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Management of Pediatric Headaches in the Emergency Department at Connecticut Children's Medical Center

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Abstract

Headaches are a common complaint for children presenting to the Emergency Department (ED) at Connecticut Children's Medical Center. Currently, there is little published regarding a standard treatment plan for pediatric headaches. The purpose of this study is to determine which medications are most commonly utilized and which are most effective in managing pediatric headaches. Differences in management of acute and chronic headaches in the ED at Connecticut Children's Medical Center were examined. A retrospective chart review was conducted of all children who presented to the ED from January 1 to March 31, 2013 with a chief complaint or discharge diagnosis with the term "headache" or "migraine". Data collection included medications administered in the ED, intensity of headache (pain score scaled 1-10) before and after medication, and disposition (home or admitted). Acute headaches were defined as headaches lasting 1-7 days and chronic headaches as lasting more than 7 days. Of 165 children who presented to the ED at Connecticut Children's Medical Center with headaches in 2013, 72.7% presented with acute headaches, while 27.3% presented with chronic headaches. The most common medications used to manage headaches in this ED are Ibuprofen, Toradol, IV fluid (NaCl), Reglan and Acetaminophen. It cannot be assumed that one medication brought the pain score down because multiple drugs were administered. Therefore, efficacy of individual drugs could not be determined. Ibuprofen was used more frequently to manage acute headaches, while Reglan and Benadryl were used more often for chronic headache management. This study can be a basis for future prospective studies that examine medication efficacy in managing pediatric headaches, ultimately resulting in the development of treatment guidelines for the ED.

Introduction

Pediatric headaches are a common health problem. In 1962, Bille (Bille, 1962) observed a 40% prevalence of headaches in children by age seven and 75% prevalence by the age of fifteen. This study, which was the first to provide a comprehensive epidemiologic report on pediatric headaches, showed that the prevalence of headaches in children increases during adolescence. A twenty-year study demonstrated that 73% of children who presented with headaches continued to experience headaches as an adult (Brna, Dooley, Gordon, & Dewan, 2005). In addition, during preteen years, headaches are more prevalent in males than in females, however during adolescence, headaches occur more frequently in females than males (Abu-Arafeh & Russell, 1994; McGrath & Hillier, 2001).

Headaches affect children in multiple ways, including academically, mentally and socially. Moreover, headaches are the third leading illness resulting in missed days of school for children (Brna, Dooley, Gordon, & Dewan, 2005). Children who experience recurrent headaches are particularly impacted. Children with frequent headaches not only miss more school than their peers, their academic performance is often impaired as well (Allen, 2006). Also, pediatric headaches can lead to changes in personality and a decline in social function (Allen 2006).

While migraine headaches are common in children, the most frequent type of headache affecting children is the tension headache, which can last between 30 minutes and 7 days. It is characterized by a pressing or tightening pain that may extend to the neck and upper back (Cummings, Wittick, Cantor, 2009). Tension headaches, which can be triggered by stress, depression, anxiety or decreased quality of sleep, tend to occur on the weekdays in the daytime, consistent with school hours (Cummings, Wittick, Cantor, 2009).

Genizi and colleagues conducted a study in 2013 that examined the frequency of learning disabilities and attention-deficit hyperactivity disorder (ADHD) in children who experience migraine and tension type headaches (Genizi et al., 2013). They found a 40.7% prevalence of either ADHD, learning disabilities or both conditions in children with tension and migraine headaches (Genizi et al., 2013). Furthermore, ADHD had a more significant impact on the children with tension headaches in comparison to those with migraine headaches (Genizi et al., 2013). Genizi and colleagues also observed that children with migraine headaches performed better in school than children with tension headaches (Genizi et al., 2013).

Although headache classification guidelines have been established by the International Headache Society (The Headache Classification Committee of the International Headache Society, 1988, 2004), there has been much dispute on how to approach and manage pediatric headaches. Recommendations for management of pediatric headaches have been based on studies of adult headaches. Currently, medications such as Ibuprofen, Acetaminophen, Sumatriptan, Toradol (Ketorolac), Reglan (Metoclopramide), Ondansetron, Naproxen, Amitriptyline, Flunarizine and Prochlorperazine are used to treat children (Rosenblum & Fisher, 2001; Walker&Teach, 2008; Gelfand & Goadsby, 2012). Additionally, some non-pharmacological methods have been used. These include change in diet and increased exercise (Molofsky 1998).

Pediatric headache complaints are common in emergency departments, such as the Emergency Department (ED) at Connecticut Children's Medical Center. While some children may visit their primary care physician for treatment of headaches, children often visit pediatric emergency departments instead. Adolescents tend to present to emergency

departments with headaches more frequently than younger children, partly because headaches become more prevalent as children age (Gelfand & Goadsby, 2012). In the ED at Connecticut Children's Medical Center, a trial and error approach is often used for headache management. Therefore, in this study, we determined which medications are most commonly used to manage pediatric headaches and examined the efficacy of the medications used in the ED. We also assessed differences in management of acute and chronic headaches because they usually have different etiologies. Causes of acute headaches include upper respiratory infections, trauma, endocrine disorders and meningitis, while post-concussive syndrome, psychological issues and brain abscesses are among the causes of chronic headaches (Cummings, Wittick, Cantor, 2009). Our goal is to use this information to eventually develop treatment guidelines for the ED at Connecticut Children's Medical Center.

Methods

We reviewed 165 patient charts of children ages 5 to 17 that presented to the ED at Connecticut Children's Medical Center, an urban pediatric hospital, from January 1 to March 31, 2013 with a chief complaint or discharge diagnoses with the term "headache" or "migraine". We used the Picis ED Pulsecheck charting system to review the charts (Figure 1). We collected the following data: age, acute vs. chronic headache, intensity of headache (pain score scaled 1-10) before and after medication administration, medications administered in the ED, prescriptions written in the ED for home, and disposition (home or admitted). Acute headaches were defined as headaches lasting 1-7 days and chronic headaches as lasting more than 7 days. Children who left before evaluation or against medical advice were excluded from this study. Statistical Package for the Social Science (SPSS) software was utilized to perform statistical analysis of the data. Pearson's Chi-Square test was used to compare the quantitative variables in the acute and chronic headache groups (Table 1). Table 1 shows the results of a Pearson's Chi-Square test performed to examine the correlation between the frequency of a medication with respect to its use for treatment of acute vs. chronic headaches. Other variables were analyzed using the Independent Samples t-test (Table 2a, 2b). Tables 2a and 2b show the results of an Independent Samples t-test done to investigate the association between a medication and pain score decrease.

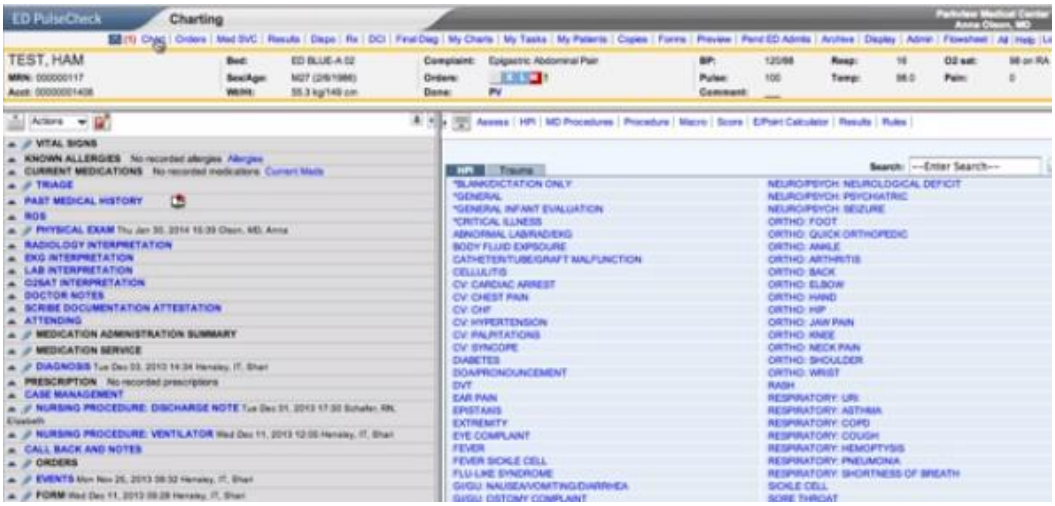

Figure 1. Example of a hypothetical patient chart in Picis ED PulseCheck. Source: YouTube. Video: Picis Training for PMC: Results and MDM.

Table 1. Example of Pearson Chi-Square Test results via SPSS software

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.533[a]	1	0.465		
Continuity Correction[b]	0.173	1	0.677		
Likelihood Ratio	0.562	1	0.454		
Fisher's Exact Test				0.548	0.349
Linear-by-Linear Association	0.529	1	0.467		
N of Valid Cases	128				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.16.

b. Computed only for a 2x2 table

Table 2a. Example of Independent Samples T-Test results via SPSS software

Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
Difference	Equal variances assumed	1.262	0.268	-0.294	39
	Equal variances not assumed			-0.324	21.904

Table 2b. Example of Independent Samples T-Test results via SPSS software

Independent Samples Test					
		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
Difference	Equal variances assumed	0.960	0.039	0.784	-1.542
	Equal variances not assumed	0.964	0.039	0.855	-1.740

Results

Initial review indicated that in 2013, there were 1,400 pediatric complaints and/or diagnoses of general headaches, migraine headaches, and post-concussion headaches in the Emergency Department (ED) at Connecticut Children's Medical Center. In this study, we reviewed 165 of the charts for the children who presented with headaches that year. Patient age and gender were assessed because these factors are associated with pediatric headaches. As shown in Table 3, the median age of children in our sample is 12 years, which is early adolescence. Consistent with earlier studies (Abu-Arafeh & Russell, 1994; McGrath & Hillier, 2001), females in this group are somewhat more affected by headaches than are males. In addition, we observed that acute headaches account for approximately three fourths of headaches while the remaining one fourth are chronic headaches. We also observed that almost all children were sent home rather than admitted with serious neurological disorders that required urgent care. Furthermore, a pain score decrease was achieved in three fourths of the cases, indicating pediatric headache management in the ED was effective overall.

Table 3. Patient Characteristics

Total Patients	165	
Mean Age	12.25 years	
Gender	Female	55.6%
	Male	44.4%
Headache	Acute	72.7%
	Chronic	27.3%
Disposition	Discharged Home	96.1%
	Admitted	3.9%
Decrease in pain score	Yes	76.3%
	No	23.7%

We recorded the percentage of children who were given each medication to determine which medications are most commonly utilized in the ED at Connecticut Children's Medical Center (Table 4).

Table 4. Medications Administered to 165 Children Presenting with Headache in 2013

Medication Name	% Children Given Medication
Ibuprofen	37.9%
Acetaminophen	16.3%
Triptan	2.0%
Ondansetron	9.8%
Narcotic	2.6%
Toradol	24.8%
Benzodiazephine	0.00%
Prochlorperazine	0.00%
IV fluid (NaCl)	35.9%
Topamax	0.00%
Amitriptyline	0.00%
Reglan	34.6%
Benadryl	12.4%

As shown in Table 4, the most common medications used to treat pediatric headaches in the ED at Connecticut Children's Medical Center are Ibuprofen, Acetaminophen, Toradol, IV fluid (NaCl), and Reglan.

The medications used in the ED at Connecticut Children's Medical Center were correlated with pain score to determine the effectiveness of the medications. The intensity of the headaches was measured using a pain scale of 1-10, which was recorded before and after medication administration. To assess effectiveness, we examined the change in pain score for the children. If the children's pain score decreased after medications were given, the medications were considered to be effective. If the children's pain score did not decrease after treatment, the medications were deemed as not effective. While 76.3% of the children reported feeling less pain by the end of their emergency department visit, it was difficult to measure which specific medications were associated with this decrease. While

some children were treated using only one medication, one specific medication alone was insufficient to treat most children's headaches. Therefore, the children were often given multiple medications during their stay in the ED, and it is likely that the combination of medications administered is what actually caused most children's pain score to decrease. This may be indicative of a possible synergistic effect between the medications being used in the ED at Connecticut Children's Medical Center. As such, we cannot assume that any one medication brought the pain score down. This was demonstrated when we attempted to perform statistical analysis, as the data produced insignificant and misleading results. For these reasons, we cannot make statistically significant conclusions about medication efficacy based on the data.

Additionally, for each medication administered, we assessed its frequency of use for treatment of acute and chronic headaches to determine if there was a difference in headache management based on type.

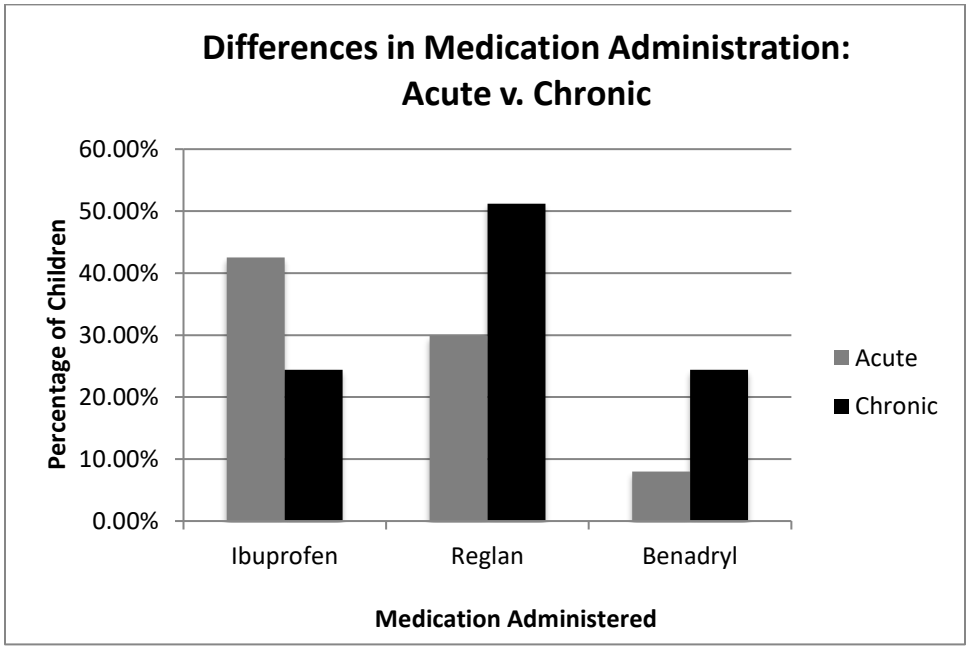

Figure 2: Differences in Management of Acute and Chronic Headaches

We found a statistically significant difference in the administration of Ibuprofen, Reglan, and Benadryl to treat acute and chronic headaches in the ED at Connecticut Children's Medical Center. Ibuprofen was prescribed significantly more frequently ($p < 0.05$) for the treatment of patients with acute headaches than chronic headaches (Figure 4). In contrast, there was no statistically significant difference ($p > 0.05$) between the use of Acetaminophen in the management of acute or chronic headaches. In addition, the use of Triptan, Ondansetron, Narcotic, Toradol and IV fluid showed no significant differences for treatment of acute and chronic headaches. Furthermore, the use of Reglan ($p < 0.01$) and Benadryl ($p < 0.01$) both exhibited statistically significant differences in the treatment of acute and chronic headaches (Figure 4). Both were used more frequently to treat children with chronic headaches than acute headaches. None of the children in this cohort were given Benzodiazephine, Prochlorperazine, Topamax, or Amitriptyline for headache treatment, and therefore, no correlations could be calculated for these medications.

Discussion

To optimize patient care at Connecticut Children's Medical Center, it is important to develop headache treatment guidelines for this ED. Rather than a trial and error method of treatment which can be time consuming and frustrating, a standard pediatric headache treatment plan could provide more structure to the treatment process. Health care providers could use the treatment guidelines to determine which medications are most appropriate to manage a child's headache. To further this goal, we determined which specific medications have been commonly used to manage pediatric headaches in the ED at Connecticut Children's Medical Center. For instance, contrary to practices in other pediatric emergency departments, medications such as Amitriptyline, Sumatriptan, Flunarizine, Naproxen, and Prochlorperazine were not used to treat any of the children presenting to the ED at Connecticut Children's Medical Center (Rosenblum & Fisher, 2001; Walker&Teach, 2008; Gelfand & Goadsby, 2012).

In this study, we have determined that Ibuprofen, Acetaminophen, Toradol, IV fluid (NaCl), and Reglan have been utilized the most to manage pediatric headaches in the ED at Connecticut Children's Medical Center. The next step in developing treatment guidelines involves assessing the effectiveness of these medications in a prospective study. Additionally, the differences in management for type of headache should be further researched because we found a significant difference in the administration of Ibuprofen, Reglan, and Benadryl with respect to treatment of acute and chronic headaches. Benadryl, which is not generally used as often as Ibuprofen or Reglan to treat headaches in the ED at Connecticut Children's Medical Center, is particularly significant for treating chronic headaches.

For children with acute headaches, Ibuprofen is the ideal medication to administer first. This has been supported by studies conducted by Hämäläinen, Hoppu and Valkeila (1997) and Lewis and colleagues (2002). The 1997 study showed that Ibuprofen was superior to a placebo and Acetaminophen in improving acute headache pain (Hämäläinen et al., 1997). Similarly, in the 2002 study, it was concluded that Ibuprofen is an effective, well-tolerated pain medication for children who experience acute headaches (Lewis et al., 2002).

For children with chronic headaches, medications such as Reglan and Benadryl can be initially used for treatment. In a 2013 study conducted by Friedman and colleagues, they compared the use of a combination of Metoclopramide (Reglan) and Diphenhydramine (Benadryl) to Ketorolac (Toradol) for treatment of adult recurrent headaches. The study showed that the Reglan and Benadryl combination was superior to Toradol in relieving recurrent headache pain (Friedman et al., 2013). While this study was conducted with adults, it is consistent with our findings for children. A study similar to the Friedman study conducted with children would contribute to the development of a standard pediatric headache management plan.

Based on our study, we cannot assume that the decrease in pain score was associated with any one medication, as more than one medication is usually administered to the children at approximately the same time. It is pertinent to note that since 76.3% of the children who presented to ED reported a lower pain score after medication was administered, it is plausible that most of the medications being used were effective. Furthermore, the method used to measure efficacy in this study was not sufficient in providing conclusive results. This can be improved by separating the children into two

groups, one being those whom received one medication and the other would consist of children who received more than one medication. This way, we could measure efficacy based on how treatment was provided.

This is a small study with only 165 charts audited. A larger sample size might have produced additional significant correlations. Moreover, this study was limited in that it was retrospective. However, the results we found can form the basis of future prospective studies on headache management in the pediatric emergency department. For example, future research can determine which combinations of the commonly utilized medications are most associated with a decrease in pain score and shorter emergency department length of stay for children. Additionally, other potential studies could examine how comorbidities and headache triggers impact the intensity of pediatric headaches and ultimately, which medications are effective in treating children in the emergency department. Furthermore, children often receive over-the-counter medications prior to their emergency department visit. It is possible that these medications affect the efficacy of the medications administered in the pediatric emergency department. The implications of these and other future studies could advance the management of pediatric headaches and emphasize the significance of studies being conducted on children to understand how to provide more effective treatment for children.

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