

# Headache attributed to transient ischaemic attack: a prospective retrospective baseline study

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## Research Article

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## Abstract

**Background:** It is difficult to discriminate between headache attributed to transient ischaemic attack from migraine with aura. We studied the characteristics of headache-attributed transient ischaemic attacks to provide clinical evidence for the treatment of headache attributed to transient ischaemic attack.

**Methods:** We performed a prospective study with a retrospective baseline evaluation of all patients with headaches attributed to transient ischaemic attack (22) during a three-year period. The demography, vascular risk factors and clinical information were collected. The following typical symptoms were evaluated by an ABCD2 score of 4 or greater. The headache characteristics were collected within a 24-hour interval after the onset of transient ischaemic attack.

**Results:** Headache that is attributed to transient ischaemic attack accounted for 8.2% (22/269) of the patients with transient ischaemic attack. Headache attributed to transient ischemic attack was more common in women (68.2%, 15/22) and in posterior circulation of transient ischemic attack (59.1%, 13/22). These types of headaches were similar to tension-type headache and included a bilateral location (72.7%, 16/22), a dull quality (72.7%, 16/22), and a moderate intensity (54.5%, 12/22).

### Conclusions:

Our study showed that headache attributed to transient ischaemic attack was similar to a tension-type headache and was more common in women and in patients with posterior circulation transient ischaemic attacks.

## Introduction

Transient ischaemic attack (TIA) is a common cerebrovascular disease, and some patients with TIA have an associated headache[1–6]. Although many studies have detailed the clinical symptoms of TIA[7–9], these studies have seldom described the clinical characteristics of headache attributed to TIA. In the International Classification of Headache Disorders 3rd edition[10], the diagnosis of headache attributed to TIA is any new headache that occurs simultaneously with a TIA and disappears within 24 hours[10].

However, there is still no uniform description of the characteristics of headache attributed to TIA. The mechanism of headache attributed to TIA is also unclear. We conducted a detailed study on the characteristics and related factors of headache attributed to TIA.

## Materials And Methods

### Study design

We collected a total of 269 TIA patients in the stroke unit of the First Affiliated Hospital of Chongqing Medical University from July 2017 to July 2020. We found 50 patients with headache. According to the

diagnosis of headache attributed to TIA in the International Classification of Headache Disorders 3rd edition[10] and the exclusion criteria, 22 patients who had been diagnosed with headache attributed to TIA were recruited.

## Study population

Eligible patients had both headache and focal brain ischaemia, and they had a resolution of their symptoms but did not have evidence on magnetic resonance imaging (MRI) with diffusion weighted imaging (DWI) of any responsible lesions that caused their neurological deficits. The exclusion criteria were as follows: (i) patients who were younger than 18 years of age, (ii) patients with severe depression or other diseases and who could not cooperate with the protocols of the experiment, (iii) patients with a previous history of primary headaches before enrolment, (iv) patients who had responsible lesions on MRI with DWI that caused their neurological deficits, and (v) patients with incomplete medical records. The headache type was emerging or was different from previously, had occurred simultaneously with TIA, and was relieved within 24 hours. One neurologist collected the information during face-to-face interviews. The sociodemographic characteristics, risk factors, clinical symptoms, medical history and personal history of the patients with TIA and headache were recorded. The headache features that were studied included the location, quality, intensity, duration and accompanying symptoms.

## Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 20.0 (Chicago, IL, USA). The clinical characteristics were analysed by using descriptive statistics. The mean  $\pm$  standard deviation (SD) was used to express the quantitative variables. Categorical variables were summarized as numbers and percentages. Student's t test and the chi-squared test were used to test the comparisons of the categorical variables between the groups. All statistical tests were two-sided, and  $p<0.05$  was defined as statistically significant.

## Results

During the study period, 269 patients with TIAs were included; 22 patients had been diagnosed with headache attributed to TIA. All patients with headache attributed to TIA agreed to participate in and complete the study. We confirmed that headache attributed to TIA was more prevalent in patients with posterior circulation TIAs (59.1%, 13/22). Table 1 shows the demographic data of the patients with headache attributed to TIA. The mean ages of the patients were 65.1 years in the females and 68.6 years in the males. There was a higher proportion of females in our study (68.2%, 15/22). Hypertension was the most common risk factor (71.4%, 13/22).

**Table 1**  
**Demographic information of headache attributed to TIA.**

<b>Characteristics</b>	<b>Males</b>	<b>Females</b>	<b>All</b>
	<b>(N = 7)</b>	<b>(N = 15)</b>	<b>(N = 22)</b>
Mean age(years)	68.6	65.1	66.2
Age interval	39–84	48–77	39–84
Hypertension	5(71.4%)	8(53.3%)	13(59.1%)
Diabetes	2(28.6%)	3(20.0%)	5(22.7%)
Hyperlipidemia	4(57.1%)	1(6.7%)	5(22.7%)
Current smokers	2(28.6%)	0(0%)	2(9.1%)
Alcohol	2(28.6%)	0(0%)	2(9.1%)
<b>Headache characters and symptoms of TIA in headache attributed to TIA.</b>			

All of the patients simultaneously developed headache and TIA, and their headache resolved within 24 hours (Table 2). In 72.7% (16/22) of the patients, the headache was bilateral. In 72.7% (16/22) of the patients, the headache was a dull quality. More than half (54.5%) of the patients suffered from a headache of moderate intensity. Migrainous accompanying symptoms were infrequent in the patients with headache attributed to TIA, and the most common accompanying symptom was dizziness (45.4%, 10/22). Three patients (13.6%, 3/22) had a personal history of headache. However, those headaches were not primary headaches or medication-overuse headaches. Three patients took medications when they experienced a headache (two patients took antihypertensive drugs and one patient took acetaminophen). In the patient who took acetaminophen, the headache was relieved within 2 hours. In the patient who took antihypertensive drugs, the headache was not relieved.

Table 2  
Headache features of headache attributed to TIA.

<b>Headache features</b>	<b>Males</b> <b>(N = 7)</b>	<b>Females</b> <b>(N = 15)</b>
Location		
Unilateral	3(42.9%)	3(20.0%)
Bilateral	4(57.1%)	12(80.0%)
Quality		
Dull	5(71.4%)	11(73.3%)
Pulsating	1(14.3%)	2(13.3%)
Pressing	0(0.0%)	1(6.7%)
Tightening	1(14.3%)	0(0.0%)
Burst	0(0.0%)	1(6.7%)
Intensity		
Mild	1(14.3%)	5(33.3%)
Moderate	4(57.1%)	8(53.3%)
Severe	2(28.6%)	2(13.3%)
Duration		
0-5min	3(42.9%)	5(33.3%)
5min-1h	0(0.0%)	7(46.7%)
1h-12h	2(28.6%)	0(0.0%)
12h-24h	2(28.6%)	2(13.3%)
Accompanying symptoms		
Photophobia/phonophobia	0(0.0%)	1(6.7%)
Vomiting	0(0.0%)	4(26.7%)
Nausea	2(25.5%)	5(33.3%)
Dizzy	1(14.3%)	9(60.0%)
Family history of headache	0(0.0%)	3(20.0%)
Personal history of headache	1(12.5%)	2(13.3%)

The duration of TIA varied from a few seconds to 24 hours (Table 3). Thirteen patients (59.1%) had a TIA duration from a few seconds to 10 minutes, four patients (18.2%) had a TIA duration from 10 minutes to 1 hour, and five patients (22.7%) had a TIA duration from 1 hour to 24 hours, as shown in Table 3. Eleven patients had ever suffered a TIA. An ABCD2 score of 4 or greater was mostly seen in patients who had a duration of TIA that was less than 10 min (54.5%, 6/11).

**Table 3**  
Symptoms of TIA in headache attributed to TIA patients.

Symptoms of TIA	Duration of TIA symptoms		
	0-10min	10min-1h	1h-24h
Disturbances of sensation(n = 3)	2(66.7%)	0(0.0%)	1(33.3%)
Motor disturbances(n = 9)	5(55.6%)	1(11.1%)	3(33.3%)
Speech disturbance(n = 6)	3(50.0%)	1(16.7%)	2(33.3%)
Visual disturbances(n = 3)	2(66.7%)	0(0.0%)	1(33.3%)
Coordination disturbances(n = 11)	6(54.5%)	3(27.3%)	2(18.2%)
Previous TIA history(n = 11)	6(54.5%)	1(9.1%)	4(36.4%)
ABCD2≥4(n = 11)	6(54.5%)	1(9.1%)	4(36.4%)

After 3 months, 8 patients had a recurrent TIA (36.4%, 8/22); among them, five patients had been diagnosed with headache attributed to TIA. One patient had a headache without TIA.

After collecting the imaging data (MRI and computed tomography (CT)), we found that every patient had at least one brain MRI with DWI. None of the patients had imaging data that showed responsible lesions causing the patient's neurological deficits. Twenty patients received vascular-related examinations (Computed tomography angiography, Transcranial Doppler ultrasonography, Digital Subtraction Angiography, carotid ultrasonography). Two patients refused to have vascular-related examinations. None of the vascular-related examinations in the patients indicated significant cerebral artery stenosis and occlusion.

## Discussion

At present, there is no uniform conclusion about the characteristics of headache attributed to TIA. The ICHD-3 does not describe it in detail. Few studies have reported the characteristics of headache attributed to TIA, and most studies have analysed headache attributed to TIA together with other neurovascular diseases [1, 3, 4, 11, 6, 12]. In this study, we attempted to provide the clinical features of headache attributed to TIA. Our study found that the incidence of headache attributed to TIA was 8.2% (22/269),

while in previous studies, the incidence ranged from 16–44% [1–6]. The reason for our low prevalence is that we emphasized the simultaneous occurrence of headache and TIA when we enrolled patients, and we only enrolled patients who had headaches that were relieved within 24 hours. Our patients were screened strictly according to the diagnostic criteria of ICHD-3 for headache attributed to TIA. In previous studies, TIA patients with related headache were screened.

Headache attributed to TIA was more common in posterior circulation TIAs (59.1%), which was in accordance with previous studies. The reason for our low prevalence is that we emphasized the simultaneous occurrence of headache and TIA when we enrolled patients, and we only enrolled patients who had headaches that were relieved within 24 hours. Our patients were screened strictly according to the diagnostic criteria of ICHD-3 for headache attributed to TIA. In previous studies, TIA patients with related headache were screened.

It was shown that headache attributed to TIA was more common in women in our study. Some studies [13, 14] have shown that the TIA incidence is higher in men than in women [15], and men have more vascular risk factors than women, such as hypertension and smoking [16, 17]. In a study sample of 5991 TIA patients, headaches were more common in women than men [18]. In our study, we found that there was a higher prevalence of women with a TIA headache. The prevalence of migraine is significantly higher in women than in men[19]. The review by kjersti G vettvik previously showed the complex association between oestrogens and migraine [20]. We hypothesize that the high incidence of migraine in women may result in a higher prevalence in women with headache attributed to TIA. However, the specific mechanism is still unknown, and further research is needed.

Headache attributed to TIA was more common in posterior circulation of TIA (59.1%) which was in accordance with previous studies [1, 2, 4, 21]. It is well known that posterior circulation strokes are rarer than anterior circulation strokes within all of the stroke and TIA types, and we found that posterior circulation ischaemic events accounted for approximately 20–25% of all strokes and TIAs after reviewing the relevant materials [22, 23]. The pathophysiological mechanism is still controversial. Edmeads et al. considered that the pathophysiology may involve the release of vasoactive substances, such as serotonin and prostaglandins, from activated platelets [24]. The pathogenesis of posterior circulation of TIA is unclear and rarely studied.

We found that headache attributed to TIA accounted for 8.2% of all TIA patients. In most of the patients, the headache was bilateral (16/22) and dull (16/22), and the severity of the head was mainly moderate (12/22) in most of the patients, similar to TTH. Consistent with previous studies, we found that headache attributed to TIA was usually bilateral, dull and of moderate intensity [1, 2, 5]. Typical TTH is a mild to moderate, compression or tightness headache that is bilateral and that is not aggravated by daily physical activity [25]. Our study was different from the Russian study. In the Russian study, 16 patients (13.3%) of 120 patients suffered a new type of headache [21]. Among the 16 patients, 12 patients had migraine-like headaches, 3 patients had tension-type-like headaches, and one patient had thunderclap headaches [21]. They found that headache attributed to TIA was similar to migraine-like headache [21].

TTH and migraines have very different frequencies, severities and durations. The different results of the two studies may have been caused by the following reasons. The authors collected data from TIA patients with headaches, while we registered patients with headache attributed to TIA by strictly following the ICHD-3 [10]. Patients with a history of prior primary headache and who had medication-overuse headaches were excluded. Therefore, there is limited research on headache attributed to TIA, so more research is needed to illustrate the differences between our study and the research from Russia.

The symptoms of migraine with aura (MA) are similar to the symptoms of TIA, so we need to identify the differences between them. The mode of onset is crucial: the focal deficit is typically sudden in TIA and more frequently progressive in migrainous aura

[10]. Furthermore, positive phenomena (e.g., scintillating scotoma) are far more common in migrainous aura than in TIA, whereas negative phenomena are more common in TIA [10]. Although there are some ways to distinguish between the premonitory symptoms of MA and the transient functional loss of TIA, the characteristics of headache associated with TIA have not been fully studied. We hope this study will provide some clinical evidence for the diagnosis of headache attributed to TIA.

There are also some limitations in this study. First, the small sample size we collected is mainly due to the low incidence of TIA headache. Second, it was not a completely prospective study, and we spent much time screening the patients evaluated in this study. Finally, our study only recruited patients from a single centre.

## Conclusions

Our study mainly focused on headache attributed to TIA, and we are committed to improving the clinical diagnosis and treatment of headache attributed to TIA. We found that headache attributed to TIA was more common in women and in posterior circulation TIAs. Therefore, when we treat female patients with a posterior circulation TIA, we should not only pay attention to the symptoms and the nervous system deficits but also to the headache symptoms.

## Abbreviations

CT Computed tomography

DWI Diffusion weighted imaging

MRI Magnetic resonance imaging

TIA Transient ischaemic attack

MA Migraine with aura

ICHD-3 International Classification of Headache Disorders

## Declarations

### Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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## Ethical considerations

The study was approved by the ethics board at the First Affiliated Hospital of Chongqing Medical University(20170306). All patients of headache attributed to TIA were informed and agreed to sign written informed consent before collecting information.

## Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Authors' contributions

GT conceived and oversaw the study. JLZ, QL and QL collected the data and made statistical analysis. QLL, XRY performed data analysis. JLZ and QL wrote manuscript.

All authors read and approved the manuscript.

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