Original Article

Pain Management for Nontraumatic Headache Patients Presenting with Red Flag Symptoms in the Emergency Department

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Abstract

Background: Headache is a common presentation in the emergency department (ED) and contributes substantially to global disability. Pain management of nontraumatic headache can be challenging, particularly in patients presenting with red flag symptoms, where diagnostic priorities and concerns over secondary causes may delay or influence analgesic treatment. This study aimed to evaluate patterns of analgesic use and the adequacy of pain control among nontraumatic headache patients with red flag symptoms presenting to the ED of a Malaysian teaching hospital. **Methodology:** A retrospective review was conducted on the Radiology Department database of Hospital Pakar Universiti Sains, Malaysia. Adult patients who presented with nontraumatic headache, with at least one red flag symptom-based headache and who underwent cranial computed tomography (CT) between 2009 and 2012 were included. Pain was assessed via an 11-point numeric rating scale (NRS) before and after treatment. The medication type, timing of administration, pain score changes, and CT findings were analysed via descriptive and inferential statistics. **Results:** Of the 216 eligible patients, 144 had complete pain score documentation and were included in the analysis. The mean pretreatment NRS score was 5.21 ± 0.21, which decreased significantly to 0.19 ± 0.05 posttreatment ($p < 0.05$). Only 29.6% of patients received analgesia within 20 minutes of ED admission. Tramadol was the most commonly prescribed first-line agent (18.2%), followed by metoclopramide (14.6%) and diclofenac (11.1%), reflecting the frequent use of multimodal analgesia. Higher initial pain scores were associated with earlier medication administration and a greater likelihood of abnormal cranial CT findings. **Conclusions:** Multimodal analgesia is widely practiced in the management of nontraumatic headache in the ED. Tramadol emerged as the most commonly prescribed first-line agent, followed by metoclopramide, diclofenac, fentanyl, prochlorperazine, and parecoxib. Most patients experienced substantial pain relief, with a considerable proportion attaining complete pain resolution prior to disposition.

Keywords: *nontraumatic headache, pain management, tramadol, multimodal analgesia*

INTRODUCTION

According to the Global Burden of Disease (GBD) study, headache disorders significantly burden global health.[1] Headache is a common presenting complaint in the emergency department (ED). It accounts for 1–4% of all ED visits.[2] A multicenter observational study in Singapore reported that nontraumatic headaches accounted for 1.8% of ED visits and were associated with admission rates ranging from 12.1% to 39.8%.[3]

In Malaysia, headache is a common medical complaint and a leading cause of disability that affects academic and work performance.[4] Pain management for headache disorders can be straightforward yet challenging, particularly in ED settings. Studies indicate that inadequate headache management is more prevalent in Asian and African settings than in European and North American settings.[5] There are many challenges in the ED that may affect pain management, such as time constraints, variability in clinical protocols, and the need to address diverse patient needs.[6] A local study also revealed that

healthcare providers tend to underestimate the pain score of patients with headache, leading to inadequate pain management.[7]

Guidelines discouraged the use of opioids for nontraumatic headache in the ED because of their limited efficacy and increased risks, including headache chronification and higher revisit rates.[6,8,9] Instead, evidence-based treatments such as intravenous (IV) metoclopramide, prochlorperazine, nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, subcutaneous sumatriptan, and corticosteroids are recommended as first-line therapies.[8,9] Nevertheless, a recent multicenter observational study from Singapore found that tramadol is among the three most commonly prescribed analgesics, either alone or in combination, for nontraumatic headache.[3]

To the best of our knowledge, no specific study has investigated the pain management of nontraumatic headaches presenting with red flag symptoms in the emergency setting in the Malaysian population. This study aimed to evaluate the patterns of medication use for managing nontraumatic headache in patients presenting to the ED of a teaching hospital. Additional objectives included assessing the adequacy of pain control.

MATERIALS AND METHODS

This was a retrospective study based on the Radiology Department database of patients who presented to the ED with nontraumatic headaches as one of the complaints had red flag symptoms and underwent cranial computed tomography (CT) scans. The red flag symptoms are based on the 'SSNOOP' mnemonic (systemic symptoms/signs and disease, neurologic symptoms or signs, onset sudden or onset after the age of 40 years, and change in headache pattern) that was introduced by Dodick.[10]

The data were collected from 2009--2012 in the ED, Hospital Universiti Sains Malaysia (HUSM), Kelantan, Malaysia. The inclusion criteria were adult patients (more than 12 years old) presenting with nontraumatic headaches who had either one or more red flag symptoms and who underwent cranial CT scans. A complete pain score assessment before and after pain management was necessary. All pain assessments in this study were performed by the treating doctors via a numeric rating scale (NRS). The 11-point NRS is used regularly by most doctors in the ED and HUSM, as most of the participants were adult patients.

The exclusion criteria were any patient known to have any intracranial lesion and referred cases from district hospitals or clinics with suspected intracranial lesions. The cranial CT findings were categorized as normal findings or abnormal findings on the basis of the report by the radiologist.

The data collection started by reviewing the database. The request for the CT scan must be made by the ED doctors of Hospital USM. Case notes were traced from the database. All the cases were reviewed on the basis of the inclusion and exclusion criteria. A format sheet was created for documentation and data collection. Demographic data, vital signs, history-taking documentation, physical examination findings, cranial CT findings, diagnosis, pain score assessment, and disposition from the ED were recorded. The collected data and variables from the samples were categorized accordingly via statistical analyses via SPSS™ 22. Multivariate analysis was performed via logistic regression to analyse the significance of the predictive value from the univariate analysis. Ethical approval was obtained from the Ethical Board Review and Hospital Ethics Committee on 29 July 2013 (Reference USMKK/PPP/JEPeM [270.4(1)]. The sample size was determined via the single proportion method and was based on the prevalence of headaches reported in a renowned international study by Goldstein et al. in 2006.[11] The power sample size was significantly calculated, with 92 samples for this study.

RESULTS

A total of 216 patients who presented with red flag symptoms were included in this study. From the data, only 144 patients were selected and analysed for pain management, whereas the remaining 72 patients' case notes were incomplete and excluded from the pain score analysis. Figure 1 shows the study flow with the number of patients with pain assessment, CT scan findings, and their dispositions. The mean age was 49.5 (±0.99) years, with the youngest patient being 16 years old and the oldest patient being 83 years old.

Independent Variables		Frequency(%)	Mean (SD)
Sex			
	Male	116 (53.7)	
	Female	100 (46.3)	
Race			
	Malay	213 (98.7)	
	Chinese	3 (1.3)	
Age			49.5 (±0.99)
CT Scan Finding			
	No abnormality detected	146 (67.6)	
	Abnormal Cranial CT Scan	70 (32.4)	
	• Infarction	41 (19.0)	
	• Bleeding	9 (4.2)	
	• Tumors	20 (9.3)	
Medication Time Given (from the time of admission)	Given in 20 minutes	64 (29.6)	4.3 (±0.7)*
	Given after 20 minutes	80 (37.0)	21.2 (±3.2)*
	Unknown	72 (33.3)	-
Pain Score in ED			
	Pre-Treatment		5.21 (±0.21)
	• Mild (1-4)	53 (24.5)	
	• Moderate (5-7)	46 (21.3)	
	• Severe (8-10)	45(20.8)	
	Post Treatment		0.19 (±0.05)
	• No Pain	127 (58.9)	
	• Mild	17 (7.9)	
	Incomplete documentation**	72 (33.3)	

BPPV: Benign Postural Vertigo, CT: Computer Topography, CVA: Cerebral Vascular Accident, DBP: Diastolic Blood Pressure, MAP: Mean Atrial Pressure, SBP: Systolic Blood Pressure, SD: Standard Deviation, TIA: Transient Ischemic Attack
*time frame in a minute of serving medication.
** Incomplete documentation of pain score in the case noted.

Table 1: Demographic data and variable results collected (n = 216)

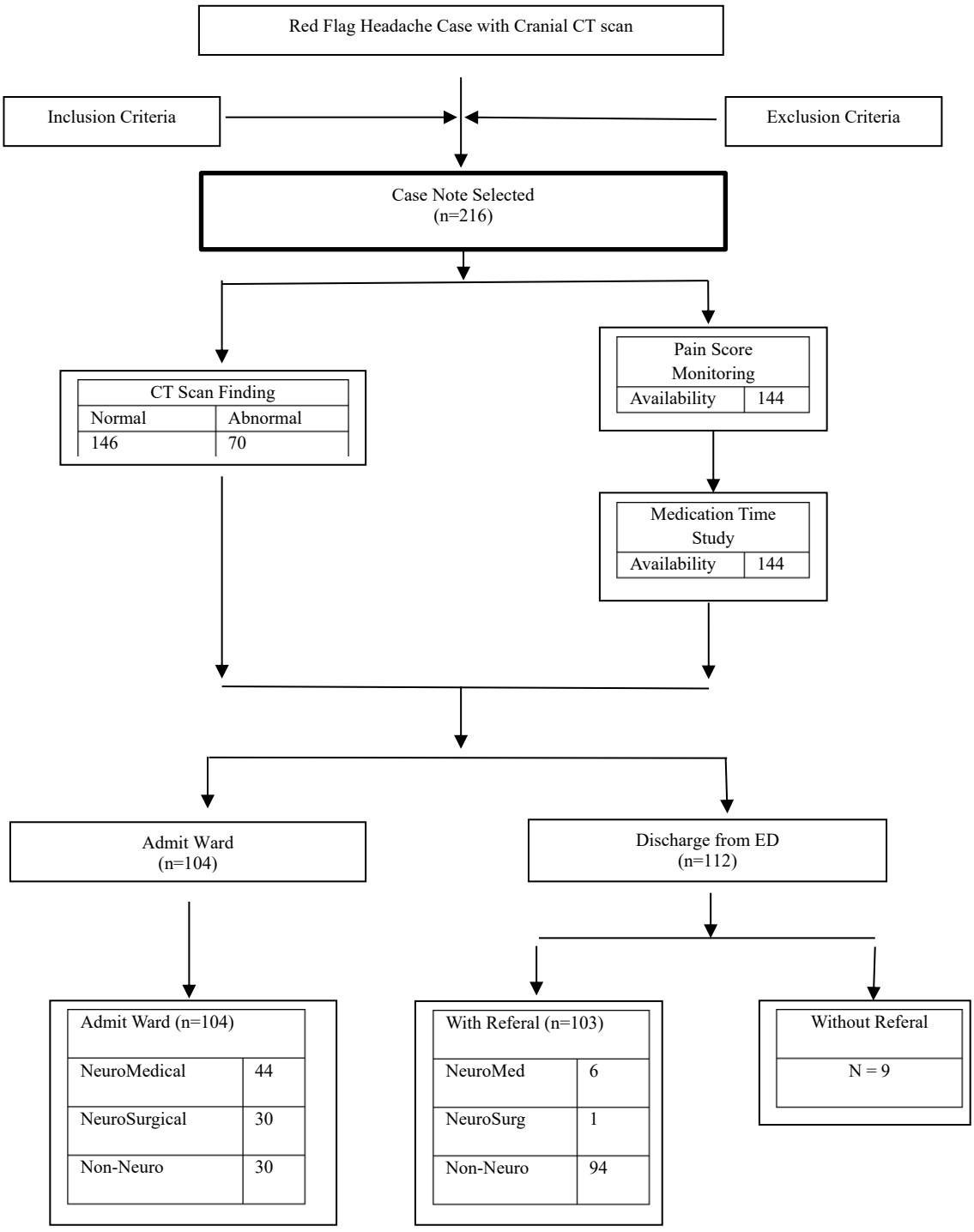

Figure 1: Flowchart of the study and distribution of patients

To categorize treatment received by patients, three categories were created: received within 20 minutes, received more than 20 minutes, and unknown due to a lack of documentation. Table 2 and Table 3 show that only 144 patients received pain management, and pain assessment was conducted. Only 64 patients (29.6%) received pain treatment within 20 minutes, whereas 80 patients (37.0%) received pain treatment 20 minutes after admission to the ED at HUSM

	Pain score value		
Pain score	Low	Highest	Mean (SD)
Pre- Med	2	10	5.21 (±0.21)
Post-Med	0	3	0.19 (±0.05)

*p <0.05

Table 2: Mean pain score (NRS) before and after medication (n=144).

	Pre-Pain Score		
	B (95% C c)	T	P value
Post Pain Score	0.680 (1.894 – 0.060)	1.894	0.060

[a] Univariable Logistic Regression, r = 21.259
[c] Confidence Interval
n = 144

Table 3: ANOVA table for the pain score comparing the two means before and after surgery. (n =144)

	Frequency of medication given in ED [c]							
	1st		2nd		3rd		Total Group	
Name of Drugs used.	*f*	(%)	*f*	(%)	*f*	(%)	*f*	(%)
NSAIDs								
• Diclofenac	56	(11.1)	18	(3.6)	-	-	74	(14.6)
• Ketolorac	7	(1.4)	3	(0.6)	-	-	10	(2.0)
• Parecoxib	32	(6.3)	1	(0.2)	-	-	33	(6.5)
Narcotics								
• Morphine	-	-	6	(1.2)	2	(0.4)	8	(1.6)
• Fentanyl	47	(9.3)	4	(0.8)	4	(0.8)	55	(10.9)
• Tramadol	92	(18.2)	37	(7.3)	-	-	129	(25.5)
Anxiolytic/ Sedations								
• Midazolam	15	(3.0)	4	(0.8)	2	(0.4)	21	(4.2)
• Diazepam	-	-	2	(0.4)	-	-	2	(0.4)
• Haloperidol	-	-	4	(0.8)	-	-	4	(0.8)
Antiemetic/Anti-dizziness								
• Prochloperazine	43	(8.5)	6	(1.2)	-	-	49	(9.7)
• Promethazine	4	(0.8)	1	(0.2)	-	-	5	(1.0)
• Metochlopromide	74	(14.6)	42	(8.3)	-	-	116	(22.9)

Total Batch	371	(73.3)	127	(25.1)	8	(1.6)	506	(100)

[C] = the medication in adult dose. Kappa Value = 0.296, p = 0.188. All the initial medication that was served at ED was staged in 1st, 2nd and 3rd stage for the pain control to achieve lesser NRS score.

Table 4: Choice of initial medication usage in the ED HUSM for managing red flag symptoms in nontraumatic headache patients

The pain score was monitored via the NRS, which was implemented as the 5th vital sign by the Malaysia Ministry of Health (KKM) in 2008.[7] The numerical pain score was given on a scale of 0--10, as a lower score indicates less pain and gradually increases accordingly. The NRS score of headache patients was classified on the basis of mild, moderate, or severe pain. Mild pain is present when the NRS score is between 1 and 3, moderate pain is present when the NRS score is between 4 and 6, and severe pain is present when the NRS score is between 7 and 10. The mean NRS score of patients before treatment was 5.21 (±0.21), with the highest NRS score of 10 and the lowest NRS score of 2. The NRS score was significantly lower after treatment, with the lowest NRS score being 0 and the highest being 3.

Table 4 shows many types of treatment modalities, such as analgesics, antiemetics, and some sedative agents. Drug usage was categorized by its mechanism of action and put on a frequency table according to the sequences given in the ED HUSM for managing nontraumatic headache patients with red flag symptoms.

The multimodality usage of the different types of medication was classified according to the sequence of timeline medication and noted as the 1st line for the first initial medication used in the ED for the management of 'red flag' headache, followed by the 2nd line and 3rd line if the patient needed another medication. The 2nd and 3rd lines were added as initial medications given at the ED HUSM for the management of a headache. The frequency table usage of medication noted the highest usage of medications such as tramadol (18.2%) as a favourable first-line medication for managing headache patients in the ED, HUSM, followed by metoclopramide (14.6%) and diclofenac (11.07%). The most common 2nd-line drug was metoclopramide (8.3%), followed by tramadol (7.31%) and diclofenac (3.56%). The most common 3rd-line drug was fentanyl (0.79%), followed by midazolam (0.39%) and morphine (0.39%). Haloperidol was administered in 4 patients (0.79%) as a 2nd-line drug for managing headache patients. There is evidence of overlapping usage of drugs with multimodal medication approaches, as a total of 506 drugs were used to manage 144 patients

	Time Frame Medication Given					
	≤20 minutes		>20 minutes		Total Fraction	
	f	%	*f*	%	*f*	%
Pain Score						
Mild	1	(0.7)	52	(36.0)	53	(36.7)
Moderate	28	(19.0)	18	(13.0)	46	(21.0)
Severe	35	(24.3)	10	(7.0)	45	(31.3)
Total	64	(44.0)	80	(56.0)	144	(100)

Kappa Value = 0.44, r = 0.382, p = 0.018**

Table 5: Cross-tabulation table pain score vs time frame medication given.

Table 5 shows a positive correlation with a significant correlation between pain score and medication given, as the greater the pain score was, the faster the patients received medication (less than 20 minutes in time). The table also shows the categorization of the 11-point NRS pain score into mild (1--4), moderate (5--7), and severe (8--10).

Variables	**CT scan**	**n**	**Mean**	**Std. Dev.**	***t***	**p value**

Pre-Pain Score						
Mild	Normal	31	1.8	2.0	2.33	0.076
	Abnormal	22				
Moderate	Normal	27	3.4	2.3	-3.47	0.068
	Abnormal	19				
Severe	Normal	16	6.2	1.8	1.34	0.043
	Abnormal	29				
Total		**144**				

*p<0.05 at fisher exact.

**Pearson Chi-Square = 13.563. 30% have expected count less than 5. Minimum is 0.98

Table 6: Association of the initial pain score with red flag headache patients who underwent emergency cranial CT from the EDHUSM by t test. (n=144)

Table 6 shows a cross-tabulation table with a univariate test of initial pain scores incomparable to abnormal cranial CT findings. T test analysis revealed a positive correlation between severe pain score and NRS score above 8, with a p value of 0.043. There was a positive linear correlation between increased pain scores and positive findings on abnormal cranial CT scans among nontraumatic headache patients with red flag symptoms.

DISCUSSION

There were 72 case notes with poor documentation about pain score assessment, making only 144 patients available for data analysis. A study by Todd et al. revealed that 83% of patients had pain assessments, whereas our study revealed that only 67.6% had proper documentation of pain assessment.[12] The percentage of patients with mild pain (NRS score of 1--3) was the highest, followed by moderate and severe pain, with percentages of 25.5%, 21.3%, and 20.8%, respectively. Most patients experienced no pain after treatment (before discharge from the ED, HUSM), accounting for 59.7% of the patients. Only 7.9% of the patients still experienced mild pain posttreatment. Only 64 out of 144 nontraumatic headache patients with red flag symptoms received pain treatment within 20 minutes of admission to the ED.

Based on the cross-tabulation presented in Table 4, ED doctors tend to utilize multiple pharmacological agents in the management of headache. Tramadol emerged as the most frequently selected first-line medication. As a weak opioid agonist, tramadol is considered both safe and effective within the Malaysian clinical context, making it a preferred analgesic among ED residents.[13,14] A comparable prescribing pattern has been observed in Singaporean EDs, where approximately one-third of patients receive intravenous tramadol, either as monotherapy or in combination with other agents.[3]

Other frequently administered agents included metoclopramide, diclofenac, fentanyl, prochlorperazine, and parecoxib. Parecoxib has been shown to be an analgesic alternative to morphine in acute pain.[15] This prescribing pattern contrasts with data from Italian EDs, where NSAIDs dominate the management of acute primary headache, with nearly 75% of patients receiving an NSAID as first-line therapy.[16] In the United States, practice trends have shifted toward greater opioid use for headache-related ED visits, with opioid administration increasing from 20.6% in 2001 to 35.0% in 2010, alongside a modest increase in NSAID use from 26.2% to 31.4%.[17] Despite these trends, opioids are strongly discouraged owing to their association with increased return visits, medication overuse, and substantial addiction risk.[18]

A total of 33.3% or 72 patients who did not have complete documentation about pain medication administration in the ED or HUSM were included. This result is comparable to that of a study in a large multicenter ED network in the United States and Canada, which reported that nearly 40% of patients with NRS scores less than 4 did not receive any pain management treatments while in the ED.[12] In this study, the mean initial pain score was 5.21 ± 0.21, with the highest pain score of 10, whereas the lowest pain score recorded was 2. This is likely attributable to the fact that most patients presented with only mild pain. The Global Pain Report has also suggested that Malaysians are generally perceived to have greater pain tolerance,[19] which may influence both patients' reporting and clinicians' treatment decisions. In addition, the presence of abnormal neurological symptoms of greater clinical concern than the headache itself may have contributed to insufficient pain management.[20]

LIMITATION

The retrospective nature of the study limited the ability to evaluate the clinical rationale behind medication selection. Additionally, the reporting of medication-related adverse effects was not captured. These limitations underscore the need for prospective studies with standardized documentation to more accurately evaluate the appropriateness and outcomes of pain management strategies. In addition, the nature of red flag symptoms might interfere with the pain management of patients.

CONCLUSION

Multimodal analgesia is widely practiced in the management of nontraumatic headache in the ED. Tramadol emerged as the most commonly prescribed first-line agent, followed by metoclopramide, diclofenac, fentanyl, prochlorperazine, and parecoxib. Most patients experienced substantial pain relief, with a considerable proportion attaining complete pain resolution prior to disposition.

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