

Clinical and radiological characteristics of cerebral vein thrombosis: a retrospective study

Mosaad Almegren

College of Medicine, Imam Mohammad Ibn Saud Islamic University, Riyadh, Kingdom of Saudi Arabia

ABSTRACT

Cerebral vein thrombosis (CVT) is a rare type of stroke that can present with a wide range of symptoms and signs, making it challenging to differentiate from other neurological conditions. Therefore, this study aimed to evaluate the clinical characteristics and risk factors of cerebral vein thrombosis patients. This descriptive analysis included 103 CVT patients registered in two centers, one in Saudi Arabia and one in Oman. The study covered all patients who presented to these centers from 2006 to 2020 with a confirmed diagnosis. Out of the 103 CVT patients included in the study, 32% were male, and 68% were female, with a mean age of 39 years. Headache was the commonest presenting symptom, followed by seizures. Identifiable risk factors were observed in most patients, with oral contraceptive pills and pregnancy being the most prevalent risk factors. The transverse sinus was the most commonly involved sinus, followed by the sagittal sinus, while intracerebral bleeding was present in 22% of patients. CVT is an uncommon type of stroke that affects individuals in the middle age group, particularly child-bearing age females. The clinical characteristics of CVT vary, with headache being the most prevalent clinical presentation, and its diagnosis requires a high degree of clinical suspicion.

Correspondence: Mosaad Almegren, College of Medicine, Imam Mohammad Ibn Saud Islamic University. P.O. Box 7544, Othman Bin Affan road, Al Nada, Riyadh, Kingdom of Saudi Arabia.
Tel.: +966.112037100.
E-mail: moalmegren@imamu.edu.sa

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Introduction

Cerebral vein thrombosis (CVT) occurs due to a decrease in blood flow in the cerebral veins, resulting from partial or complete occlusion of the dural sinuses that drain blood from the brain. CVT is a relatively rare, potentially fatal neurological disorder that can be challenging to diagnose because of wide variability in clinical and radiological presentation.¹ CVT is less common than ischemic stroke and intracerebral hemorrhage, with an estimated incidence range of 3-4 cases/million/year, accounting for less than 1% of all stroke types, and is three times increase in females than in males.² However, a retrospective Australian study reported a higher incidence rate of 15.5 cases per million per year,³ while another retrospective study reported an even higher rate of 1.32 per 100,000 person-years.⁴

CVT is a multifactorial disorder with sex-specific causes and varied clinical characteristics. The clinical characteristics of CVT are diverse and can manifest in various symptoms, from headache to coma, resembling other disorders, and presenting diagnostic challenges.⁵ Headache is the most common presenting feature in CVT, with other frequently observed symptoms and signs including seizures, impaired level of consciousness, motor/sensory deficits, and vomiting.⁶

CVT typically has a favorable prognosis if diagnosed and treated promptly, while delayed diagnosis and treatment can result in poor outcomes including death or disability.⁵ However, data on CVT in the Arabian Gulf population are limited. In a small case series of 26 patients from Saudi Arabia, headache was the most common symptom, and the transverse sinus was the most commonly affected sinus.⁷ In another study involving

the pediatric age group, identifiable risk factors for CVT were found in 80% of the study population.⁸ Therefore, we evaluated the clinical characteristics and risk factors of CVT patients from Saudi Arabia and Oman.

Materials and Methods

We conducted a retrospective cohort analysis of 103 CVT patients registered in two centers from Saudi Arabia and Oman from January 2006 to December 2020. Patients were included if they were adults aged 18 years or older, and CVT was confirmed radiologically using magnetic resonance imaging (MRI), computed tomography (CT), or cerebral angiography. CVT is defined as complete or partial occlusion of the dural sinuses or veins, or both, by a blood clot that is confirmed radiologically.

Data were collected by reviewing the medical records of included patients. The following were collected: age, gender, chronic diseases (diabetes mellitus, hypertension, history of venous thromboembolism, malignancy), clinical presentation, risk factors, sinuses involved, time from symptoms onset to confirmed diagnosis, and length of hospital stay. Follow-up data were collected from the time of CVT diagnosis to the last follow-up date, death, or end of the study period (December 2021). Patients who did not attend at least one follow-up visit after hospital discharge were excluded.

Clinical data were collected from the patient's medical records and distributed in a pre-designed spreadsheet, which was used for further analysis. The median, mean, and standard deviation were calculated, and frequency and proportion were used to calculate binary and categorical data variables. All analyses were performed using IBM SPSS Statistics (version 21).

The study protocol was reviewed and approved by the ethical committee of both participating hospitals.

Results

We identified 103 CVT patients from 2006 to 2020, of whom 33 (32%) were males, and 70 (68%) were females, with a mean age of 39 (\pm 13) years. The median follow-up time was 23 months (0-101 months), and the median length of hospital stay was 11 days (0-90 days). Diabetes mellitus and hypertension were found to be the most common chronic diseases (16.5% and 15.5%, respectively). A history of venous thromboembolism (VTE), coronary artery disease, chronic renal impairment, and chronic obstructive pulmonary disease were also observed. Table 1 shows the results. Risk factors were identified in most patients (77.6%), with 16 patients carrying more than one risk factor. Gynecological causes were found to be the main risk factor for CVT (45.6%), with 47 out of 70 females (67%) being affected. Oral contraceptive pills (OCP) and hormonal replacement therapy accounted for 28 females (40%), pregnancy for 11 females (15.7%), and puerperium for eight females (11.4%). However, infections, including central nervous system (CNS), head, and neck infections, were the major risk factors in males (18%). Other risk factors, such as thrombophilia, neurosurgery, and head trauma, were also observed.

Headache was the most frequently observed clinical presentation, observed in 86 patients (83%), followed by seizures in

43 patients (41.7%), vomiting in 39 patients (37.8%), sensory/motor deficits in 39 patients (37.8%), impaired level of consciousness in 32 patients (31%), and visual loss in 23 patients (22.3%). The median time from the onset of symptoms to confirmed radiological diagnosis was 5 days (range 0-700 days).

Table 1. Demographics and risk factors in 103 patients with cerebral vein thrombosis.

Variable	N (%)
Mean age	39 \pm 13 years
Female	70 (68%)
Chronic disease	
Diabetes mellitus	17 (16.5)
Hypertension	16 (15.5)
History of VTE	10 (9.7)
Coronary artery disease	8 (7.8)
Chronic kidney disease	8 (7.8)
COPD	4 (3.9)
Risk factors	
OCP	26/70 (37)
Hormonal replacement therapy	2/70 (2.8)
Pregnancy	11/70 (15.7)
First trimester	1/11
Second trimester	3/11
Third trimester	7/11
Puerperium	8/70 (11.4)
Infection	10 (9.7)
Neurosurgery	4 (3.9)
Head trauma	4 (3.9)
Cancer	3 (2.9)
Thrombophilia	11 (10.6)
Prothrombin gene mutation	2
Antiphospholipid antibody syndrome	5
Antithrombin III deficiency	2
Protein C deficiency	1
Protein S deficiency	1
More than one risk factor	16 (15.5)
No identifiable risk factor	23 (22.3)

VTE, venous thromboembolism; COPD, chronic obstructive pulmonary disease; OCP, oral contraceptive pills.

Table 2. Radiological features.

Radiological feature	N (%)
CT	47 (45.6)
MRI	27 (26.2)
CT and MRI	29 (28.2)
Sinus/vein involved	
Transverse	71 (68.9)
Sagittal	69 (67)
Sigmoid	59 (57.3)
Straight	19 (18.4)
Deep cerebral veins	18 (17.5)
Cortical veins	16 (15.5)
Single sinus/vein involvement	20 (19.4)
Multiple sinuses/veins involvement	83 (80.6)
Cerebral hemorrhage	23 (22.3)

CT, computed tomography; MRI, magnetic resonance imaging.

CT was the primary radiological imaging for CVT diagnosis in 47 patients (45.6%), while MRI was used in 27 patients (26.2%), with one-third of patients undergoing both CT and MRI at the time of diagnosis. The transverse sinus was the major sinus involved in 71 patients (69%), followed by the sagittal sinus in 69 patients (67%). Multiple sinus involvement was the main radiological feature in 83 patients (80.6%), while single sinus involvement was documented in 20 patients (19.4%). Deep cerebral vein involvement was found in 18 patients (17.4%), cortical vein involvement in 16 patients (15.5%), and cerebral bleeding at the time of CVT diagnosis in 23 patients (22.3%) (Table 2).

Discussion

This study presented the demographics, clinical presentations, risk factors, and radiological characteristics of 103 adult patients diagnosed with CVT from Saudi Arabia and Oman. Two-thirds of the study population were females, with a mean age of 39 years (± 13). Diabetes mellitus and hypertension were the patients most commonly observed chronic diseases. OCP and pregnancy were the major risk factors in females, while CNS and head and neck infections were the major risks in males. Headache was the main presenting symptom, followed by seizures and sensory/motor deficits. Multiple sinus involvement was the major presentation in more than two-thirds of the patients, with the transverse and sagittal sinuses being the most commonly involved sinuses.

Similar to our results, in the international study on cerebral vein and dural sinus thrombosis (ISCVT), a prospective multicenter observational study of 624 patients with a mean age of 39 years, the headache was the major presenting feature, and OCP were the main risk factor in females, whereas thrombophilia was diagnosed in more than one-third of patients (compared to 10% in our study). However, the rate of antiphospholipid antibodies was close to our study at 5%.⁶ Deep cerebral vein involvement was higher in our study (17.4%) compared to ISCVT, which was 10%, whereas cortical vein involvement was similar.⁶

Studies from Saudi Arabia and Oman, with populations ranging from 22 to 119 patients and mean ages ranging from 29 to 38 years, reported that headache was the most common symptom.⁷⁻¹³ Seizures, vomiting, motor deficits, and impaired levels of consciousness were frequently reported symptoms. Unfortunately, CVT-related headaches have no specific characteristics; therefore, a high index of suspicion is required in a patient with a headache and red flags for CVT, including new onset, persistent, or a headache that does not respond to analgesics or in a patient with other associated symptoms such as seizures, vomiting, or CVT risk factors, including OCP, pregnancy, or a history of VTE.

In this study, OCP were the major risk factor in females (40%). In contrast to our results, OCP accounted for less than 15% of female CVT risk factors in three retrospective studies from Saudi Arabia and Oman.^{8,9,13} Identifiable risk factors were reported in most patients from all studies, including pregnancy, thrombophilia, infection, and head trauma.⁷⁻¹³ Similar to our study, antiphospholipid antibodies accounted for 7% of risk factors in a retrospective study from Oman but between 15-21% in two other studies from Saudi Arabia.^{7,13,14}

Similar to our study, multiple sinus involvement was observed in most patients from Saudi Arabia and Oman.⁷⁻¹⁴ The transverse sinus was the most frequently involved, followed by the sagittal and sigmoid sinuses. In contrast to our study, deep cerebral vein thrombosis accounted for 2-9% of the two retrospective studies.^{11,13} A higher rate of cerebral hemorrhage (42%) was observed in a retrospective study that included 119 patients, while a lower rate of hemorrhage was observed in other studies.^{8,11-13}

Retrospective type and a relatively small sample size were the limitations of this study. However, it provides valuable insight into the clinical presentations, risk factors, and radiological features of CVT in Arabian Gulf countries, including Saudi Arabia and Oman.

Conclusions

Our study revealed that headache is the major presenting symptom in patients with CVT. Risk factors are identifiable in most patients, with obstetric factors being the predominant ones. The transverse sinus is the most frequently involved sinus, and multiple sinus involvement is the most observed pattern of sinus thrombosis.

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