Original Article

Thunderclap headache management among Emergency Department visitors in tertiary care center in Makkah City: Retrospective cohort study

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ABSTRACT

الأهداف: تقييم الالتزام بهذه الإرشادات في إدارة حالات صداع الرعد المفاجئ في مستشفى مدينة الملك عبدالله الطبية التخصصية (KAMC) في مكة المكرمة. صداع الرعد المفاجئ (TCH) هو صداع شديد ومفاجئ الحدوث، وغالبًا ما يشير إلى نزيف تحت العنكبوتية (SAH). توصي النسخة الثالثة من التصنيف الدولي لاضطرابات الصداع (ICHD-3) باتباع نهج تشخيصي لصداع الرعد المفاجئ، يتضمن التصوير المقطعي (CT)، البزل القطني (LP)، الدراسات الوعائية، والتصوير بالرنين المغناطيسي (MRI).

المنهجية: شملت هذه الدراسة الحشدية الرجعية المرضى البالغين الذين يعانون من صداع الرعد المفاجئ، كما هو معرّف في إرشادات (ICHD-3)، خلال الفترة من ديسمبر 2018 إلى يونيو 2023. تم استخدام طريقة العينة المريحة غير الاحتمالية لاختيار المرضى.

النتائج: من بين 377 سجلًا أوليًا، استوفى 173 مريضًا معايير الإدراج. كان متوسط العمر 52.6 عامًا، وكان 57.2% من المرضى من الذكور. كانت أكثر الأمراض المصاحبة شيوعًا ارتفاع ضغط الدم (39.9%) والسكري (20.2%). تضمنت السمات السريرية الرئيسية الغثيان/القيء (41.0%) وفقدان الوعي (27.7%). بلغت نسبة الالتزام بإرشادات (ICHD-3) حوالي 96.5%، حيث خضع 99.3% من المرضى للتصوير المقطعي خلال ٦ ساعات. تم تشخيص معظم المرضى (91.3%) بحالات نزفية، وخاصة نزيف تحت العنكبوتية (85.5%)، مع نسبة تعافي بلغت 89.2%. ومع ذلك، توفي 8.1% من المرضى، ويرجع ذلك أساسًا إلى مضاعفات مثل النزيف المتكرر والعدوى.

الخلاصة: أدى الالتزام العالي بإرشادات (ICHD-3) في إدارة حالات صداع الرعد المفاجئ إلى نتائج إيجابية، مما يبرز فعالية التقييم المنهجي. تؤكد الدراسة على أهمية التدخل الفوري وتشير إلى أن العوامل الديموغرافية قد لا تؤثر بشكل كبير على نتائج صداع الرعد المفاجئ. ينبغي إجراء المزيد من الدراسات لاستكشاف الالتزام بالإرشادات في بيئات متنوعة.

Objectives: To evaluate adherence to the guidelines in managing thunderclap headache (TCH) at King Abdullah Medical City Specialist Hospital (KAMC) in Makkah. A thunderclap headache, a severe and sudden onset headache, often signals a subarachnoid hemorrhage (SAH). The International Classification of Headache Disorders, 3rd edition (ICHD-3), recommends a diagnostic approach for TCH, including computed tomography (CT), lumbar puncture (LP), vascular studies, and magnetic resonance imagining (MRI).

Methods: This retrospective cohort study included adult patients presenting with TCH, as defined by ICHD-3, from December 2018 to June 2023. Non-probability convenience sampling was used to select patients.

Results: Of 377 initial records, 173 patients met the inclusion criteria. The mean age was 52.6 years, with males comprising 57.2%. Hypertension (39.9%) and diabetes mellitus (20.2%) were common comorbidities. Key clinical features included nausea/vomiting (41.0%) and loss of consciousness (27.7%). Compliance with ICHD-3 guidelines was 96.5%, with 99.3% undergoing CT within 6 hours. Most patients (91.3%) were diagnosed with hemorrhagic conditions, primarily SAH (85.5%), with a recovery rate of 89.2%. However, 8.1% of patients died, primarily due to complications like rebleeding and infection.

Conclusion: High adherence to ICHD-3 guidelines in TCH management led to favorable outcomes, demonstrating the effectiveness of systematic evaluation. The study highlights the importance of timely intervention and suggests that demographic factors may not significantly influence TCH outcomes. Further research should explore guideline adherence in varied settings.

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Headaches are among the most prevalent disorders affecting the nervous system, with a global prevalence estimated at approximately 40% among adults.[1] The International Classification of Headache Disorders, 3rd edition (ICHD-3) categorizes headaches into 2 broad types: primary and secondary, with primary headaches more widespread than secondary.

Migraines, tension headaches, and cluster headaches are examples of primary headaches. Secondary headaches refer to headaches that result from an underlying disease, such as infections and vascular diseases.[2]

A thunderclap headache (TCH) can be defined as severe pain with an abrupt onset, reaching its maximum intensity in less than a minute.[2] One of the most common causes of TCH is subarachnoid hemorrhage (SAH), which must be considered and immediately investigated as an emergency. In addition, there are other, less common causes.[3]

There are 43 cases of SAH occur per 100,000 adults annually.[4] Factors like blood pressure, smoking, excessive alcohol use, a family history of aneurysms, and genetic predispositions are recognized as risks.[5-8] Additionally, studies have shown that women tend to experience subarachnoid hemorrhages (SAH) more than men.[9-10] In addition to TCH, SAH can also manifest symptoms like nausea, vomiting, stiff neck, photophobia, loss of consciousness, and focal neurological deficits.[9] The SAH is a severe condition that results in 40% mortality and 50% to 66% permanent disability.[11]

According to the ICHD-3 recommendations, computed tomography (CT) without contrast should be performed after the history and physical examination to detect SAH, especially in the first 6 hours, because it is highly sensitive.[12-13] However, if CT fails to detect the etiology, further evaluation using a lumbar puncture (LP) is indicated, followed by a non-invasive craniocervical contrast-enhanced vascular study, which includes CT angiography, magnetic resonance angiography (MRA), and digital subtraction angiography (DSA). In the event of normal findings regarding all the previous investigations, magnetic resonance imaging (MRI) is indicated for a full parenchymal assessment.[2] This approach guarantees a comprehensive and systematic evaluation of patients presenting with TCH. Physicians advance to the subsequent diagnostic step only if the preceding one yields negative results. However, clinical judgment and the patient's medical history occasionally necessitate an alternative approach. This flexibility permits personalized patient care while maintaining adherence to the guidelines outlined by the ICHD-3.

This comprehensive evaluation approach thoroughly investigates all potential causes of TCH. The ICHD-3 recommendations aid physicians in differentiating between benign etiologies of TCH and other life-threatening etiologies that require prompt attention and intervention. More comprehensive data is essential to better understand how well the ICHD-3 guidelines are followed in managing patients who present with TCH in Saudi Arabian Emergency Departments (ED).

This retrospective cohort study aims to assess the compliance and application of the ICHD-3 recommendations and evaluate demographic characteristics, clinical features, and outcomes of patients presenting to the ED with TCH at King Abdullah Medical City Specialist Hospital (KAMC) and the approach to their management. The results from this study can contribute to a deep understanding of the compliance rate with ICHD-3 guidelines and the outcomes of current clinical practices in diagnosing and managing this potentially life-threatening condition

Methods.

Study design and setting. We conducted an observational descriptive study with a retrospective cohort design to assess the management of patients presenting to the ED with TCH according to the ICHD-3 guidelines. This study involved reviewing the medical records of patients who presented to the ED with the criteria of TCH at KAMC in Makkah City, a tertiary specialist hospital. Data collection spanned from December 2018 to June 2023, during which the study included all eligible patients presenting to the ED with TCH. The sampling technique used was non-probability convenience sampling.

Search method. A literature review was conducted using PubMed and Google Scholar to identify prior studies related to TCH and adherence to ICHD-3 guidelines. Keywords included "thunderclap headache," "subarachnoid hemorrhage," and "ICHD-3 guidelines."

Participants. The study population consisted of adult patients aged 18 years or older. Eligibility criteria were based on ICHD-3 guidelines, including patients who presented with a severe headache that had a sudden onset, reached maximum intensity within the first minute, and lasted for at least 5 minutes. Patients were excluded if they could not accurately describe the characteristics of the headache, lacked information regarding the headache description, or had a history of trauma within the past seven days before presentation.

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company.

Ethical approval. We started our study activities after receiving ethical approval from the Biomedical Ethics Committee at KAMC Hospital (IRB: 23-1145). Confidentiality was highly maintained, and no identifying patient information was collected.

Variables and data sources. The primary variables of interest included the demographic characteristics of patients (age, gender, nationality), clinical characteristics of TCH (severity, onset, duration), compliance with ICHD-3 recommendations, and patient outcomes, including the final diagnosis (such as SAH) and treatment provided. Other variables included the diagnostic pathways, and the types and timing of investigations ordered. The research team sourced data from the medical records of patients who met the inclusion criteria. All variables were assessed by reviewing the documented data in the patient files and extracted from the same hospital system using standardized forms.

Study size. We determined the study size by including all patients who met the inclusion criteria within the specified period (December 2018 to June 2023). Therefore, we did not predetermine the sample size; instead, we included all eligible cases during the study period.

Statistical analysis. We used BlueSky Statistics version 10.2.1 (Chicago, IL: BlueSky Statistics LLC) for statistical analysis. We summarized demographic and clinical characteristics using descriptive statistics. We expressed continuous variables as mean±standard deviation (SD) or median (range), and presented categorical variables as frequencies and percentages. We evaluated associations between demographic characteristics, final diagnoses, and patient outcomes using Chi-square tests for categorical variables and one-way analysis of variance (ANOVA) for age comparisons. We assessed compliance with ICHD-3 guidelines by calculating the frequency and percentage of compliance. We set the significance level for all statistical tests at $p<0.05$ and used two-sided tests. Sensitivity analyses and handling of missing data were not necessary as we included all available records. We treated age as a continuous variable, comparing it across different diagnostic categories and patient outcomes. We used the one-way ANOVA test to assess age differences. We analyzed categorical variables with Chi-square tests to examine associations between variables such as gender and nationality with final diagnoses and patient outcomes.

Table 1 - Demographic factors and associated comorbidities. (n=173)

Age	min=15, max=105
Mean±SD	52.6243±14.8
Median	52
Factors	n (%)
Gender	
Female	74 (42.8)
Male	99 (57.2)
Nationality	
Saudi	99 (57.2)
Non-Saudi	74 (42.8)
Comorbidity	
Cardiac Disease	16 (9.2)
Diabetes Mellitus	35 (20.2)
Hypertension	69 (39.9)
Chronic Kidney Disease	7 (4.0)
Thyroid Disease	5 (2.9)
Previous Stroke	3 (1.7)
None	66 (38.2)

Results. We conducted this retrospective cohort study at KAMC, focusing on patients who presented to the ED with a headache complaint and were subsequently admitted to the neuroscience, neurointensive care (ICU), or neurosurgery wards. The study period spanned December 2018 to June 2023.

Table 2 - Frequency of associated clinical features. (n=173)

Presentation	n (%)
Clinical feature	
Decrease in Level of Consciousness	2 (1.2)
Dizziness	8 (4.6)
Confusion	8 (4.6)
Fatigue	5 (2.9)
Loss of Consciousness	48 (27.7)
Nausea/Vomiting	71 (41.0)
Neck Pain	9 (5.2)
Weakness	15 (8.7)
Seizure	18 (10.4)
Photophobia	21 (12.1)
Visual Impairment	8 (4.6)
Memory Loss	3 (1.7)
Sensory Disturbance	5 (2.9)
Prior History of Headache	25 (14.5)
None	33 (19.1)
Examination	
Pinpoint Pupils	11 (6.4)
Comatosed	18 (10.4)
Neck Stiffness	36 (20.8)
Fever	4 (2.3)
Hypertension	12 (6.9)
Normal	73 (42.2)

Table 3 - Final diagnoses of patients with TCH and assessment of Patients Diagnosed with SAH. SAH - Subarachnoid Hemorrhage, ICH - Intracerebral Hemorrhage, SDH - Subdural Hematoma, ACA - Anterior Cerebral Artery, MCA -Middle Cerebral Artery, CT - Computed Tomography, ED -Emergency Department. n=173

Diagnosis	n	(%)
Hemorrhagic Conditions (91.3%)		
SAH	148	(85.5)
ICH	4	(2.3)
SDH	6	(3.5)
Aneurysms (3.5%)		
Basilar Fusiform Aneurysm	1	(0.6)
Bilateral Saccular Aneurysm of ICA	1	(0.6)
Non-ruptured Left ACA Aneurysm	3	(1.7)
Non-ruptured Left MCA Aneurysm	1	(0.6)
Vascular Malformations (2.9%)		
Vascular Malformation	5	(2.9)
Other Conditions (2.3%)		
COVID-19	1	(0.6)
Cerebral Venous Thrombosis	1	(0.6)
Ischemic Stroke	1	(0.6)
Ruptured Arachnoid Cyst	1	(0.6)
Assessment of Patients Diagnosed with SAH (n=148)		
Criteria	**No**	**Yes**
Was the CT requested within 6 hours of the patient's ED arrival?	1 (0.7)	147 (99.3)
Were the CT results reported within 6 hours of the patient's ED arrival?	7 (4.7)	141 (95.3)
Was the CT able to detect SAH?	1 (0.7)	147 (99.3)
Patient's outcome	n (%)	
Death	12 (8.1)	
Recovery	132 (89.2)	
Unknown	4 (2.7)	

After obtaining approval from the hospital's ethical committee, we retrieved the records of patients admitted with headache complaints during the specified period. The team collected data in 2 phases: first, they extracted and filtered the data based on inclusion and exclusion criteria. Second, they incorporated the finalized data into the study. We utilized this data to complete the collection form used in our research.

We excluded 204 files from the initial dataset of 377 patient records based on the following criteria: we excluded 185 records because the headache characteristics did not meet the definition of TCH as per the ICHD-3 and we excluded 19 records due to admissions from the Outpatient Department (OPD) or insufficient data.

After filtration, we included 173 patient records that met the inclusion criteria

Table 1 clearly shows the ages of the 173 patients in our study. With a mean age of 52.62 years (SD= 14.8). The median age was 52 years. Of the 173 patients presenting with TCH included in the study, a higher proportion were male patients (57.2%, n=99). Additionally, **Table 1** shows the comorbidities found in the patients from our study. The most prevalent comorbidity was hypertension, present in 69 patients (39.9%). Diabetes mellitus was the second most common, affecting 35 patients (20.2%).

Table 2 details how frequently various clinical features were observed among the 173 patients who experienced TCH. The most common associated clinical feature was nausea and vomiting, reported by 71 patients (41.0%). A history of loss of consciousness followed this in 48 patients (27.7%). Additionally, 25 patients (14.5%) reported having a prior history of headache before presenting with TCH. Regarding the examination findings, the most common was neck stiffness, observed in 36 patients (20.8%). A comatose state was noted in 18 patients (10.4%).

Figure 1 summarizes the investigations ordered for patients presenting with TCH. All 173 patients underwent an initial CT brain without contrast. Among these, 6 patients (3.5%) had negative (normal) results; further investigations were conducted for these patients. Of the 167 patients (96.5%) with positive (abnormal) CT brain without contrast results, 156 had a CTA as the second investigation. Additionally, 11 patients did not have a second investigation requested.

Table 3 summarizes the final diagnoses of patients presenting with TCH alongside the assessment of patients diagnosed with SAH specifically. The majority of patients were diagnosed with hemorrhagic conditions, accounting for 91.3% of the cases. SAH was the most common diagnosis, found in 85.5% of patients.

For patients with SAH, 99.3% had a CT scan requested within 6 hours of arrival at the ED, and in 95.3% of cases, the CT results were reported within this critical time window. With 99.3% of CT scans successfully detected the hemorrhage. Patient outcomes show a high recovery rate of 89.2%. However, 8.1% of the patients unfortunately succumbed to the condition.

According to the ICHD-3 criteria in **Table 4**, secondary causes of TCH were properly ruled out in 167 patients (96.5%) suggested by the high compliance rate (96.5%). All 6 patients (3.5%) whose evaluation did not fully comply with the ICHD-3 recommendations had non-compliance at the second ordered investigation stage. They were likely assessed based on clinical suspicion of another diagnosis requiring an alternative approach.

Table 5 shows the association of demographic

Table 4 - Compliance with ICHD-3 Recommendations. ICHD-3 - International Classification of Headache Disorders, 3rd Edition; CTA - Computed Tomographic Angiography; MRI - Magnetic Resonance Imaging; LP - Lumbar Puncture. (n=173)

Compliance	n	(%)	Details of Non-Compliance	
No	6	(3.5)	Second Investigation	CTA instead of LP: 5 MRI instead of LP: 1
Yes	167	(96.5)		

characteristics with the final diagnoses of TCH and SAH outcomes. Patients with aneurysms had a mean age of 48.7 years (SD=13), while those with hemorrhagic conditions were slightly older, with a mean age of 53.4 years (SD=14.6). The ANOVA test (F=1.8700, p=0.1365) indicated no significant age differences among the diagnosis groups. The Chi-square test also showed no significant association between gender or nationality and the final diagnosis of TCH. Among females, 1.4% had aneurysms, and 91.9% had hemorrhagic conditions, compared to 5.1% and 90.9%, respectively, among males (p=0.4999).

Regarding patient outcomes in SAH cases, the mean age of those who died was 49.1 years (SD=19.0), while those who recovered had a mean age of 53.0 years (SD=13.7). The ANOVA test (F=1.7189, p=0.1829) showed no significant age differences among outcome groups. The Chi-square test found no significant associations with outcomes based on gender or nationality.

Discussion. This retrospective cohort study aimed to evaluate demographic characteristics, clinical features, and outcomes of patients presenting to the ED with TCH at KAMC between December 2018 and June 2023 and the approach to their management. The results show vital demographic distributions, associated health conditions, clinical features, diagnostic pathways, and patient outcomes.

The study consisted of 173 patients, with ages ranging from 15 to 105 years, a mean age of 52.6 years (SD±14.8), and a median age of 52 years. This distribution suggests that the study population is predominantly middle-aged to elderly, with a substantial age range. Regarding gender distribution, there was a higher proportion of males (57.2%) than females (42.8%). Most of the patients in our study were diagnosed with SAH (85.5%), which is consistent with the peak age for SAH globally.[11] However, this gender distribution contrasts with the general prevalence outside Saudi Arabia, where females have a higher prevalence than males.[9,10] This discrepancy may suggest different epidemiological patterns in Saudi Arabia. Additionally, most patients in our study were Saudi nationals (57.2%). Common comorbidities showed hypertension was the most prevalent (39.9%), followed by diabetes mellitus (20.2%), and cardiac disease (9.2%). These findings align with the general prevalence of these conditions in older populations and suggest that individuals with these comorbidities may be at a higher risk of presenting with TCH, as shown in previous literature.[14]

Nausea and vomiting were the most frequent presentations in clinical features associated with TCH, reported in 41.0% of patients, followed by loss of consciousness in 27.7% of cases. Only 14.5% of patients reported a history of headaches before their presentation. Surprisingly, TCH was the only presenting symptom in 19.1% of patients without other associated symptoms. It suggests that TCH can occur in isolation and warrants prompt investigation to rule out serious underlying conditions such as SAH, even when other clinical features are absent. In a 2015 study, researchers documented this presentation while reviewing the approach to TCH in patients with reversible cerebral vasoconstriction syndrome.[15] Examination findings revealed that neck stiffness was the most common abnormality (20.8%), consistent with the presentation of SAH. These symptoms and signs emphasize TCH's severity and varied presentation, necessitating thorough and rapid evaluation in the emergency setting.

Regarding compliance with the ICHD-3 recommendations for the evaluation of TCH, out of the 173 patients presenting to the ED with TCH, 167 (96.5%) were evaluated properly, and secondary causes of TCH were adequately ruled out or diagnosed. For the remaining 6 patients (3.5%), the physicians evaluated 5 with a CTA and 1 with an MRI following a negative non-contrast CT instead of an LP. These deviations from the ICHD-3 recommendations may be due to the specific presentations of these patients, as the physicians pursued an alternative diagnosis instead. The 2019 American College of Emergency Physicians guideline for evaluating acute headaches in the ED also recommends a CTA after a negative non-contrast CT as a reasonable alternative to an LP.[16]

Numerous previous studies have established the critical nature of diagnosing SAH within a 6-hour window. Prompt diagnostic measures, such as CT scans

within this timeframe, significantly enhance diagnostic accuracy and patient outcomes, as a negative CT finding within 6 hours of symptom onset essentially excludes SAH.[17]

The study revealed that the majority of patients (91.3%) were diagnosed with hemorrhagic conditions, with SAH being the most prevalent (85.5%), which aligns with existing literature indicating SAH as the leading cause of TCH.[18] Prompt diagnostic measures were apparent, with 99.3% of SAH patients undergoing CT scans within 6 hours of ED arrival. Impressively, 95.3% of results were reported within the same 6-hour window. This 6-hour timeframe has been consistently highlighted across various studies as a crucial period for accurate diagnosis and timely intervention in SAH cases,[17,19] reflected in our study by the notably high recovery rate of 89.2%, reinforcing the effectiveness of clinical management and intervention strategies. Nonetheless, 8.1% of patients succumbed to complications, predominantly rebleeding, hydrocephalous, and seizures, which is consistent with previously documented complications,[20,21] with rebleeding yielding a worse prognosis overall,[19] emphasizing the potential severity of SAH despite timely intervention.

Statistical analysis revealed no significant association between demographic characteristics (age, nationality, and gender) and the final diagnoses of TCH or patient outcomes. These findings suggest that TCH's clinical presentation and outcomes are likely influenced more by the underlying pathology and timely intervention rather than demographic factors. For instance, the Chi-square

Table 5 - Association of demographic characteristics with final diagnoses of TCH and SAH outcomes. TCH: Thunderclap Headache.

Association of demographic characteristics with final diagnoses of TCH (n=173)						
Age	**Final Diagnosis**					
	Aneurysms	**Hemorrhagic conditions**	**Other conditions**	**Vascular malformation**	**F value**	**Pr(>F)**
n (%)	6 (3.5)	158 (91.3)	4 (2.3)	5 (2.9)	1.8700	0.1365
Mean ± SD	48.7 ± 13	53.4 ± 14.6	40.75 ± 21.1	43.0 ± 13.75		
Median	48.0	53.0	40.5	47.0		
Min	30	15	22	22		
Max	65	105	60	58		
Gender n (%)						
Female	1 (1.35)	68 (91.9)	2 (2.7)	3 (4.05)	74 (100)	0.4999
Male	5 (5.05)	90 (90.9)	2 (2.0)	2 (2.0)	99 (100)	
Total	6 (3.5)	158 (91.3)	4 (2.3)	5 (2.9)	173 (100)	
Nationality						
Non-Saudi	3 (4.1)	70 (94.6)	0	1 (1.35)	74 (100)	0.2281
Saudi	3 (3.0)	88 (88.9)	4 (4.0)	4 (4.0)	99 (100)	
Total	6 (3.5)	158 (91.3)	4 (2.3)	5 (2.9)	173 (100)	
Association of demographic characteristics with SAH patient outcomes (n=148)						
Age	**Outcome**					
	Death	**Recovery**	**Unknown**	**F value**	**Pr(>F)**	
n (%)	12 (8.1)	132 (89.2)	4 (2.7)	1.7189	0.1829	
Mean ± SD	49.1±19.0	53.0±13.7	64.5±23.3			
Median	43.5	52.5	54.5			
Min	22	15	50			
Max	79	105	99			
Gender						
Female	4 (6.0)	61 (91.0)	2 (3.0)	67 (100)	0.6793	
Male	8 (9.9)	71 (87.65)	2 (2.5)	81 (100)		
Total	12 (8.1)	132 (89.2)	4 (2.7)	148 (100)		
Nationality						
Non-Saudi	5 (7.6)	58 (87.9)	3 (4.55)	66 (100)	0.4581	
Saudi	7 (8.5)	74 (90.2)	1 (1.2)	82 (100)		
Total	12 (8.1)	132 (89.2)	4 (2.7)	148 (100)		

test for nationality and gender yielded *p*-values of 0.2 and 0.5, respectively, for final diagnoses and 0.45 and 0.7 for patient outcomes, indicating no statistically significant associations. Additionally, the association of outcomes showed no statistical significance among genders in our study, aligning with a previous 2022 study that investigated gender differences in SAH outcomes and reported no significant association between genders.[21]

The study's findings spotlight the importance of adherence to established diagnostic guidelines to ensure accurate and timely diagnosis of TCH, which is critical for favorable patient outcomes. However, limitations such as the study's retrospective nature, potential selection bias, relatively small sample size (particularly in specific subgroups), and possible limitations in data collection methods may affect the generalizability of the results. This study occurred in a tertiary specialist care center, which may also affect the results. The involvement of secondary care centers, preferably multiple, could have provided more accurate and detailed results. We encourage other researchers to consider this in future research. Future prospective studies with larger sample sizes are warranted to validate these findings and further explore the factors influencing TCH outcomes.

In conclusion, this study underscores the importance of systematic evaluation and adherence to diagnostic guidelines in managing TCH. The high compliance with ICHD-3 guidelines and the positive outcomes in most patients underscore the effectiveness of current clinical practices in diagnosing and managing this potentially life-threatening condition on time. Future studies should explore adherence in different medical centers, compare the outcomes of applying different guidelines and approaches to TCH, and investigate the impact of various sociodemographic characteristics in other regions of Saudi Arabia that have yet to be extensively studied.

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