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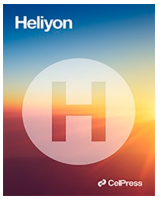

Research article

Investigating the traditional medicine shoulder pain (Jian Tong) characteristics in patients with ischaemic stroke in the early rehabilitation phase

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ABSTRACT

Introduction: Ischaemic stroke often leaves serious sequelae affecting patients' daily activities and quality of life, especially shoulder pain. Shoulder pain after stroke often occurs in the first 3 months with an occurrence rate of 25–72% due to the strong natural neurological mechanism during the time, interferes with the recovery of motor function, increases hospital stay, is associated with depression, and limits mobility as well as inhibits treatment results. In Vietnam, Traditional Medicine (TM) has played an essential role in treating and rehabilitating shoulder pain after stroke for quite a long time. Studies on the pathology of shoulder pain (Jian Tong) after stroke in TM in Vietnam are still inadequate. Therefore, this study evaluated the severity and characteristics of post-stroke Jian Tong in patients with ischaemic stroke.

Methods: The study was conducted from January 1, 2023–May 1, 2023. The study consisted of two phases: Phase 1: Searching TM documents and selecting the characteristics that appear in the documents as components for the questionnaire of phase 2. Phase 2: Conduct a cross-sectional study to investigate the characteristics of Jian Tong in 65 patients after ischaemic stroke in the early rehabilitation phase.

Results: In phase 1, the study encoded 17 features of Jian Tong from 10 literary documents. In phase 2, we surveyed over 65 patients, and the result was that shoulder pain aggravated by exertion had the highest rate, whereas shoulder pain alleviated by cold and distended shoulder had the fewest. Pain level measured by Number Rating Scale (NRS) points and gender was significantly related to the characteristics of TM shoulder pain – Jian Tong ($p < 0.05$).

Conclusion: The study demonstrated the pain level and the characteristics of Jian Tong in patients with ischaemic stroke in the early rehabilitation phase to contribute to the process of personalized diagnosing and treating Jian Tong after stroke for each patient, especially based on the theoretical basis and reasoning methods of Traditional Medicine.

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1. Introduction

Stroke was the second leading cause of death in the world in 2019, with 162,890 cases [1]. Every year in Vietnam, an average of 200,000 people encounter a stroke [2]. An ischaemic stroke occurs when there is an obstruction to the brain's blood flow, which results in damage to parts of the brain and impaired mental functions. Ischaemic stroke accounts for 87% of clinical stroke cases, according to the American Heart Association [3,4]. Stroke leaves severe sequelae for patients after the acute phase, affecting daily activities and quality of life [5]. A study by Sophie B. et al. in 2019 showed that pain was one of the most common complaints among patients after stroke, especially shoulder pain [5]. Shoulder pain after stroke often occurs in the first 2–3 months with an occurrence rate of 25–72%, interferes the recovery of motor function, increases hospital stay, is associated with depression, and limits mobility as well as inhibits treatment results [6,7]. Therefore, a sheer understanding of the symptoms of shoulder pain that appear after a stroke can contribute to supporting treatment, avoiding prolonging the patients' recovery time, and reducing the onerous burden on society.

Based on TM, shoulder pain was classified into "bi zheng" illness type by "Yellow Emperor's Classic of Internal Medicine" long ago. Then it was known by many terms, namely "jian bei bi tong", "jian bi tong", "jian bi" according to "The Systematic Classic of Acupuncture and Moxibustion". However, "Jian Tong" was used most commonly [8]. With the recent thriving medical background, besides Modern Medicine, TM also plays an important role in the treatment and rehabilitation of patients with shoulder pain after stroke [9–11]. A study by Yang C. (2018) revealed that acupuncture treatment on the Tiaokou acupoint (ST38) brought clinical effectiveness, improved Constant-Murley scale scores, and reduced VAS scores [10]. In 2021, Zhang L. conducted a clinical trial study using Traditional Medicine decoction, proving that Wenjing Tongluo Decoction combined with paroxetine had a significant clinical effect in treating post-stroke shoulder pain. It reduced the shoulder pain level and improved the patients' motor function of the affected upper limb and their self-care ability and health status [11]. Research by Ren M (2022) gathered results showing that distinctive treatments of Traditional Medicine, such as acupuncture and massage, combined with rehabilitation methods, clearly reduced shoulder pain and improved motor function in patients with hemiplegic shoulder pain [9]. To properly handle and select the appropriate traditional medicine methods to treat shoulder pain after stroke, doctors and physicians need to correctly identify the disease characteristics and syndromes connected with the perspective and analysis of Traditional Medicine [12]. Without a doubt, it is very important to wholly comprehend the characteristics of Jian Tong in patients with shoulder pain after stroke. In China, the study by Wang Y. et al. (2021) investigating the types of TM of shoulder and neck pain recorded 4 syndromes: Qi and Blood Deficiency, Damp-Heat, Wind-Cold-Dampness, Blood Stasis [13]. However, currently the number of studies on the pathology of shoulder pain after

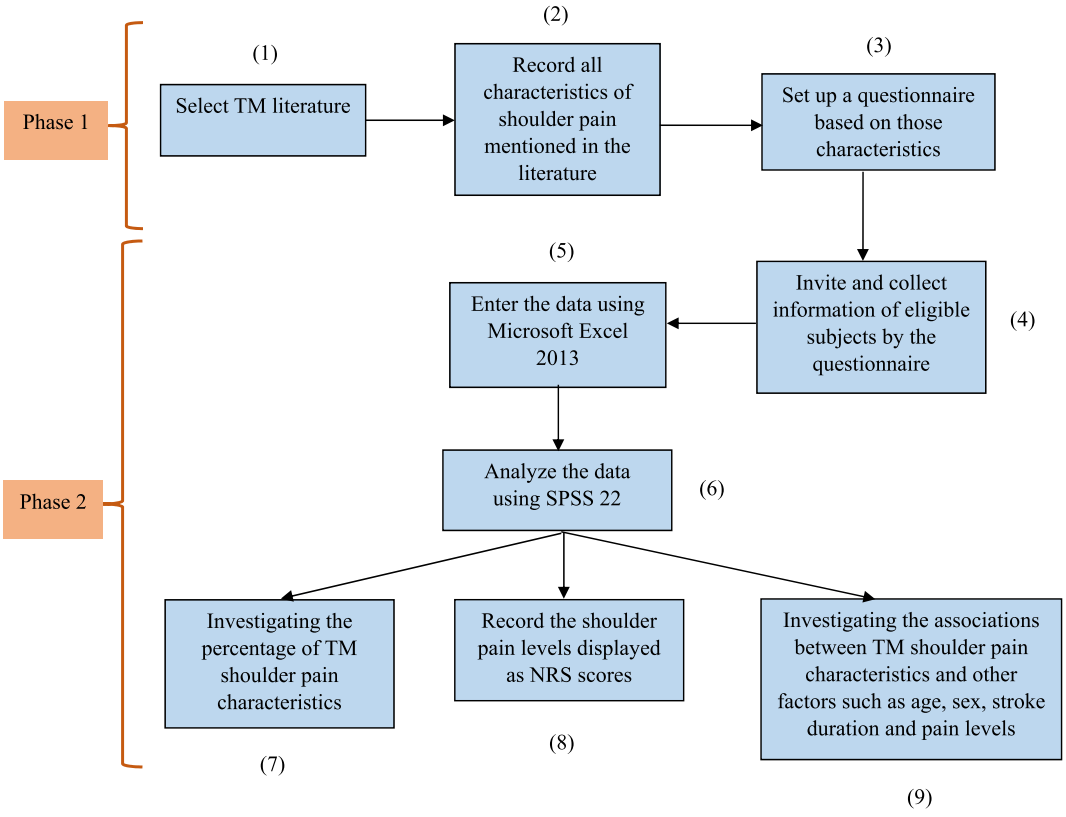

Fig. 1. Two phases of study.
Step (1)–(3): Phase 1 of the study, Step (5)–(9): Phase 2 and data analysis phase of the study.

stroke in Vietnam, from a Traditional Medicine perspective, is unfortunately still very limited; This is the reason we went about this study topic with the aim to assimilate the characteristics of TM shoulder pain in order to create a premise for the care and treatment career of shoulder pain after stroke with TM methods and contribute to future studies with similar patterns.

The study decided to select a group of patients with ischemic stroke in the early rehabilitation phase (24 h–3 months), which is the most apparent recovery period for patients after stroke as it comes with the strongest natural neurological mechanism in the first 3 months [14,15]; After this time, the "ceiling effect" is liable to occur, making it more challenging to evaluate the improvement of patients [15]. Furthermore, this is also the time when shoulder pain often arises due to muscle weakness, joint imbalance, excess exercise, inappropriate care support, increased muscle tone, and spasticity [16].

2. Materials and methods

2.1. Study setting and participants

2.1.1. Comprised 2 phases

Phase 1: Used the descriptive study design with the subjects being TM literature meeting the conditions: textbooks from the traditional medicine department of domestic and foreign medical universities or fundamentally classic TM books or TM monographs by authors who are galenic physicians or Associate Professor Doctor of Philosophy with more than 20 years of experience in traditional medicine treatment [17,18], in which the corresponding textbook and monograph appraisal councils in Vietnam have approved the textbooks and monographs. After listing the collected characteristics, they would be described by rate and encoded into variables to form the questionnaire for the second stage [18] (Fig. 1).

Phase 2: Conducted a cross-sectional study on 65 patients with ischaemic stroke in the early rehabilitation phase who were treated inpatient and outpatient from January 2023–April 2023 at 2 hospitals: Ho Chi Minh City Hospital of Traditional Medicine, Ho Chi Minh City Hospital For Rehabilitation - Professional Diseases (Fig. 1).

Inclusion criteria: Patients meeting all of the following criteria: Aged 18 years or older; diagnosed with ischaemic stroke (based on the diagnostic criteria of the Ministry of Health of Vietnam or according to medical records/front-line discharge papers); recently developed symptoms of shoulder pain and have not been treated with any shoulder pain relief method according to the medical record; are aware and cooperate with doctors; with the phase of rehabilitation varies from 24 h to 3 months after stroke; voluntarily agree to participate in the study.

Exclusion criteria: Patients with cognitive disorders, mental disorders, or dementia who cannot communicate fluently with doctors (by MMSE scores); Patients unable to complete the questionnaire [19].

Withdrawal criteria: Patients who do not want to continue participating in the study; patients with worsened conditions and are not healthy enough to continue the study.

2.2. Sample size

Using the formula: $n = Z^2_{\left(1-\frac{\alpha}{2}\right)} \cdot \frac{p(1-p)}{d^2}$.

With α: Type I Error, $\alpha = 0{,}05$.

Z: Standard normal distribution value, $Z_{0{,}975} = 1{,}96$ with the reliability of 95%.

p: The prevalence of ischaemic stroke, $p = 0{,}0443$ [20].

d: Tolerable error, $d = 0{,}05$.

The study calculated the minimum sample size $n \geq 65$. During the proceeding period, the study surveyed 65 patients in total.

2.3. Data collection

Phase 1: Literary documents would be selected from sources such as the faculty library, the school library, and the electronic documents databases. In our study, the document storage sources were three large libraries in Vietnam:

- Library of University of Medicine and Pharmacy at Ho Chi Minh City
- General Sciences Library of Ho Chi Minh City
- National Library of Vietnam

Then, we would look over each document that meets the criteria to find the Jian Tong topic unit or synonyms such as "jian bei bi tong", "jian bi tong", "jian bi", select all the characteristics of Jian Tong mentioned, eliminating duplicates then listed the frequency and incidence rate of the characteristics in each document and encoded into variables for saving the data more conveniently and forming the questionnaire used in phase 2. Questions used in the questionnaire to detect the characteristics of Jian Tong were evaluated for reliability and validity by a panel of experts. Experts were "professionals who have research works or work in related fields", with the criteria for determining experts being having research works, published scientific articles, working time, or long experience in the field [21]. Our study included 5 experts (meeting the minimum number of 3 experts and the maximum number of 10 experts) [21,22]. These experts had graduated from a university majoring in Traditional Medicine with a Master's degree or higher and had more than 5 years of experience in practicing medical examination and treatment or researching Traditional Medicine.

Phase 2: List inpatients and outpatients with ischaemic stroke in the early rehabilitation phase. Patients who meet the inclusion criteria would be explained and invited to participate, and then a study consent form (Appendix 1) would be signed if they agreed to participate. Next, the patient would receive and answer questions on the questionnaire from phase 1 within 20 min.

2.4. Study instruments and outcome measures

The questionnaire consisted of 3 parts: general information (first and last name, patient code in hospital, age, gender, height, weight, BMI, address), shoulder pain state after stroke based on Modern Medicine (pain level, stroke duration starting from the occurrence of the first symptom to the study time), characteristics of shoulder pain based on TM.

Pain was measured using a Numeric Rating Scale (NRS). This scale was a fractional digital version of the Visual Analog Scale (VAS). The scale had 11 points, including numbers from 0 to 10, in which 0 was equivalent to "no pain" and 10 was equivalent to "maximum pain". Respondents were then instructed to choose a number from 0 to 10 that best represented their pain intensity [23], which was divided into 3 categories including Mild: NRS 1–5, Moderate: NRS 6–7, Severe: NRS 8–10 according to Boonstra (2016) [24]. This measurement was a one-way evaluation scale that was easy to understand and follow, reused repeatedly, and more suitable than multi-way evaluation scales for patients with no educational and cultural background [25]. The scale feasibility and reliability had been evaluated [26]. When compared with the VAS scale, NRS had the advantage of being simpler, easier to understand, more accessible to manage, and less prone to errors than VAS; therefore, it could be easily accessible to the majority of patients [26,27].

2.5. Variable

Regarding the independent variables, age was a quantitative variable, calculated by subtracting the year of birth from the current year through the survey; age group was a nominal variable based on age and had three values: 18 years old–29 years old: young adult, 30 years old–59 years old: middle-aged, ≥60 years old: old aged; gender was a qualitative variable, with two values: male and female; BMI was a quantitative variable, calculated based on height and weight; obesity variable was a bivariate variable (present when BMI ≥25 kg/m^2 according to IDI & WPRO criteria).

Stroke duration was a quantitative variable, calculated from the time of the occurrence of stroke to the time of the survey conducted and was divided into 2 periods (period 1: from 24 h to less than 30 days, period 2: from 30 days to 90 days). Pain level was an ordinal variable, classified based on the patient's self-assessed NRS score, with 3 values: mild/moderate/severe (Mild: NRS 1–5, Moderate: NRS 6–7, Severe: NRS 8–10).

There were 17 dependent variables, which were the characteristics of TM shoulder pain with two values: Yes and No, including fixed shoulder pain, moving shoulder pain, intermittent shoulder pain, shoulder pain with heaviness, cold shoulder pain, burning shoulder pain, shoulder pain alleviated by warmth, shoulder pain alleviated by cold, shoulder pain aggravated by cold, dull shoulder pain, shoulder pain with numbness, pale shoulder skin, red shoulder skin, purple shoulder skin, distended shoulder, shoulder pain with contraction, shoulder pain aggravated by exertion.

2.6. Data analysis

Data were analyzed using SPSS 22 software. Qualitative variables are described by frequency and percentage. Quantitative variables are presented as mean ± standard deviation if normally distributed or median and interquartile range if not normally distributed (Fig. 1).

Table 1
Selected literary documents.

Number	Name	Author	Publication date	Language	Type
1	Pathology and neurological treatment combine Eastern and Western Medicine	Trinh Thi Dieu Thuong Nguyen Van Dan	2021	Vietnamese	Curriculum
2	Symptoms of Oriental Medicine	Nguyen Thi Son	2016	Vietnamese	Curriculum
3	Internal pathology of Traditional medicine	Nguyen Nhuoc Kim	2017	Vietnamese	Curriculum
4	Internal pathology of Traditional medicine	Tran Quoc Bao	2011	Vietnamese	Curriculum
5	Internal Traditional Medicine	Hoang Bao Chau	1997	Vietnamese	Monograph
6	Oriental Medicine Acupuncture and Internal Medicine	Le Van Suu	2000	Vietnamese	Monograph
7	Internal Traditional Medicine	Hoang Trong Quang Tran Thuy Hong	2001	Vietnamese	Curriculum
8	Zhong Yi Xue Gai Lun (translated by the Institute of Oriental Medicine)	Nanjing Academy of Chinese Medicine	2019	Vietnamese (Chinese in origin)	Foreign curriculum
9	Differential Diagnosis of the Condition in Traditional Medicine (translated by Nguyen Thien Quyen, Dao Trong Cuong)	Institute of Oriental Medicine	2003	Vietnamese (Chinese in origin)	Foreign monograph
10	Diagnosis in Chinese Medicine. A Comprehensive Guide	Giovanni Maciocia	2018	English	Foreign curriculum

Table 2
Characteristics of shoulder pain after stroke in TM.

Code	Variable	Frequency (%) recorded in literature	Definition	Frequency (%) recorded in clinical practice
SP01	Fixed shoulder pain	7 (70%)	Yes: Detected by interrogation: Shoulder pain has an exact fixed point/exact fixed points No: The above symptom is not present	58 (89.2%)
SP02	Moving shoulder pain	4 (40%)	Yes: Detected by interrogation: Shoulder pain moves from place to place No: The above symptom is not present	7 (10.8%)
SP03	Intermittent shoulder pain	1 (10%)	Yes: Detected by interrogation: Shoulder pain recurs with each exacerbation No: The above symptom is not present	42 (64.6%)
SP04	Shoulder pain with heaviness	9 (90%)	Yes: Detected by interrogation: Shoulder pain has a feeling of heaviness No: The above symptom is not present	29 (44.6%)
SP05	Cold shoulder pain	5 (50%)	Yes: Any of these detected by interrogation and palpation: - Shoulder pain has a cold feeling - Touching the shoulder skin feels colder than other areas No: The above symptoms are not present	3 (4.6%)
SP06	Burning shoulder pain	6 (60%)	Yes: Any of these detected by interrogation and palpation: - Shoulder pain has a burning feeling - Touching the shoulder skin feels hotter than other areas No: The above symptoms are not present	5 (7.7%)
SP07	Shoulder pain alleviated by warmth	10 (100%)	Yes: Detected by interrogation: Shoulder pain decreases when exposed to warmth No: The above symptoms are not present	41 (63.1%)
SP08	Shoulder pain alleviated by cold	4 (40%)	Yes: Detected by interrogation: Shoulder pain decreases when exposed to cold No: The above symptom is not present	3 (3.1%)
SP09	Shoulder pain aggravated by cold	8 (80%)	Yes: Detected by interrogation: Shoulder pain increases when exposed to cold No: The above symptom is not present	16 (24.6%)
SP10	Dull shoulder pain	3 (30%)	Yes: Detected by interrogation: Shoulder pain is not severe but continuous, along with tiredness No: The above symptom is not present	23 (35.4%)
SP11	Shoulder pain with numbness	5 (50%)	Yes: Any of these detected by interrogation: - Shoulder pain with the partial or complete loss of sensation - Shoulder pain with the sensation of insects crawling on the body No: The above symptoms are not present	21 (32.3%)
SP12	Pale shoulder skin	1 (10%)	Yes: Detected by observation: Shoulder skin is white with a hint of blue or gray No: The above symptom is not present	4 (6.2%)
SP13	Red shoulder skin	6 (60%)	Yes: Detected by observation: Shoulder skin is redder than other areas No: The above symptom is not present	11 (16.9%)
SP14	Purple shoulder skin	1 (10%)	Yes: Detected by observation: Shoulder skin is dark purple or has purple bruises on it No: The above symptom is not present	0 (0%)
SP15	Distended shoulder	9 (90%)	Yes: Detected by observation and palpation: The shoulder area is swollen and becomes more painful when pressed No: The above symptom is not present	1 (1.5%)
SP16	Shoulder pain with contraction	6 (60%)	Yes: Detected by interrogation: Shoulder pain with contraction of muscles and sinews No: The above symptom is not present	21 (32.3%)
SP17	Shoulder pain aggravated by exertion	8 (80%)	Yes: Any of these detected by interrogation: Shoulder pains increase with effortful motion No: The above symptoms are not present	59 (90.8%)

*Values are represented as Frequency (Percentage).

We used the binary multivariate logistic regression model to compare each Jian Tong characteristic with many independent variables (age group, gender, stroke stage, pain level according to NRS). The differences were considered statistically significant when $p < 0.05$ (Fig. 1).

2.7. Ethical considerations

This study was conducted according to the guidelines of the Declaration of Helsinki. Council of Ethics in Biomedical Research at the University of Medicine and Pharmacy at Ho Chi Minh City approved this study on December 29, 2022, No. 1162/HĐĐĐ-ĐHYD. The study recorded information through the questionnaire. Patients were clearly explained before participating in the study and had the right to stop participating at any time. The information collected was for research purposes only and guaranteed not to be disclosed to any other party unrelated to the study.

3. Results

3.1. Phase 1

Survey of traditional medicine literature: Based on the criteria for selecting documents, 10 documents that met the sampling criteria were collected, including 7 curricula and 3 monographs (Table 1). After synthesizing and removing duplicates, 5 TM syndromes were recorded: Wind-Cold-Dampness, Wind-Damp-Heat, Phlegm-Dampness, Blood stasis, Qi and Blood deficiency and 16 characteristics of shoulder pain, denoted SP01–SP17. Which "shoulder pain alleviated by warmth" was mentioned the most (100%), while "intermittent shoulder pain", "pale shoulder skin", and "purple shoulder skin" were mentioned the least (10%) (Table 2).

3.2. Phase 2

Surveying 65 patients with ischaemic stroke in the early rehabilitation phase. The sample age ranged from 39 to 79 years old, with a mean age of 62.51 ± 10.11 (mean age ± standard deviation). The old age group accounted for the most (63.1%); the study did not record the young adult age group. Male gender contributed just beyond females, 55.4% and 44.6% respectively. The average BMI was 23.84 ± 2.85 kg/m^2, in which one-third of patients underwent obesity (BMI ≥25 kg/m^2). The mean stroke time of the study was 55.98 ± 30.88, and the 30-day–90-day stroke period accounted for 76.9% (Table 3).

When conducting phase 2, 16 out of 17 features were recorded in clinical practice except for "purple shoulder skin" one. The most common symptom was "shoulder pain aggravated by exertion" (90.8%). In contrast, the least common symptoms were "shoulder pain alleviated by cold" (3.1%) and "distended shoulder" (1.5%). The average pain score measured by NRS was 5.58 ± 2.46. The mild shoulder pain group accounted for over half of the sample size (Table 2).

As illustrated from the results, sex was a positive and significant contributor to the probability of "shoulder pain with contraction" with $p = 0.034$ ($p < 0.05$) and the OR indicating that with every female unit increased in the study, the odds of having "shoulder pain with contraction" decreased by a rate of 0.22 with 95% CI ranging from 0.05 to 0.89. This result meant that male units increased the chances of this Jian Tong feature (Table 4).

Besides, the pain level by NRS was represented by two dummy variables. The 6.50 (95% CI: 0.99–42.52) odds rate suggested that

Table 3
General information about patients.

Variable	Value (N = 65)
Age (years) [Mean (SD)]	62.51 (10.11)
BMI (kg/m^2) [Mean (SD)]	23.84 (2.85)
Stroke duration (days) [Mean (SD)]	55.98 (30.88)
Obesity [Frequency (%)]	23 (33.8)
Age group [Frequency (%)]	
Young adult (18–29)	0 (0)
Middle-aged (30–59)	24 (36.9)
Old aged (≥60)	41 (63.1)
Sex [Frequency (%)]	
Male	36 (55.4)
Female	29 (44.6)
Stroke period [Frequency (%)]	
Period 1 (24h–29 days)	15 (23.1)
Period 2 (30 days–90 days)	50 (76.9)
NRS (points) [Mean (SD)]	5.58 (2.46)
Pain level [Frequency (%)]	
Mild	33 (50.8)
Moderate	9 (13.8)
Severe	23 (35.4)

*Values are represented as Mean (Standard Deviation) or Frequency (Percentage).

Table 4
Associations between TM shoulder pain characteristics and age group, sex, stroke period, pain levels.

Variable	Age		Sex		Stroke period		Pain level by NRS		
	Middle-aged (R. group)	Old aged	Male (R. group)	Female	Period 1 (R. group)	Period 2	Mild (R. group)	Moderate	Severe
Fixed shoulder pain [OR (95% CI)]		0.43 (0.06–3.27)		1.11 (0.21–5.94)		0.43 (0.04–4.64)		0.24 (0.03–2.19)	1.26 (0.18–8.64)
P – value		0.417		0.901		0.489		0.203	0.815
Moving shoulder pain		2.31 (0.31–17.41)		0.90 (0.17–4.80)		2.31 (0.22–24.71)		4.26 (0.46–39.72)	0.79 (0.11–5.45)
P – value		0.417		0.901		0.489		0.203	0.815
Intermittent shoulder pain		0.91 (0.30–2.78)		0.45 (0.16–1.30)		0.83 (0.23–3.01)		1.19 (0.24–5.98)	1.33 (0.41–4.34)
P – value		0.866		0.140		0.776		0.837	0.642
Shoulder pain with heaviness		0.60 (0.19–1.95)		2.77 (0.95–8.07)		1.71 (0.45–6.57)		0.35 (0.06–2.08)	1.95 (0.60–6.34)
P – value		0.397		0.062		0.435		0.247	0.266
Cold shoulder pain		2.37 (0.08–72.08)		0.64 (0.05–8.29)		1×10^8 (0)		7.50 (0.18–308.34)	1.14 (0.09–19.78)
P – value		0.621		0.734		0.998		0.288	0.931
Burning shoulder pain		1.16 (0.10–13.53)		0.64 (0.08–4.94)		78×10^6 (0)		0 (0)	5.50 (0.55–55.32)
P – value		0.903		0.670		0.999		0.999	0.148
Shoulder pain alleviated by warmth		1.47 (0.48–4.47)		1.22 (0.43–3.50)		0.51 (0.13–1.97)		0.68 (0.14–3.30)	0.82 (0.26–2.65)
P – value		0.498		0.708		0.331		0.631	0.742
Shoulder pain alleviated by cold		0.20 (0.01–5.70)		0.52 (0.02–14.18)		18×10^6 (0)		0.44 (0)	128×10^6 (0)
P – value		0.350		0.695		0.998		1.000	0.998
Shoulder pain aggravated by cold		1.18 (0.32–4.37)		1.14 (0.35–3.79)		1.88 (0.34–10.30)		1.73 (0.26–11.66)	3.11 (0.83–11.58)
P – value		0.805		0.826		0.467		0.575	0.091
Dull shoulder pain		0.88 (0.28–2.78)		1.26 (0.43–3.65)		2.73 (0.64–11.64)		0.47 (0.08–2.88)	0.90 (0.28–2.86)
P – value		0.828		0.669		0.175		0.417	0.853
Shoulder pain with numbness		0.28 (0.08–1.02)		0.38 (0.11–1.30)		1.81 (0.39–8.47)		0.13 (0.01–1.48)	1.64 (0.47–5.70)
P – value		0.053		0.124		0.450		0.101	0.436
Pale shoulder skin		0.58 (0.56–6.02)		4.11 (0.33–50.77)		10^8 (0)		18×10^7 (0)	14×10^7 (0)
P – value		0.644		0.270		0.998		0.998	0.998
Red shoulder skin		1.08 (0.22–5.28)		0.17 (0.03–1.02)		0.20 (0.04–1.04)		1.73 (0.22–13.35)	1.53 (0.26–8.87)
P – value		0.923		0.053		0.056		0.602	0.634
Distended shoulder		0.26 (0)		0 (0)		22×10^6 (0)		763×10^5 (0)	1.21 (0)
P – value		1.000		0.998		0.998		0.998	1.000
Shoulder pain with contraction		0.55 (0.15–2.10)		0.22 (0.05–0.89)		0.68 (0.14–3.25)		6.50 (0.99–42.52)	19.60 (3.70–103.81)
P – value		0.382		**0.034**		0.628		0.051	**0.000**
Shoulder pain aggravated by exertion		0.08 (0.00–1.66)		5.63 (0.38–83.55)		8.50 (0.68–106.97)		19×10^7 (0)	22×10^7 (0)
P – value		0.103		0.210		0.098		0.999	0.998

*Binary logistic regression test.

patients in the moderate group were more likely to have "shoulder pain with contraction" than those in the mild group, but the difference was insignificant nevertheless ($p = 0.051 > 0.05$). However, patients in the severe group drastically rose the chances of coming down with "shoulder pain with contraction" as the odds rate of 19.60 (95% CI: 3.70–103.81) and $p = 0.000$ (<0.05) inferring

that patients in the severe group heightened the probability of "shoulder pain with contraction" by a factor of 19.60 and this variation was significant (Table 4).

There were no significant differences between age, sex, stroke period, pain level, and the remaining 14 characteristics ($p > 0.05$) (Table 4).

4. Discussion

4.1. Shoulder pain in literature

Our study collected 10 medical literary documents, meeting the conditions according to the selection criteria, similar to the study of Nguyen THD (2016) and Le THT (2022). Our research used foreign medical literature to help diversify characteristics in different geographical regions. Specifically, our study recorded characteristics from documents of different races and geographical regions (Vietnam, China, Europe) and different aspects of Traditional Medicine (bases, pathology, treatment) [17,18].

4.2. General information about the sample

The average age of the study sample was 62.51 ± 10.11 years old. This value was similar to a study by Le NB (2021) in Vietnam and that of Hu X (2022) in China [28,29]. The majority age group in our study was the old group (≥60 years) with 63.1%, different from the study of Vo TP (2018), which belonged to the 45–65 group (52.8%) or the study of Nguyen DP (2022) with the 50–69 group (48.1%) [30,31]. This difference was because of how the age groups were divided between various studies, but the results are consistent with the characteristics of age risk factors in stroke patients - people aged 55 years and older doubled their risk of stroke every ten years [32].

This study has a higher proportion of men than women, similar to domestic and foreign studies [30,33,34]; compatible with the premise that male gender is one of the risk factors for stroke [32].

The mean BMI of the study sample was recorded as 23.84 ± 2.85 kg/m^2, and one-third of patients in the study were obese, roughly the same as that of a study conducted in Korea by Jeong HY (2020) [35], lower than that of the Danish study by Dehlendorff C (2014) with an average BMI of 25.7 and obesity accounting for more than half [36]. These differences might be because the overweight and obesity status in Asian countries is lower than that in American and European countries, so studies in Asia have a lower average BMI and, therefore, a lower obesity rate [37].

The average stroke duration of the study was 55.98 ± 31.88 days, longer when compared with other studies. One of the reasons was that the complete recovery time was very long, so most patients turned to home treatment if they had improved their ability to walk and function at a basic degree to save hospital costs [38,39].

4.3. Shoulder pain after stroke

The results obtained from clinical practice and literature were virtually alike. Most of the symptoms with a high frequency of occurrence in the medical literature also tended to appear more in clinical practice such as "shoulder pain aggravated by exertion", "fixed shoulder pain", "pain alleviated by warmth", "shoulder pain with heaviness". A study by Dromerick AW (2008) examining shoulder pain after stroke likewise indicated similar results where the majority of shoulder pain increased with passive movement (88.2%), affecting daily functions and activities [40]. Patients after stroke often experience Qi deficiency syndrome, which makes symptoms related to exertion worsen. In addition, the more deficient Qi is, the more severe the blood stasis will be, leading to severe fixed pain [12,41]. In the pathogenesis of shoulder pain after stroke, the intrusion of Wind, Cold, and Dampness from the exterior is one of the common pathogenic factors. Among them, Cold and Dampness are the most important and common in presenting the distinctive features of shoulder pain. The contract nature of Cold hinders the normal flow of Qi and Blood and results in severe pains. Stickiness and heaviness are features of Dampness, which make joints feel weighed down [12]. The primary purpose of treatment is to eliminate external pathogens from the channels while strengthening the internal organs to minimize the local blockage of Blood in the channels causing pain. It is necessary to disperse the external pathogenic Cold with agents that strengthen the body's Fire (locally or through Kidney-Yang). Resolving Dampness needs Qi-tonification (through Spleen). Pain caused by Cold often recedes when applied with warm compresses, which can explain why "pain alleviated by warmth" appeared to be common in clinical practice [42]. Studies by Gao S (2017), and Zhong GL (2019) represented the effectiveness of reducing shoulder pain after stroke when using warming methods such as warm acupuncture combined with external application of Traditional Medicine or penetrating acupuncture [43,44]; conceivably because the majority of patients in these studies had shoulder pain caused by Cold. As mentioned before, Qi (especially Defensive Qi) and Blood deficiency in general will make the body more prone to external factors and unable to ensure smooth circulation to clear any congestion of Qi and Blood in the body. Thus, the principle treatment for this is to replenish Qi and Blood and nourish Liver-Blood and Kidney-Essence and Kidney-Yang. When the Liver and Kidney are impaired, there will be insufficient production of Essence and Blood, leading to the Kidney-Yang being unable to evaporate fluids and creating insufficient Defensive Qi to protect the body against external pathogenic factors.

On the other hand, symptoms with a low incidence in the literature also had a rare clinical occurrences such as "distended shoulder". This symptom is often described along with heat, redness, and pain in the description of wind-heat in the literature, which are features similar to an incidence of acute, intense inflammation of the shoulder and will worsen the patient's condition [12,45]. The "purple shoulder skin" feature, which, although it appeared in the literature, was not clinically recorded, might be because "purple

shoulder skin" is a manifestation of blood stasis caused by physical trauma [12,46]. In clinical practice, shoulder injuries are not a direct mechanism for post-stroke shoulder pain, so this feature was not clinically recognized.

The mean pain score of the study was 5.58 ± 2.455. The mild pain group accounted for the most (50.8%). This result was similar to the study of Gaitan M. (2019), where most patients with shoulder pain after stroke did not exceed 6/10 points in the 10-point VAS [47]. Besides, the study of Duong TTH (2022) evaluated pain in patients with acute ischaemic stroke using the NRS scale to assess and record that shoulder pain was mainly mild [48].

4.4. Associations between shoulder pain characteristics and age, sex, stroke period, pain levels

Determining Jian Tong's characteristics in patients was influenced by many different factors. Therefore, to evaluate the impact of these factors simultaneously on each characteristic, we decided to use the binary multivariate logistics regression model instead of models that independently compared each independent factor with Jian Tong's characteristics. This binary multivariate logistics regression model was eligible for comparing a dependent outcome variable with two values, usually yes and no, and various independent variables. Researchers could examine the association between each variable while keeping the values of the other independent variables constant to wholly understand the independent relationship of each variable to the outcome and the impact of each confounding factor. The dependent variable in this analysis was each of the Jian Tong characteristics of the patient (yes and no); the independent variables included factors such as age group, gender, stroke period, and pain levels by NRS [49].

In the moderate and severe groups, the difference they made in the odds of shoulder pain with contraction arising were at an increasing rate of 6.50 and 19.60, respectively. The proportion of the feature was higher in the severe pain level group, which was consistent with the theory of TM. According to TM, "pain with contraction" is often caused by two main mechanisms: the invasion of wind – cold - dampness and the deficiency of Liver-Blood/Liver-Yin. Cold is known for its ability to congeal and contract materials of the body, which makes Qi and Blood more likely to stagnate and cause intense pains; tissues such as muscles, sinews, blood vessels, and skin more likely to contract, causing stiffness and lack effortless motions. The Liver plays an important role in the act of nourishing and moistening the sinews; therefore, whenever the Liver-Blood is deficient, the sinews will lack moistening and nourishment, which may cause contractions and spasms, or impaired extension/flexion, muscle cramps [12,50]. According to some studies and theories, this contraction state was similar to the post-stroke spasticity of modern medicine [51,52].

The two sexes' body morphology and internal organ structure have specific differences, creating differences in physiological functions, psychological characteristics and forming distinctive constitutions. Men mostly use Qi, which makes them easily Qi-deprived; Women mostly use Blood, so Blood could be damaged a lot. According to Traditional Medicine, the symptom of "shoulder pain with contraction" is often caused by Wind - Cold - Dampness (in which welding plays the most important role in manifesting the contraction state of shoulder pain) and Liver-Blood/Liver-Yin deficiency. When men do not consume enough food and work too hard, their Qi often weakens and cannot warm the vessels, causing them to contract. When external Cold invades or internal Yin exceeds, Yang is consumed and damaged and, therefore, loses its function in warming and transporting, preventing Blood from flowing smoothly in the vessels.

Additionally, the nature of Cold also contributes to the contraction process. Besides, Qi and Blood are peculiarly intertwined as Qi is Yang, which has Yang functions: warming, protecting, transforming and raising, as opposed to Blood, which is a denser and more material type and related to the nourishing and moistening of Yin functions. However, Blood derives from Qi with the contribution of the Spleen, Lungs, Heart and depends on Qi to provide it with energy to function properly and this relationship can be recognized in the clinical signs. For instance, signs of Qi deficiency develop after a massive blood loss. On the other hand, after going through the depletion of Qi such as nagging and heavy sweating, one might expect signs of Blood deficiency. Thus, even if one starts by manifesting Qi/Yang deficiency, longevity might gradually transform into Blood/Yin deficiency afterward [12]. Indeed, according to a study on Traditional Medicine body constitution by Guo JS (2012), Qi deficiency is one of the three most common types of constitution in male pilots; 17.4% of male pilots had Qi deficiency [53]. These findings indicated that men often had constitution features that would make the "pain with contraction" more liable to occur.

4.5. Strength and limitation

In Vietnam, the studies on the pathological characteristics of shoulder pain after stroke in TM had not been fully exploited, so this study was the first study to inspect the frequency of TM shoulder pain characteristics in clinical practice. The study measured the shoulder pain level using modern medicine's NRS score. It investigated the occurrence rate and association with other factors of Jian Tong characteristics according to Traditional Medicine, partly finding a relationship between Modern Medicine and Traditional Medicine, thereby creating a small step for future researchers by considering a new direction with the absolute aim of contributing to the treatment of shoulder pain patients after stroke. In addition, the study also used the NRS scale to assess pain, which had been evaluated for feasibility and reliability, with the advantages of being easy to use, minimizing errors, and being popular and effective in the practice of measuring pain levels and treating shoulder pain after stroke [26,27]. Our literature data sources were from three foremost national libraries and the questionnaire was appraised by a panel of experts before being put into use. The multivariable logistic regression method evaluated the influence of factors such as age group, gender, stroke period, and pain levels by NRS on Jian Tong's characteristics. In addition, we focused on the group of patients with ischemic stroke in the early rehabilitation phase to bring homogeneity to the study. We will continue to carry out studies on shoulder pain after stroke in patients with hemorrhagic hemorrhage, lacunar stroke, or in other phases of stroke rehabilitation. However, this study still had some limitations, such as the study was only directed in Ho Chi Minh City, the number of samples collected was fairly moderate, the study duration was not long, so it might

not be able to represent the general population. Therefore, future studies could expand on sampling sites and increase the observation time to collect more diverse samples.

This study only inspected ischemic stroke patients in the early rehabilitation phase; therefore, it could not cover all the characteristics of shoulder pain after stroke in patients with cerebral hemorrhage and patients in the other phases of rehabilitation, including the acute phase, late rehabilitation phase, and chronic phase. As a result, it was possible in the future to conduct studies on shoulder pain after stroke in subjects with exclusive ischaemic stroke in the early rehabilitation phase. This study used the descriptive cross-sectional method as the main clinical research method. Besides the outstanding advantages of this method, the recording of disease information in a moment or a short period would make it difficult to determine the chronological sequence (causality between exposure factors, infection, and disease or how the presence of a trait develops with the disease) thus future studies may use longitudinal methods to investigate the chronological feature of post-stroke shoulder pain characteristics.

5. Conclusion

The results of this study met the initial objective by recording the percentages and associations of shoulder pain characteristics according to TM (in literature and clinical practice) and the general personal information. The results showed that the pain level by NRS was associated with "shoulder pain with contraction" whereas sex was associated with "shoulder pain with heaviness". These data would contribute to the construction and clinical visualization of teaching materials for schools, centers, and institutions while also serving as a small stepping stone for broader future studies, such as prospective studies investigating the association between post-stroke shoulder pain characteristics and the effectiveness of TM treatment methods, studies examining the characteristics of patients with hemorrhagic stroke, lacunar stroke or studies examining patients in other rehabilitation phases, exclusive of the early one. Moreover, future studies have the odds to evaluate the localization of damage based on imaging to investigate the relationship between shoulder pain after stroke and the location of damaged cerebral blood vessels.

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Data availability statement

The data associated with this study will be made available on request for the readers who are concerned; please directly contact the corresponding author via email (lebaoluu@ump.edu.vn).

CRediT authorship contribution statement

Linh Thi Hoang Le: Writing - review & editing, Writing - original draft, Investigation, Resources, Software. **Duong Thi Huong Nguyen:** Data curation, Conceptualization, Formal analysis, Methodology, Writing - review & editing. **Huy Khanh Tang:** Writing - review & editing, Validation, Methodology, Formal analysis, Visualization. **Vi Thien Luu:** Investigation, Formal analysis, Data curation, Writing - original draft. **Ngan Anh Pham:** Investigation, Data curation, Supervision. **Luu Bao Le:** Writing - review & editing, Project administration, Methodology, Conceptualization, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

TM	Traditional Medicine
NRS	Number Rating Scale
VAS	Visual Analog Scale
BMI	Body Mass Index
IDI & WPRO	International Diabetes Institute & World Health Organization Western Pacific Regional Office
SPSS	Statistical Package for the Social Sciences

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e24626.

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