



## Evaluation of the assessment and management of acute migraines in two Australian metropolitan emergency departments

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### ABSTRACT

**Introduction:** Migraines are one of the commonest presenting complaints to emergency departments (ED), and may result in prolonged length of stay with symptoms being severe and refractory to typical remedies, such as paracetamol, non-steroidal anti-inflammatory drugs and triptans. The objective of this study was to describe and compare patient demographics, presentation, management and outcomes to hospital discharge between first presenters and patients with a history of migraines in two metropolitan emergency departments in Melbourne, Australia. Given that the assessment and management of patients who have had a prior history of migraines is likely to be substantially different, patients were subgrouped by this exposure variable.

**Methods:** A total of 365 patients were identified retrospectively during the study period of March 2013 – September 2014 that met the inclusion criteria of a headache with no organic cause and/or symptoms consistent with visual or abdominal migraines. Presenting pain scores, assessment, management and disposition were extracted using explicit chart review.

**Results:** The mean age of patients included was 37.8 years and 23.3% were males. Significantly more first presenters were investigated with a CT scan of the brain (34.4% as compared to 22.9% of patients with a prior history of migraine).

Initial management included administration of paracetamol in 178 (48.8%) cases, NSAIDs (mostly ibuprofen and aspirin) in 187 (51.2%) and parenteral dopamine antagonists (e.g. metoclopramide, prochlorperazine and chlorpromazine) in 191 (52.3%) cases. Migraine-specific agents such as triptans were prescribed in 46 (12.6%) and ergots in two (0.5%) cases. Opioids such as morphine or oxycodone were administered in 94 (25.8%) cases. There was no statistical difference in the management of patients with a history of migraines as compared to first presenters, with the exception of the use of intravenous fluids and parenteral dopamine antagonists. The median length of stay in the ED was 4 (inter-quartile range 2–7) hours, with 163 (44.7%) patients admitted to the short-stay unit. A pain score of  $\geq 5$  was recorded at discharge in 31 (8.5%) patients. Disposition was similar across both groups of patients.

**Conclusions:** Although first presenters seem to be more thoroughly investigated, the acute management of migraine did not differ largely between patients who had a history of migraine compared with first presenters. The management of acute migraine in the ED setting has varied efficacy, suggesting that further research into newer therapeutic options is needed.

**Keywords:** Migraine disorders, headache, emergency department

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## BACKGROUND

Migraines are a common presenting complaint to the emergency department (ED).<sup>1,2</sup> Despite this, there is a paucity of reports on management options for migraine in the ED.<sup>3</sup> Patients presenting to the ED pose an additional treatment challenge for physicians when compared to the migraine sufferer at home as symptoms are usually more prolonged, severe and may be refractory to first-line remedies.<sup>4,5</sup>

Acute migraine treatment typically follows a step-wise approach, with simple analgesics and anti-emetics given in the first-line of therapy and triptans used in the second line of treatment. Refractory attacks can be treated with dopamine antagonists such as phenothiazines or ergots.<sup>6,7</sup> In the ED setting, parenteral non-steroidal anti-inflammatory drugs (NSAIDs) and dopamine antagonists can also be used for initial symptom control.<sup>8–10</sup> Given the range of medications, management of migraine is varied and the use of other medications, such as ketamine and propofol has also been reported.

The Australian Therapeutic Guidelines recommend prophylaxis in patients who regularly experience more than two to three acute migraine attacks each month. A variety of effective options are available, with the eventual drug choice being determined by neurologist opinion and patient preference. Commonly used prophylactic agents include beta-blockers (propranolol, metoprolol), anti-convulsants (sodium valproate, topiramate, gabapentin), anti-hypertensives (candesartan, lisinopril, verapamil, clonidine), amitriptyline, pizotifen, methysergide and cypro-heptadine.<sup>11</sup>

Given that migraines are the third most prevalent disorder and the seventh highest cause of adult disability worldwide, it is evident that this debilitating condition poses a major public health burden.<sup>12–14</sup> Children and adults alike face long-term repercussions from school or work absences due to poorly managed migraines.<sup>15,16</sup> Given the variability of management and introduction of newer treatment options, a study of current migraine management in Australian EDs was of interest. In addition, the management of patients who have had migraines before and those who have not can be significantly different. Therefore, among patients who presented to two metropolitan EDs and were diagnosed with migraine, we aimed to describe and compare patient demographics, presentation, management and outcomes to hospital discharge between first presenters and patients with a history of migraines.

## METHODS

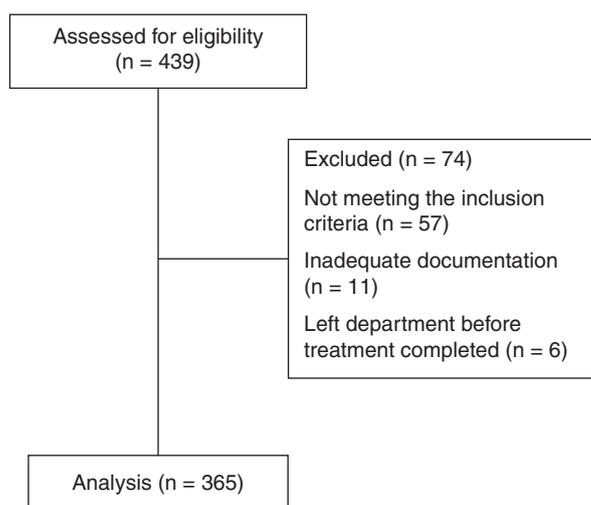
### Patient selection

This was a retrospective cohort study where eligible patients were identified from The Alfred Health ED database, which records data on all presentations to The Alfred Hospital Emergency and Trauma Centre (E&TC) and Sandringham Hospital ED. The Alfred Hospital E&TC is a major metropolitan centre that receives approximately 60,000 patients per year. Sandringham Hospital is a community hospital that receives approximately 35,000 patients per year. This study was approved by The Alfred Hospital Research & Ethics Committee.

Between the study period of 1 March 2013 and 30 September 2014, a total of 439 patients were discharged with a primary diagnosis of migraine from the EDs of The Alfred and Sandringham hospitals. Of the 439 patients screened, 365 met the following inclusion criteria: (a) Headache with no organic cause identified, including visual migraines and abdominal migraines; (b) discharge diagnosis of migraine; (c) presenting complaint of “migraine” as recorded in the triage text. Exclusion criteria were: (a) Headache associated with a clear organic cause; (b) inadequate documentation in medical records on presentation and/or management; (c) patient leaving the department before assessment and/or management was completed (Figure 1).

### Data extraction

An explicit retrospective chart review was conducted on all included patients. Demographic data were directly extracted from the administrative database of electronic health records. All data points were collected using a standardised de-identified form and cross-checked for accuracy and consistency by at least two investigators. Pain severity was extracted when documented using a graphic pain score, which is a patient-reported scale comprising of 10 levels, with 1 representing minimal pain and 10 representing the worst pain possible. In accordance with the current ED guidelines, patients were asked to report their pain scores on admission and just prior to discharge, which was then recorded by nursing staff. Data on investigations extracted included blood tests and computed tomography (CT) imaging of the brain.



**Figure 1.** Selection of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 September 2014.

Management of patients was subgrouped into pharmacological or conservative intervention. Conservative intervention was classified as the administration of intravenous (IV) fluids or observation only. Pharmacological intervention was classified into groups based on their mechanism of action. Of note, the parenteral dopamine antagonists included chlorpromazine, prochlorperazine, metoclopramide and droperidol. Anti-emetics were classified as those that worked on different pathways (e.g. ondansetron) as well as oral dopamine antagonists (e.g. oral metoclopramide). Outcomes measures reported were patient disposition destination, length of hospital stay and pain score on discharge.

### Analysis

Patients were subgrouped by a prior history of migraine as this was considered to substantially alter investigations and management. In addition, this distinction would allow comparison and analysis of any differences between the two groups. Continuous, near-normally distributed data are reported using means (standard deviations) while skewed or ordinal data are reported using medians (inter-quartile ranges). The significance of difference between means was evaluated using Student's *t* test, the significance of difference between medians was evaluated using the Mann–Whitney *U* test while the significance of difference between proportions was evaluated using the  $\chi^2$  test or Fisher's exact test when values were  $< 5$ . A *p* value of  $< 0.05$  was considered to be statistically significant. All analyses were performed using the software Stata V 11.0 (Statacorp, College Station, Texas, USA).

### RESULTS

Demographics and presenting history of included cases are summarised in Table 1, with an overall mean age of 37.8 (SD 15.1) years and the majority of the patients being female (74.8%).

#### Investigation of migraines

Of the 240 patients with a prior history of migraine, 55 (22.9%) were investigated with a CT brain scan, while among the 125 patients with no prior history of migraines, 43 (34.4%) were investigated with a

**Table 1.** Demographics and presenting history of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 September 2014. *n* = number of patients.

Variable	History of migraines ( <i>n</i> = 240)	Primary presentation ( <i>n</i> = 125)	<i>p</i>
Age (years)	38.1 (13.6)	37.3 (17.6)	0.65
Sex, male	56 (23.3%)	36 (28.8%)	0.25
Prescribed migraine prophylaxis	24 (10.0%)	0 (0%)	$< 0.01$
Initial severity of pain	7 (5–9)	6 (4–8)	0.06

Numbers in parentheses indicate standard deviation if it is a single number, interquartile range if it is a range and percentages as specified.

**Table 2. Investigation of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 Sep 2014. *n* = number of patients.**

Variable	History of migraines ( <i>n</i> = 240) (%)	Primary presentation ( <i>n</i> = 125) (%)	Total (%)	<i>p</i>
Referral to the inpatient team	21 (8.8)	17 (13.6)	38 (10.4)	0.15
CT brain scan	55 (22.9)	43 (34.4)	98 (26.8)	0.02
Blood tests	119 (49.6)	52 (41.6)	171 (46.8)	0.15

CT scan of the brain ( $p = 0.02$ ) (Table 2). There was no significant difference in the proportion of patients who had pathology tests requested or had been referred to an inpatient team.

### Management of migraines

The management of patients is outlined in Table 3. There was no statistically different management of patients with a history of migraines as compared to first presenters, with the exception of the use of intravenous fluids and parenteral dopamine antagonists.

### Outcomes and disposition in ED

Table 4 summarizes the outcomes and disposition of the patients, with the majority returning home after treatment or after spending some time in the short-stay unit. Only 3% needed admission for the management of their migraine. The median length of hospital stay was similar between those with a history of migraines (4.4 hours) and those who were presenting for the first time (3.8 hours). Both groups also had a median pain score of two on discharge. However, 31 (8.5%) patients had a reported pain severity of more than five on discharge (Figure 2).

### DISCUSSION

Patients with migraines presented to the ED of two Australian hospitals complaining of high pain scores. The majority of cases had a prior history of migraines, but only a small proportion (10.0%) were on prophylactic migraine treatment. Management was varied and consistent with previous reports from Australian centres.<sup>17</sup> Despite a substantial period of management in the ED, a substantial proportion of patients were discharged home with considerable pain.

Given the nature of migraines and its similarities to other more severe and life-threatening conditions, such as giant cell arteritis, cerebrovascular events and meningitis, it is necessary to thoroughly investigate each new presentation to exclude the more sinister causes of headache. This is reflected in 34.5% of first presenters undergoing a CT scan of the brain and 10.4% requiring assessment by inpatient teams to confirm the diagnosis, as compared to 22.9% and 8.8% respectively for the patients with a history of migraines. Although clinical decision rules were not evaluated, this seemed to

**Table 3. Management of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 September 2014. *n* = number of patients.**

Variable	History of migraines ( <i>n</i> = 240) (%)	Primary presentation ( <i>n</i> = 125) (%)	<i>p</i>
Intravenous fluids	170 (70.8)	54 (43.2)	< 0.01
Anti-emetics	102 (42.5)	41 (32.8)	0.07
Paracetamol	97 (40.4)	56 (44.8)	0.44
Paracetamol+ codeine	17 (7.1)	8 (6.4)	0.81
Non-steroidal anti-inflammatory drugs	130 (54.2)	57 (45.6)	0.12
Triptans	34 (14.2)	12 (9.6)	0.21
Opioids	52 (21.7)	42 (33.6)	0.01
Parenteral dopamine antagonists	150 (62.5)	41 (32.8)	< 0.01
Ergots	2 (0.8)	0 (0)	0.55
Other combination medications (aspalgin, mersyndol)	4 (1.7)	1 (0.8)	
Steroids	4 (1.6)	1 (0.8)	0.66
Benzodiazepines	2 (0.8)	0 (0)	0.55
Local anaesthetic (as an occipital nerve block)	2 (0.8)	0 (0)	0.55

**Table 4. Outcomes and disposition of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 September 2014. *n* = number of patients.**

Variable	History of migraines ( <i>n</i> = 240)	Primary presentation ( <i>n</i> = 125)	<i>p</i> -value
Median pain score on discharge	2 (0–4)	2 (0–5)	0.60
Departure destination			0.05
- Home	122 (50.8%)	69 (55.2%)	
- Short stay	114 (47.5%)	49 (39.2%)	
- Admit	4 (1.7%)	7 (5.6%)	
Hospital length of stay (hours)	7.3 (12.6)	6.9 (8.6)	0.72

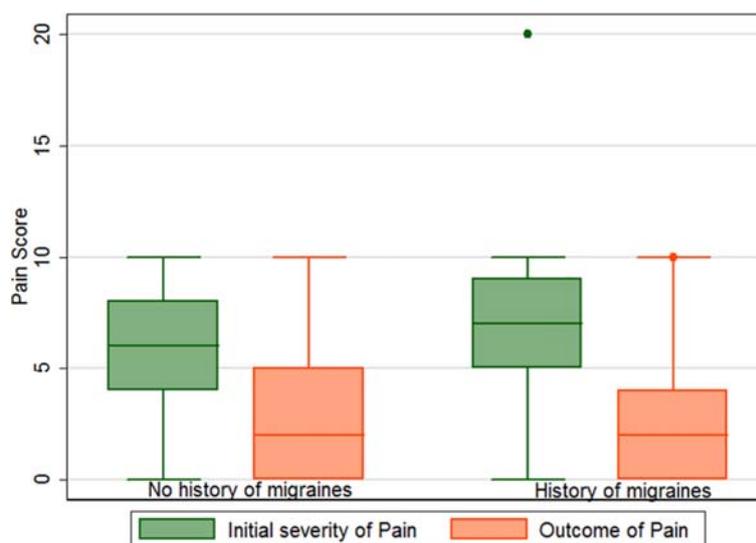
Numbers in parentheses indicate standard deviation if it is a single number, interquartile range if it is a range and percentages as specified.

suggest that rules that aid in direct emergency neuroimaging such as “POUNDing” did not appear to be routinely used.<sup>18,19</sup>

It may be argued that management of migraine in the ED should start at the rescue analgesia stage rather than with a trial of simple analgesia. In the setting of protocols for management of migraines being based on low levels of evidence, various treatment regimens remain varied. This is further complicated by patients’ varying responses to analgesia, and pain being a subjective measure. In this study, it was difficult to isolate specific agents and co-relate them to measurable outcomes (e.g. pain or length of stay) due to the retrospective nature of this study as well as the concurrent use of multiple agents. Nevertheless, it was noted that the vast majority of patients received simple analgesia, NSAIDs, dopamine receptor antagonists (mainly metoclopramide, prochlorperazine, chlorpromazine) and triptans.

The role of parenteral dopamine antagonists, such as metoclopramide, prochlorperazine and chlorpromazine, is well established as a monotherapy for acute treatment in migraines. Droperidol has also been shown to be effective, but has more side effects, including akathisia. In general, dopamine antagonists have been shown to have equivalent efficacy when compared to therapies using triptans.<sup>20</sup> A significantly larger proportion of patients with a history of migraines received parenteral dopamine antagonists (62.5%), which could be attributed to these patients having experienced pain refractory to oral agents, and therefore had needed parenteral agents to supplement their analgesia.

Steroid therapy was also minimally used, with only five patients (1.4%) receiving steroids. Of these, two patients were given dexamethasone and a further three patients received prednisolone, which may reduce the rate of early headache recurrence, but the evidence remains inconclusive.<sup>21–23</sup>



**Figure 2. Pain scores on admission and discharge of patients presenting with acute migraine to two Australian EDs between the study period of 1 March 2013 and 30 September 2014.**

In this study, two cases received local anaesthetic as a greater occipital nerve block. This is a technique more commonly used in cases of chronic migraine, and its efficacy in acute presentations of headache is uncertain.<sup>24</sup> Lignocaine infusions are part of the hospital's guidelines (in which this study took place) for the treatment of refractory migraines, but were not used in patients included in this study. Their benefit has been demonstrated in chronic daily headache with substantial medication overuse.<sup>25</sup>

Novel migraine management options exist, but most clinicians are unfamiliar with such agents. For example, calcitonin gene-related peptide receptor antagonists (e.g. telcagepant) are available, but their therapeutic profile and safety are still being investigated.<sup>26</sup> In addition, the use of transcutaneous magnetic stimulation has also demonstrated pain relief at two hours post-treatment but this is only currently available in the United Kingdom and United States.<sup>27,28</sup> In addition, alternative therapies such as acupuncture and mindfulness meditation have been documented to be useful and continue to be studied.<sup>29–31</sup>

Preliminary research has suggested that both a sedative dose and smaller doses of propofol may be effective at migraine pain reduction, and may reduce the length of hospital stay. In a randomised controlled trial comparing propofol to sumatriptan, pain intensity was significantly lower in the propofol group 30 minutes after treatment, and accompanied by significantly lower need for anti-emetic therapy and lower recurrence of symptoms.<sup>32,33</sup> Propofol is familiar among emergency physicians, being used frequently for procedural sedation in the ED. However, further research is required to establish propofol as a more regular option for the management of migraines.

Despite prolonged length of stay in the ED, a substantial proportion of patients were discharged home with presumably considerable pain. There was no significant difference in the disposition between patients with a history of migraines and first presenters.

This study is limited in being a retrospective review, thus associated with selection bias. However, cases were identified by both the presenting complaint and the discharge diagnosis, and included all cases presenting to the two EDs within the defined time period. As both hospitals were located in Metropolitan Melbourne, generalisability to other settings may be limited. Variability of pain scores is substantial among patients and may not be the ideal tool to gauge the effectiveness of migraine management. In addition, length of stay may be affected by exogenous factors such as safety of discharge and ED overcrowding, and may not strictly be reflective of the efficacy of management.

## CONCLUSIONS

Although first presenters underwent more investigations in the ED, the acute management of migraine did not differ largely between patients who have had a migraine before as compared to first presenters. The management of acute migraine in the ED setting was varied, often requiring admission to the short-stay unit for a substantial proportion of patients, with pain not completely relieved on discharge from hospital. These findings lead to the hypothesis that further research into newer therapeutic options such as calcitonin gene-related peptide receptor antagonists, transcutaneous magnetic stimulation or the use of propofol may improve patient experience, flow through the ED and outcomes.

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