	MIGR WO AURA NOT INTRACT NO SM
34620	VARIANT MIGRAINE NOT INTRACT N
34680	OTHER MIGRAINE NOT INTRACT NO
34690	UNSP MIGRAINE NOT INTRACT NO S
34691	UNSP MIGRAINE FORMS INTRACTABL
34692	UNSP MIGR NOT INTRACT W SM

**Table 2**  
Change in treatments for migraine

	1999–2000	2014	Difference	95% CI
Treatments ED				
IV fluids	14%	88%	74%	65%–81%
DRA	24%	83%	58%	48% to 66%
Ketorolac IV	5%	38%	34%	25% to 42%
Dexamethasone	0%	22%	22%	15% to 29%
Antihistamines	56%	50%	–7%	–18% to 5%
Parenteral narcotics	80%	24%	–56%	–45% to –64%
Discharge prescriptions				
Oral narcotics	30%	8%	–22%	–30% to –13%

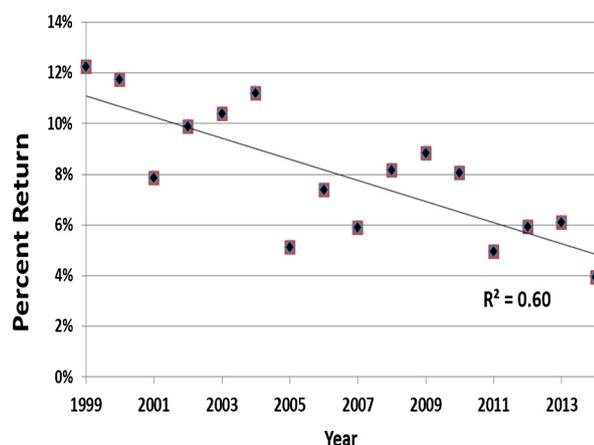


Fig. 1. Percent return of migraine patients in 72 h vs. year.

increased use of DRA, ketorolac, dexamethasone and intravenous fluids. We also found the revisit rates for migraines decreased significantly during this time period. To our knowledge, this is the first study directly reporting decreased use of narcotic medications together with decreased revisit rates. We speculate that the decrease in revisit rates was due to use of different medications, although other factors such as changes in access to primary care physicians may have also contributed.

Others have examined the ED treatment of migraine over time and found results different from ours. Friedman et al. [4] using the National Hospital Ambulatory Medical Care Survey in 1998 and 2010 found use of opioids increased slightly from 1998 to 2010 and, in spite of recommendations to the contrary, opioids were still used in 2010 in more than half of all ED visits for migraine. Our finding of 80% use of opioids in 1999–2000 is very high compared to this national sample. In another study using the same database, Mazer-Amirshahi et al. [5] found that ED visits where an opioid was prescribed increased from 21% in 2001 to 31% in 2010, a relative increase of 49%. The results in these two studies is contrary to our findings that the proportion of patients given narcotics in the ED decreased from 80% to 24% and the narcotic prescriptions decreased from 30% to 8% over the time period from 1999–2000 to 2014. These two studies differed from our study in having different time periods and geographic areas.

We found only one previous study that examined revisit rates. In a retrospective cohort study from 2009 to 2012, Bachur et al. [23] showed that for children with migraines, the majority are successfully discharged from the ED and only 5.5% revisited within 3 days. This is similar to our revisit rate of 7% in the same time period. However this study did not report revisit rates versus year.

## 5. Limitations

Our study has a number of limitations. We performed a retrospective chart review which has innate problems [22]. However, we believe the chart review process was valid as three investigators abstracted data from twenty charts and found complete agreement ( $\kappa = 1$ ) The abstractor was not blinded to the hypothesis of the paper; however, there were well-defined objective data that were present in all charts as the charts were templated.

Migraine patients were identified by the ED physician diagnosis and by ICD9 codes. As a result, some patients who had migraine may have been given other diagnoses in the ED such as headache, cephalgia, and vomiting. Further, patients with other conditions may have been assigned the diagnosis of migraine in the ED. This may have led to over or undercounting of migraine patients. Local practice for the assignment of diagnosis of migraine may vary. For example, a national survey showed that 0.8% of ED patients had their primary diagnosis as

migraine [24], whereas 0.29% of our patients were given a migraine diagnosis by our ED physicians. In addition, regarding revisits, some patients returning to the ED may have gone to other hospitals. We do not feel, however, that these factors would have likely changed over the course of our study or influenced our results.

Our study included four hospitals in the northeast. Other hospitals in our area or in other geographic regions may have different practices for treating migraines. There was some turnover in physicians working at the four hospitals from 1999–2000 to 2014, which may have contributed to some of the changes we observed.

## 6. Conclusion

We found that treatment of migraines changed significantly from 1999–2000 to 2014. The use of IV fluids, DRA, ketorolac and dexamethasone increased whereas the use of narcotics decreased. At discharge, prescriptions for oral narcotics decreased. In addition, we found that the revisit rate for migraines decreased significantly from 1999–2000 to 2014. Because this was a retrospective study, we cannot claim that change in treatments caused the decrease in revisit rates. Changes in other factors, such as access to primary care, could have also contributed.

## Authors contributions

JRA, BE and PR conceived and designed the study. MR did the major data collection and wrote the first draft. JRA did the data analysis. All authors took part in revisions.

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