



# Inpatient Pediatric Migraine Treatment: Does Choice of Abortive Therapy Affect Length of Stay?

David C. Sheridan, MD<sup>1</sup>, and Garth D. Meckler, MD, MSHS<sup>2</sup>

**Objective** To describe the inpatient management of pediatric migraine and the association between specific medications and hospital length of stay (LOS).

**Study design** Historical cohort study review of patients age <19 years of age admitted to a single tertiary care children's hospital between 2010 and 2015 for treatment of migraine headache.

**Results** The cohort consisted of 58 encounters with an average patient age of 14.3 years (SD 3.2 years) with a female predominance (62%). The mean number of inpatient medications received by patients was 3 (range 1-7), with dopamine antagonists and dihydroergotamine used most commonly (67% and 59% of encounters, respectively). The average LOS was 56 hours (95% CI 48.2-63.2) and did not vary by medication received, although patients who received an opioid had a significantly longer LOS (79.2 vs 47.9 hours respectively;  $P < .001$ ).

**Conclusions** Children admitted to the hospital for treatment of migraine headache frequently require a large number of medications over an average hospital LOS of more than 2 days without apparent differences based on medication received other than prolonged stays for subjects who received opioids. (*J Pediatr* 2016;179:211-5).

Pediatric headaches are common, affecting one-third of children during elementary school and increasing in prevalence during high school to affect one-half of adolescents.<sup>1</sup> Preventive therapies may be effective in the pediatric population, but evidence-based options are limited and few are approved by the US Food and Drug Administration in this age group, resulting in low rates of use.<sup>2</sup> Even with prophylaxis, children often experience episodic breakthrough headaches that require abortive treatment. Outpatient options include oral first-line analgesics such as ibuprofen or acetaminophen and migraine-specific therapies such as triptans. When these are ineffective, children may present for further care in an emergency department (ED), where headache accounts for 1% of pediatric visits to the ED, and migraine is the most common primary headache disorder treated in this setting.<sup>3</sup> Abortive therapies in the ED include dopamine antagonists and anti-inflammatory agents.<sup>4</sup> Although highly effective, up to 7% of children treated in the ED do not respond to abortive therapy and require inpatient admission to alleviate their headache.<sup>5</sup> Although not recommended for migraine,<sup>6-8</sup> studies in both children and adults suggest that opioids are not used uncommonly in the outpatient and ED setting,<sup>9,10</sup> and evidence from studies in adults suggests that the use of opioids may lessen response to migraine-specific treatments,<sup>11</sup> increase the risk of chronic migraine,<sup>12,13</sup> and put patients at risk for dependence and frequent ED use.<sup>14</sup>

Despite the growing literature on outpatient and ED abortive treatment for pediatric migraine headache, there has been little published on the inpatient management of children who require hospitalization for further treatment of refractory migraines. Dihydroergotamine (DHE) has been used in this setting with good success.<sup>15</sup> Little is known about other inpatient treatment strategies for refractory pediatric migraine, including migraine-specific therapies and opioid analgesics, or whether clinical response to DHE might be rapid enough to consider its use as an abortive therapy in the ED. The objective of this study, therefore, was to describe the range of medications commonly used on the inpatient unit to treat pediatric migraine and to compare different medications in terms of their effect on hospital length of stay (LOS).

## Methods

This was a historical cohort study of all pediatric patients admitted for migraine headache at a single tertiary care pediatric hospital. This study was approved by the institutional review board. The study population comprised all patients younger than 19 years of age admitted to the hospital from June 2010 to April 2015. The cohort was selected by searching the electronic medical record system at our hospital (EPIC 2010) for patients with an admitting *International Classification of*

DHE	Dihydroergotamine
ED	Emergency department
ICD-9	<i>International Classification of Diseases, Ninth Revision</i>
LOS	Length of stay

From the <sup>1</sup>Department of Emergency Medicine, Oregon Health & Science University, Portland, OR; and <sup>2</sup>Department of Pediatrics, Pediatric Emergency Medicine, University of British Columbia BC Children's Hospital, Vancouver, British Columbia, Canada

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*Diseases, Ninth Revision (ICD-9)* diagnosis code of “migraine” or “headache.” If the admitting ICD-9 diagnosis code was “headache,” patients were only included in the final study sample if the billing discharge ICD-9 diagnosis code included “migraine.”

Data abstracted from the medical record included sex, age, inpatient LOS, prophylactic migraine medication use before the patient’s visit to the ED, home abortive medications, and class of inpatient medication(s) received. Inpatient medications were recorded if they included dopamine antagonists (prochlorperazine, metoclopramide, and promethazine), DHE, parental valproate, magnesium, diphenhydramine, triptans, or nonsteroidal anti-inflammatory drugs. In addition, although not recommended for the treatment of migraines, opioid medications received during an inpatient stay were recorded.

The primary objective was to describe common inpatient medications used for migraine and to investigate whether there were differences in LOS by medication type. The primary outcome was hospital LOS compared by medications received. Secondary outcomes included descriptive measures of treatment received including number of DHE doses received, opioid use, and abortive and prophylactic prescription medications used before arrival to the ED.

### Statistical Analyses

Patient demographics were summarized by the use of descriptive statistics including means and SDs. Inpatient medications were dichotomized as received or not. The hospital LOS was analyzed by an independent sample *t* test for the top 3 medications received. A *P* value with an alpha of <.05 was considered statistically significant. All analyses were performed in STATA 14 (StataCorp LP, College Station, Texas).

## Results

There were 60 patient encounters that met initial inclusion criteria during the study period; however, 2 patients subsequently were excluded: one was removed because the primary admission was for syncope and a second was admitted for video electroencephalography but did not receive migraine treatment. The final study cohort consisted of 58 patient encounters.

The average age of the cohort was 14.3 years (SD of 3.2 years) with a female predominance of 62% of the population (**Table I**). The majority of patient encounters (60%) were direct admissions rather than admission from the study-site ED. More than one-half the patients (57%) had a prescription for prophylactic agents at home before their visit to the ED and hospital admission. Of patients using prophylactic migraine medications, the 3 most common agents were topiramate (52%), amitriptyline (24%), and valproic acid (10%). Multiple patients had more than one preventative medication listed in their chart. For abortive treatment, 43% of patients had a triptan on their admission home-medication reconciliation list, and 29% had a prescription for an opioid.

The average number of migraine medications used by inpatients was approximately 3 different medication classes per encounter (SD 1.64, range 1-7). **Table II** details inpatient

**Table I. Study population characteristics**

Subject demographics	N = 58
Mean age, y	14.3
Sex	
Female	36 (62%)
Male	22 (38%)
Outpatient medication prescriptions	
Prophylactic medications	
Topiramate	30 (52%)
Amitriptyline	14 (24%)
Valproic acid	6 (10%)
Home medication prescriptions	
Triptan	25 (43%)
Opioid	17 (29%)

medication treatments. The most common medications administered were dopamine antagonists (67% of encounters) and DHE (59% of encounters). For patients who received DHE, an average of 5.9 doses (SD 2.8) was administered during the inpatient stay.

The average inpatient LOS was 56 hours (95% CI 48.2-63.8). There was no difference in LOS between subjects who received dopamine antagonists (56.8 hours, 95% CI 47.6-65.9 vs 54.3 hours, 95% CI 38.3-70.4; *P* = .77), DHE (56.9 hours, 95% CI 48.8-65.1 vs 54.6 hours, 95% CI 38.8-70.4; *P* = .77), or nonsteroidal anti-inflammatory drugs (63.5 hours, 95% CI 49.2-77.8 vs 50.3 hours, 95% CI 41.6-58.9; *P* = .09) compared with those patients who did not receive one of these agents, respectively (**Figure**). There was a statistically significant longer LOS among patients who received an opioid compared with those who did not (79.2 hours, 95% CI 60.5-97.8 vs 47.9 hours, 95% CI 40.6-55.2, respectively; *P* < .001).

## Discussion

In this single-center, retrospective cohort study, there was no association between any specific abortive migraine medication and hospital LOS. The average inpatient LOS was 56 hours, and most subjects were treated with multiple doses of medication or multiple medications to terminate their refractory migraine headache. Our large cohort study of the inpatient management of pediatric migraine headache provides

**Table II. Inpatient medications received**

Medications	Patient encounters (%)
Dopamine antagonist	39 (67%)
DHE	34 (59%)
IV fluid	28 (48%)
NSAID	25 (43%)
Diphenhydramine	23 (40%)
Sodium valproate	18 (31%)
Opioid	15 (26%)
Magnesium	11 (19%)
Triptan	8 (14%)

IV, intravenous; NSAID, nonsteroidal anti-inflammatory drug.

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