



**School of Medicine Undergraduate Study Program**

**Prevalence and Clinical Characteristics of Cerebral Venous Thrombosis at St. Paul's Hospital Millennium Medical College, Adult Medical Ward from, 2025**

**By: Biruk Wubneh (Medical Intern)**

**A Research report submitted to the School of Medicine, St. Paul's Hospital Millennium Medical College in Partial Fulfilment of the Requirements for the Degree of Medical doctor.**

**Addis Ababa, Ethiopia**

**April, 2026**

**St. Paul's Hospital Millennium Medical College**  
**Undergraduate Study Program**  
**School of Medicine**

**Prevalence and Clinical Characteristics of Cerebral Venous Thrombosis: A  
Retrospective Chart Review at Adult Medical Wards of St. Paul's Hospital  
Millennium Medical College, September 2020 – August 2025**

**Principal Investigator: Biruk Wubneh (Medical Intern)**

**Name of advisors: Getachew Tilahun (MPH), Hora Yohanis (MD, Consultant  
internist)**

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|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name of investigator</b>               | <b>Biruk Wubneh (Medical Intern)</b>                                                                                                                                                                              |
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## Abbreviations and acronyms

All abbreviations and acronyms that are used repeatedly in the document and are not universally recognized are listed under this section for clarity.

|        |                                                           |
|--------|-----------------------------------------------------------|
| ACT    | Activated Clotting Time                                   |
| BBB    | Blood-Brain Barrier                                       |
| CNS    | Central Nervous System                                    |
| COVID  | Coronavirus Disease                                       |
| CSF    | Cerebrospinal Fluid                                       |
| CT     | Computed Tomography                                       |
| CTV    | CT Venography                                             |
| CVT    | Cerebral Venous Thrombosis                                |
| EVT    | Endovascular Therapy                                      |
| HIT    | Heparin-Induced Thrombocytopenia                          |
| HIV    | Human Immunodeficiency Virus                              |
| IBM    | International Business Machines (SPSS software developer) |
| ICH    | Intracerebral Hemorrhage                                  |
| ICP    | Intracranial Pressure                                     |
| ID     | Identification                                            |
| INR    | International Normalized Ratio                            |
| LMWH   | Low Molecular Weight Heparin                              |
| MRI    | Magnetic Resonance Imaging                                |
| MRV    | Magnetic Resonance Venography                             |
| PT     | Prothrombin Time                                          |
| SPHMMC | St. Paul's Hospital Millennium Medical College            |
| SPSS   | Statistical Package for the Social Sciences               |
| SSA    | Sub-Saharan Africa                                        |
| US     | Ultrasound                                                |

## ABSTRACT

**Background:** Cerebral venous thrombosis (CVT) is a rare but potentially life-threatening cerebrovascular condition, often affecting young adults and associated with diverse risk factors including infections, pregnancy, malignancy, and prothrombotic states. Despite advances in diagnostic imaging, CVT remains underdiagnosed in many low- and middle-income countries, including Ethiopia, due to limited awareness and diagnostic challenges. Current evidence on its prevalence and clinical characteristics in the St. Paul's Hospital Millennium Medical College (SPHMMC) context is scarce. Therefore, this studies aimed is to determine the prevalence and describe the clinical characteristics of CVT among patients admitted to adult medical wards of SPHMMC from September 2020 to August 2025.

**Method:** A hospital-based descriptive cross-sectional study was conducted. All patients admitted to medical wards during the study period with a confirmed diagnosis of CVT were included. The Data were extracted from patient medical charts using a structured checklist, covering socio-demographic information, clinical presentations, comorbidities and risk factors, laboratory and imaging findings, and in-hospital outcomes. The Data were entered and analyzed using SPSS version 27.

**Result:** Of the 7,075 medical ward admissions during the study period, 176 patients (2.49%) were diagnosed with cerebral venous thrombosis (CVT). The majority were young adults aged 26–35 years, and 73.3% were female. Headache was the most common presenting symptom (76.1%), followed by focal neurological deficits (38.6%), altered consciousness (35.8%), and seizures (34.7%). The superior sagittal sinus was the most frequently involved site. Anticoagulation therapy was initiated in 90.9% of patients. In-hospital complications occurred in 50% of cases, primarily infections and bleeding, with an in-hospital mortality rate of 5.7%.

**Conclusion and recommendation:** CVT predominantly affects young women and commonly presents with headache and neurological deficits. Early recognition, timely neuroimaging, and anticoagulation are essential for favourable outcomes. Strengthening follow-up and long-term monitoring is recommended to improve detection, management, and understanding of risk factor

**Keywords:** Cerebral venous thrombosis; prevalence; clinical characteristics

# 1. Introduction

## 1.1. Background

Cerebral Venous Thrombosis (CVT) is an uncommon cerebrovascular disease characterized by the presence of blood clots in the dural venous sinuses of the brain and/or the cerebral veins. The pathophysiology of CVT is related to elevated venous pressure, which can result in elevated intracranial pressure (ICP) and/or venous infarction. This is different from an arterial stroke, which is due to the blockage of arterial vessel. Key differences from arterial stroke include its relative rarity, accounting for only 0.5% to 3% of all strokes, and is therefore less common than arterial stroke. Arterial stroke usually presents as infarctions respecting arterial territories, CVT related infarctions do not, and could be bilateral, or located near the superior sagittal sinus. Moreover, the clinical syndromes of CVT typically develop over hours or days, or weeks in some cases, as opposed to arterial strokes that may be more rapidly occurring with an acute onset of focal neurological deficits. (1–4)

As mentioned above, the exact worldwide prevalence of CVT is not well known, however, CVT is known to be a rare disease with an incidence of 0.5 – 3% of stroke cases (1). Population-based studies published recently report the incidence of CVT as 1.75 per 100,000 per year in Norway, 8.7 per 1,000,000 per year in Canada, and 11.6 per 1,000,000 per year in Italy. The incidence of CVT has been increasing over the years likely because of better diagnosis and imaging (5–7).

Women are at greater risk, particularly at ages 20–44 years, with a maximum incidence of 27 per 1,000,000 in those aged 40–44 years. Other female-specific risk factors include pregnancy and postpartum period as well as use of oral contraceptives. In males, CVT is often trauma- or infection-associated. All patients have at least one risk factor, with multiple risk factors being the rule rather than the exception. Overall, in-hospital mortality is low (3–6%) but higher among cases with intracranial hemorrhage (up to 7.5%) or high comorbidity. Heparin-induced thrombocytopenia (HIT) related CVT has significantly greater mortality (33.3%). (5–8)

The most frequent presenting symptom is headache (80–98%), which can be isolated, or associated with focal neurological deficit (hemiparesis, aphasia), seizure, altered mental status or encephalopathy. The onset of the disease may also involve seizures and papilledema, with only rare appearance of cranial nerve palsies, psychiatric symptoms, paralysis and coma (9–12). CVT

can be acute, subacute or chronic and the subacute form is the most frequent. The median time from symptom onset to diagnosis is about 4–7 days, but delays are frequent, especially when headache is the only symptom (9,12).

The epidemiology of CVT in Sub-Saharan Africa (SSA) remains largely unknown, low localized numbers of cases reported thus far, implies that it may be infrequent, underdiagnosed or not reported. Despite this, it is theorized that the frequency of CVT could be higher in SSA due to the predominant age groups being young and middle-aged adults, along with high rates of iron and folate nutritional deficiencies leading to severe anemia and hyperhomocysteinemia, which are known risk factors. Limited access to public health and comprehensive healthcare may also contribute to CVT complications arising from pregnancy, puerperium, and ear, nose, sinus, throat, and facial infections, while prevalent infections like HIV and malaria are other potential contributing factors. Infection was the most frequent associated condition (63.1%) in the cases reports, followed by oral contraceptive intake (7.3%), and pregnancy/puerperium (6.2%). CVT is mostly diagnosed using CT images (85%) in SSA. Nearly all patients reported after 2000 were under anticoagulation, although the acute phase mortality (10%) was higher than in high-income countries, but a total of 46.5% of patients completely recovered. (13)

## 1.2. Statement of the problem

Cerebral venous thrombosis is a rare, yet increasingly recognized, etiology for stroke, accounting for an estimated 0.5–1% of all global stroke cases. Recent large scale epidemiological studies conducted in the US, Europe, and Asia have estimated a yearly incidence of CVT between 13 and 20 cases per million and a marked increase over the last decade probably due to better diagnosis and increased clinical awareness (14–16). In the past, CVT has been more frequent in young adults and women, in particular if pregnant, during the puerperium or when oral contraceptives are used; however, the most recent data reveals an increasing incidence in elderly men and a decrease in the percentage of CVT related to pregnancy (15,16). Racial disparity is established with Black populations having a higher incidence than Whites or Asians in the US and similar differences by geography worldwide (14,16).

Despite extensive research on CVT epidemiology and risk factors worldwide, several reports on this topic from different part of the world showed difference in geographic prevalence of CVT. There exists a notable scarcity in comprehensive data specific to the patient population served by

SPHMMC medical wards in Ethiopia. This scarcity of local data hinders the formulation of targeted interventions and tailored healthcare strategies for CVT management and prevention within this specific demographic.

A five-year retrospective study focusing on the prevalence and clinical characteristics of CVT among patients admitted to SPHMMC's medical wards aims to bridge this gap. By examining patient records from the past five years, demographic characteristics, clinical presentations, risk factors, and neuroimaging findings was analyzed. This study seeks to provide a comprehensive understanding of CVT prevalence within the Ethiopian population served by SPHMMC.

### 1.3. Significance of the study

This study is valuable and significant scientifically as it will add to the limited literature of CVT in Ethiopia and sub-Saharan Africa. Although CVT has been well documented in high-income countries, data are scarce from low and middle-income countries. By determining the prevalence of CVT and clinical characteristics at SPHMMC, this study will serve as a benchmark to other research and contribute to the global evidence with locally relevant information.

Clinically, the results of the present study may assist neurologists and general physicians by providing local evidence on the clinical presentation and patterns of cerebral venous thrombosis, which can support earlier recognition and diagnosis. Awareness of the sociodemographic and clinical profile of the disease will improve early clinical suspicion, minimize delays in diagnosis and prompt commencement of appropriate treatment. In the end, such efforts might lead to better treatment outcomes with less complications, including long-term neurological disability or death. The study is also of high public health importance. The findings will be useful to the hospital managers and policy makers to estimate the magnitude of CVT in one of Ethiopia's largest tertiary referral centers. These data are critical to inform allocation of resources, including access to neuroimaging, anticoagulation therapies, and resources on the ground for capacity building for specialized care in neurology. Furthermore, retrieving the data on the common comorbidities and risk factors, this study can contribute to the planning and development of the preventive strategies which include the increase in the quality of maternal care, better control of the prothrombotic conditions, and the early treatment for the infections.

## 2. Literature review

### 2.1. Definition and clinical importance of CVT

The first well-documented case of CVT is by the French physician Ribes in 1825, who described a 45-year-old man with headache and seizures and found at autopsy to have superior sagittal and lateral sinus thrombosis. Shortly thereafter, John Abercrombie reported the initial association between CVT and the puerperium in a 24-year-old who presented with headache and recurrent seizures two weeks postpartum and died of status epilepticus; postmortem examination showed thrombosis of the superior sagittal sinuses and cortical veins. (17)

CVT is the thrombosis of the cerebral veins and/or dural venous sinuses, resulting in obstruction of venous drainage of the brain. It has low prevalence (0.5–1.32 per 100,000 per year) but is more frequent in adolescents, women (particularly pregnant or using oral contraceptives), and children. Recent evidence indicates greater recognition, thanks to better neuroimaging and awareness. (17,18)

Early diagnosis and aggressive anticoagulation lead to a favorable outcome in the majority of patients. 5–15% however may die or have serious disability, and some have persistent long term neuropsychiatric symptoms or recurrent thrombosis. Prognosis depends on the age and sex of the patient, the extent of thrombosis, presence of coma and predisposing risks. (17,18)

### 2.2. Prevalence, incidence, demographic patterns

The exact worldwide prevalence of CVT is not well known, however, CVT is known to be a rare disease with an incidence of 0.5 – 3% of stroke cases (1). Although, its proportion among stroke subtypes has increased over 70% from 2005–2016 in the US (16).

Incidence rates vary globally, with higher rates reported in India and Europe compared to North America. Population-based studies published recently report the incidence of CVT as 1.75 per 100,000 per year in Norway, 8.7 per 1,000,000 per year in Canada, and 11.6 per 1,000,000 per year in Italy (5–7). More recent studies from the US and Europe show CVT annual incidence rates in the range of 13.9–20.2 per million, and a 5% annual rise in some regions (14,16). In hospital-based data in India, the incidence increased from 49 to 96 per 100 000 admissions after 2010, probably due to better surveillance (15).

CVT affects individuals who are young to middle-aged adults most commonly (mean age 30–50 years), although mean age of onset is increasing (e.g., an increase from 24.5 to 33.2 years in India's

population during the last decade). Women have historically made up most of the cases (43% – 67%), primarily because of pregnancy, puerperium, and oral contraceptive use. The female-to-male ratio has decreased, with some registries reporting a sex balance or male predominance as postpartum CVT decreases (15,16). The incidence of CVT is higher among hospitalized COVID-19 patients than in the general population, with a male preponderance and a wide age range (21). In the US, the CVT incidence is the highest in Black (18.6–27.2 per million), followed by White (14.3–18.5), and then Asian (5.1–13.8) populations (16). Analogous discrepancies are observed in other thrombotic states (22).

### 2.3. Risk Factors and Associated Conditions

The risk factors for CVT are multifactorial, encompassing both genetic and acquired conditions, with significant variation across age, sex, and geographic regions.

The main non-genetic risk factors are pregnancy and puerperium, oral contraceptives, infection, malignancy, anemia and autoimmune diseases, with Factor V Leiden, prothrombin G20210A mutation and protein C protein S and antithrombin deficiencies present as suspected forms of genetic predisposition (17,23–28). The interaction of multiple risk factors, usually a mix of genetic and transient acquired triggers, result in a much higher risk of developing CVT (23,26,29). There are also new contributors such as obesity, inflammation and some hematologic diseases (25,30–32). Knowledge of these risk factors and related diseases is important for the early detection, prevention, and subsequent treatment of CVT.

Regional studies reveal variations in risk factors prevalence with Asian populations having higher rates of anemia and hypercoagulable states, and lower rates of oral contraceptive use compared to Western cohorts (27,33,34). Postpartum status, infection, and thrombophilia are major risk factors in Latin America and Africa (28,33,34).

### 2.4. Clinical presentation and treatment of CVT

Patients with CVT most commonly present with headache (up to 90%), often resembling migraine or associated with raised intracranial pressure, and sometimes as a thunderclap headache. Focal neurological deficits such as hemiparesis, aphasia, or sensory loss frequently occur due to venous infarction, hemorrhage, or cerebral edema. Seizures are also common, either focal or generalized, and are typically related to venous infarction or hemorrhage. Visual disturbances, including

papilledema, visual field defects, or diplopia, usually result from raised intracranial pressure. In more severe cases, patients may develop altered consciousness ranging from drowsiness to coma, while a subset may show cognitive impairment such as confusion, disorientation, or memory problems (18).

The onset may be acute, subacute, or chronic, and the symptoms vary depending on the site of thrombosis. It is a diagnosis made with high clinical suspicion and confirmed by neuroimaging—CT/CTV or MRI/MRV are the gold standard. (17,18)

Anticoagulation with LMWH or unfractionated heparin is the first-line therapy for CVT, even in patients with intracranial hemorrhage. After the acute phase, oral anticoagulation (typically warfarin) is continued for 3–12 months, with the duration tailored to individual risk factors (35). Recent studies and guidelines increasingly support the use of DOACs (dabigatran, rivaroxaban, apixaban) as alternatives to warfarin, with similar efficacy and safety profiles (36).

Endovascular therapy (EVT), including mechanical thrombectomy and local thrombolysis, is reserved for patients who deteriorate despite adequate anticoagulation. The TO-ACT randomized trial and large observational studies found no significant benefit of EVT over standard care in terms of functional outcome or mortality, and EVT may be associated with higher risk in patients with advanced radiographic signs (infarction, edema, hemorrhage) (37,38). Decompressive neurosurgery (craniectomy) is lifesaving in patients with large parenchymal lesions and impending herniation, with about one-third achieving independence at 6–12 months (39).

## 2.5. Evidence from African Countries

A total of 68 patients with a diagnosis of CVT were included in a study, which was performed at a referral hospital in Mogadishu, Somalia, from January 2019 to December 2023. A significant majority (98.53%) of these patients were females and in 20–40 years of age group (78.34%). Postpartum emerged as a strong risk factor for CVT (77.94% of the patients); pregnancy was also highly associated. Other potential risk factors including oral contraceptive use, recent major surgery, and severe anemia were also not significantly associated with CVT (which may be related to low prevalence or characteristics of this specific cohort). The dominant clinical symptoms were headache (98.53%), altered consciousness (83.82%), focal motor deficit (80.88%), and seizure (70.59%). The superior sagittal sinus was the most common site affected by thrombosis (57.35%), and postpartum CVT showed significant association with thrombotic localizations at the transverse and sigmoid sinuses, and internal jugular vein. This study highlights the significance of the

postpartum period as a risk factor for CVT in Somalia and highlights the importance of increased clinical vigilance and preventative intervention during this period in this population. (28)

On the other hand, a prospective Tunisian series of 41 CVT patients between January 2009 and December 2012 presented a distinct risk factor profile. The patients' mean age was 41.24 years and 68% of the patients were women. Headache was the most frequent presentation (83%) followed by seizures, focal motor deficit, papilledema and changes in mental status, and the major etiologies were thrombophilia (56%) obstetric/gynecological (50%) and septic (34%). In contrast to the Somali report, the use of oral contraceptives was not a significant risk factor among Tunisian patients. The most frequent anatomic sites of involvement were the lateral (56%) and superior longitudinal (51%) sinuses, with involvement of more than 1 sinus seen in 46% of cases. Overall prognosis was favorable in 83% with 78% recovering fully by final follow-up. This study highlights distinct risk factors in the Tunisian population, including a high frequency of thrombophilia and infections, alongside postpartum states, while demonstrating a generally good prognosis (33).

There are multiple case reports on CVT in different Ethiopian setups, but to date, no study has systematically assessed the prevalence and clinical characteristics of cerebral venous thrombosis in Ethiopia.

### **3. Objective**

#### **3.1. General objective**

To assess the prevalence and the clinical characteristics of cerebral venous thrombosis among patients admitted to adult medical wards of SPHMMC between September 2020 and August 2025.

#### **3.2. Specific objective**

- ❖ To determine the prevalence of cerebral venous thrombosis among medical ward admissions during the study period.
- ❖ To describe the clinical characteristics of patients diagnosed with cerebral venous thrombosis.

## 4. Methods

### 4.1. Study area and period

The study took place at St. Paul Hospital Millennium Medical College, one of the largest referral hospitals in Ethiopia. The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty services to patients who are referred from all over the country, teaching medicine and nursing students and doing basic and applied researches. While the inpatient capacity is more than 700 beds, the college sees an average of 1200 emergency and outpatient clients daily. In the Department of Internal Medicine, there are medical wards each having different capacity of beds that give care for patients with various medical problems. The study was conducted from September 20, 2025 - January 2, 2026.

### 4.2. Study design

The study was facility based descriptive cross-sectional study at the medical wards of SPHMMC, Addis Ababa, Ethiopia.

### 4.3. Source population

All patients admitted to the medical wards of SPHMMC, Addis Ababa, Ethiopia, from September 2020 to August 2025 will be considered as the source population.

### 4.4. Study population

The study population consisted of all patients from the source population who fulfilled the inclusion criteria during the study period.

### 4.5. Selection criteria

#### 4.5.1. Inclusion criteria

- Patients admitted to the medical wards of SPHMMC between September 2020 and August 2025.
- Patients with medical records sufficiently documented for analysis

#### 4.5.2. Exclusion criteria

- Charts with incomplete or missing key information.
- Repeat admissions of the same patient (only the first admission included).

#### 4.6. Sample size determination

The minimum required sample size for estimating the prevalence of cerebral venous thrombosis (CVT) was calculated using the single population proportion formula:

$$n_0 = \frac{Z_{\alpha/2}^2 p(1 - p)}{d^2}$$

Where:

$n$  = required sample size

$Z$  = standard normal value at 95% confidence level (1.96)

$p$  = estimated prevalence of CVT

$d$  = margin of error (0.05)

Since there was no prior local study to estimate the prevalence of CVT in similar setting, a proportion ( $p$ ) of 0.5 was used to obtain the maximum sample size.

Therefore:

$$n = (1.96)^2 \times 0.5 \times (1 - 0.5) / (0.05)^2$$

$$n = 384$$

Therefore, the minimum required sample size was **384**.

- However, due to the retrospective nature of the study, all available CVT cases during the study period were included. Accordingly, a total of **176 CVT cases** admitted in medical ward from September 2020 to August 2025 were analyzed.

- Accordingly, a total of 176 CVT cases that were admitted September 2020 to August 2025 were included in the analysis to achieve the objectives of the study.

#### 4.7 Study variables

- Presence of cerebral venous thrombosis (CVT)
- Clinical presentation of CVT
- Treatment outcomes of CVT
- Age
- Sex
- Residence
- Presenting symptoms
- Presence of infection

#### 4.8. Sampling method and procedure

A census sampling technique was employed, whereby all cases of cerebral venous thrombosis (CVT) with complete medical records and first-time diagnosis, documented in the adult medical ward of St. Paul's Hospital Millennium Medical College during the study period, were included. This approach ensured the inclusion of all eligible cases, thereby minimizing selection bias and providing a comprehensive assessment of the study population.

#### 4.9. Operational definition

Outcome: The recorded in-hospital discharge status for patients with CVT (improved, discharged with deficit, referred, or died).

#### 4.10. Data collection procedures and instruments

For this study, data was extracted retrospectively from patient's medical records, ward registries, radiology reports and laboratory registers of all consecutive patients admitted to the medical wards at SPHMMC with confirmed diagnosis of cerebral venous thrombosis from September 2020 to August 2025. Structured data extraction tool developed using the relevant literature and pre-tested on a small sample of charts was used to collect data on socio-demographic features, clinical presentation, risk factors, laboratory and imaging characteristics, treatment received, and outcomes of the patients using Google forms. Data collectors who are specially trained were acquired to extract data under the guidance of the principal investigator, and the completeness and consistency of the data was inspected daily. Non-eligible and charts with missing key information was excluded, and all collected data were anonymized prior to input into a secure electronic database.

#### 4.11. Data quality control

In order to secure the quality of the data, the data extraction tool was pretested and perfected prior to implementation. The data collectors were trained on how to use the tool, objectives and inclusion criteria. Daily supervision was done during data collection by the principal investigator where the extracted charts was randomly cross-checked for correctness and completeness. Differences was adjusted by discussion and consensus. Data was double-entered and checked for consistency at entry and missing or unclear data will be verified, wherever feasible, against the source documents. No data will be identifiable, and sensitive data remained confidential.

#### 4.12. Data processing and analysis

Following data collection, all data was reviewed for consistency, cleaned, coded and entered into IBM SPSS Statistics version 29.0. The data was summarized using descriptive statistics: categorical variables as frequencies and percentages, and continuous variables with measures of central tendency and dispersion (mean, median, standard deviation, and interquartile range as applicable). The prevalence of CVT was expressed as a percentage of the total number of medical ward admissions in the study period. The clinical features, risk factors, imaging findings, therapeutic options, and outcome of patients was described with tables and figures for easy understanding.

#### 4.13. Ethical consideration

Approval from SPHMMC public health department and institutional review board was received for this study before data collection. Since this is a retrospective chart review, there was no direct contact with patients and only existing medical records were used. All data was anonymized and personal identifiers removed, ensuring that patient confidentiality and privacy was kept to the highest standards. The results of the study were presented in a summary, meaning individual patients cannot be distinguished.

#### 4.14. Dissemination of study result

Results of this study was disseminated using a variety of channels to target both academic and clinical audiences. The result of this study will be presented to the Public Health Department of SPHMMC. The results were disseminated to the Department of Internal Medicine and Neurology Unit at SPHMMC for guiding clinical practice and quality improvement based on the evidence. Moreover, the study was submitted for publication in a medical journal to add evidence on CVT prevalence in Ethiopia. Key findings may also be disseminated at national and regional medical conferences, workshops and seminars to help in implementation of evidence-based management of CVT.

## 5. Result

### 5.1 Socio-demographic characteristics of the respondents

The demographic characteristics of the patients who participated in the study were as follows: Females constituted the majority of cases (73.3%, n = 129), resulting in a female-to-male ratio of approximately 2.7:1. Slightly more than half of the patients were from urban areas (53.4%, n = 94). Regarding occupation, office workers formed the largest group (41.5%, n = 73), followed by farmers (26.1%, n = 46). The age distribution indicated that cases of cerebral venous thrombosis were observed across all adult age groups. The highest proportion of patients fell within the 26–35year age category, followed by those aged 18–25 years.

Table 1 Sociodemographic characteristics of the participants

|            |                | Count | %     |
|------------|----------------|-------|-------|
| Age        | 18-25          | 42    | 23.9% |
|            | 26-35          | 56    | 31.8% |
|            | 36-45          | 33    | 18.8% |
|            | 46-55          | 22    | 12.5% |
|            | 56+            | 23    | 13.1% |
| Gender     | Male           | 47    | 26.7% |
|            | Female         | 129   | 73.3% |
| Address    | Urban          | 94    | 53.4% |
|            | Rural          | 82    | 46.6% |
| Occupation | office worker  | 73    | 41.5% |
|            | Farmer         | 46    | 26.1% |
|            | factory worker | 13    | 7.4%  |
|            | Student        | 25    | 14.2% |
|            | retired        | 19    | 10.8% |

## 5.2 Prevalence of Cerebral Venous Thrombosis

During the five-year study period, from September 2020 to August 2025, a total of 7,075 patients were admitted to the medical wards of St. Paul's Hospital Millennium Medical College. Among these admissions, 176 patients were diagnosed with cerebral venous thrombosis, resulting in an overall prevalence of 2.49% (95% confidence interval: 2.13% to 2.85%).

## 5.3 Clinical Presentation of Patients with Cerebral Venous Thrombosis

Among the 176 patients with cerebral venous thrombosis, headache was the most common presenting complaint, reported in 76.1% (n = 134) of cases, either alone or in combination with other symptoms. Focal neurological deficits were observed in 38.6% (n = 68), while altered level of consciousness was present in 35.8% (n = 63). Seizures occurred in 34.7% (n = 61) of patients. Less frequent presenting symptoms included vomiting in 21.6% (n = 38) and visual disturbances in 11.9% (n = 21). Multiple symptoms were common, with combinations such as headache with focal deficits (n=29) and headache with seizure(n=23) frequently reported, reflecting the variable and complex clinical presentations of these patients.

Table 2 *Clinical Presentation and Admission Characteristics*

|                                       |                          | Count | %      |
|---------------------------------------|--------------------------|-------|--------|
| Presenting Complaint                  | Headache                 | 134   | 76.1 % |
|                                       | Altered Consciousness    | 63    | 35.8%  |
|                                       | Seizure                  | 61    | 34.7%  |
|                                       | Altered Consciousness    | 63    | 35.8%  |
|                                       | Focal Neurologic Deficit | 68    | 38.6%  |
|                                       | Vomiting                 | 38    | 21.6%  |
| GCS on Admission                      | Best (13-15)             | 106   | 60.2%  |
|                                       | Moderate (9-12)          | 52    | 29.5%  |
|                                       | Worse (3-8)              | 18    | 10.2%  |
| Duration of Symptoms before Admission | < 24 hours               | 36    | 20.5%  |
|                                       | > 2 weeks                | 7     | 3.9%   |

|  |           |    |       |
|--|-----------|----|-------|
|  | 1-2 weeks | 14 | 7.95% |
|  | 1-3 days  | 68 | 38.6% |
|  | 4-7 days  | 51 | 28.8% |

As shown below, at least one comorbidity was present in 80.1% (n= 141) of patients. The most common comorbid conditions were hypertension (40.9%), diabetes mellitus (32.3%), HIV infection (17.0%), malignancy (15.3%), and thrombophilia (5.6%). Multiple comorbidities were common.

A recent infection was identified in 27.3% of patients, while 58.5% had no infection, and 14.2% had unknown infection status. Among patients with infection, the site of infection was broadly distributed without a single dominant focus.

Recent head trauma or neurosurgical procedures were reported in 28.4%, while 64.2% had no such history.

Among female patients, 28.4% were in the puerperium, 13.6% were pregnant at presentation, and 33.3% had recent oral contraceptive or hormonal therapy use. Among OCP users, 86% had used it for less than five years.

Table 3 Clinical Risk Factors and Comorbid Conditions for the respondents

|                                           |               | Count | %     |
|-------------------------------------------|---------------|-------|-------|
| Comorbidities                             | Hypertension  | 72    | 45.0% |
|                                           | DM            | 57    | 35.6% |
|                                           | HIV AIDS      | 30    | 18.8% |
|                                           | Malignancy    | 27    | 16.9% |
|                                           | Thrombophilia | 10    | 6.3%  |
| Presence of Infection                     | None          | 103   | 58.5% |
|                                           | Unknown       | 25    | 14.2% |
|                                           | Yes           | 48    | 27.3% |
| Recent Head Trauma/<br>Surgical Procedure | No            | 113   | 64.2% |
|                                           | Unknown       | 13    | 7.4%  |
|                                           | Yes           | 50    | 28.4% |
|                                           | Neither       | 97    | 55.1% |

|                                       |            |    |       |
|---------------------------------------|------------|----|-------|
| Pregnant / within 6 weeks post-partum | Pregnant   | 24 | 13.6% |
|                                       | Puerperium | 50 | 28.4% |
|                                       | Unknown    | 5  | 2.8%  |

Among the total study participants, 48 (27.3%) had a documented infection. The most commonly involved site was systemic or multi-organ infection, accounting for 17 (35.4%) cases, followed by respiratory infections in 7 (14.6%) and central nervous system infections in 6 patients (12.5%)

Table 4: Distribution of Sites of Infection Among CVT Patients with Documented Infection (n = 48)

| Site of Infection      | Count | Percent (%) |
|------------------------|-------|-------------|
| Systemic / Multi-organ | 17    | 35.4        |
| Respiratory            | 7     | 14.6        |
| Central nervous system | 6     | 12.5        |
| Gastrointestinal       | 7     | 14.6        |
| Cardiovascular         | 4     | 8.3         |
| Genitourinary          | 4     | 8.3         |
| Skin and soft tissue   | 2     | 4.2         |
| Dental or Oral         | 1     | 2.1         |

### 5.3 Lifestyle and Hormonal Risk Factors

Overall, 56.2% of patients had a history of alcohol use (current or former), while 34.1% had never used alcohol. Alcohol use status was unknown in 9.7%.

Cigarette smoking history was present in 50.6% (current or former smokers), 34.1% had never smoked, and 15.3% had unknown smoking status. Among smokers, duration of smoking varied widely.

Table 5 Lifestyle and Hormonal Risk Factors of respondents

|                                             |         | Count | %     |
|---------------------------------------------|---------|-------|-------|
| Alcohol Use                                 | Current | 53    | 30.1% |
|                                             | Former  | 46    | 26.1% |
|                                             | Never   | 60    | 34.1% |
|                                             | Unknown | 17    | 9.7%  |
| Duration of years used Alcohol              | 0       | 77    | 43.8% |
|                                             | <5      | 24    | 13.6% |
|                                             | >20     | 19    | 10.8% |
|                                             | 10-20   | 21    | 11.9% |
|                                             | 5-10    | 35    | 19.9% |
| Cigarette Smoking                           | Current | 56    | 31.8% |
|                                             | Former  | 33    | 18.8% |
|                                             | Never   | 60    | 34.1% |
|                                             | Unknown | 27    | 15.3% |
| Duration of years Smoked                    | 0       | 87    | 49.4% |
|                                             | <5      | 27    | 15.3% |
|                                             | >20     | 14    | 8.0%  |
|                                             | 10-20   | 21    | 11.9% |
|                                             | 5-10    | 27    | 15.3% |
| Recent or Current OCP/ Hormonal therapy Use | Yes     | 47    | 26.7% |
|                                             | No      | 116   | 65.9% |
|                                             | Unknown | 17    | 7.9%  |
| Duration of OCP use                         | 0       | 133   | 75.6% |

|                                 |       |    |       |
|---------------------------------|-------|----|-------|
| (If yes for the above question) | <5    | 37 | 21.0% |
|                                 | 10-20 | 1  | 0.6%  |
|                                 | 5-10  | 5  | 2.8%  |

#### 5.4 Laboratory and Imaging Findings

Laboratory investigations on admission showed that around one-third of patients had hematological or coagulation abnormalities, with the most frequent being abnormal INR (43%) and haemoglobin. MR venography was the most frequently used imaging modality (73.3%), followed by CT venography (18.8%) and conventional angiography (8.0%), revealing the superior sagittal sinus as the most commonly involved site (47%), followed by the transverse (27%) and sigmoid sinuses (20%). Deep venous system involvement was less frequent (7%). Multiple sinus involvement occurred in several cases.

Table 6 Laboratory finding of respondents

| Parameter                          | N   | Mean $\pm$ SD       | Normal (%)  | Abnormal (%) |
|------------------------------------|-----|---------------------|-------------|--------------|
| Hemoglobin (g/dL)                  | 176 | 12.9 $\pm$ 2.3      | 109(61.9%)  | 67 (38.1%)   |
| WBC count (cells/mm <sup>3</sup> ) | 176 | 10679 $\pm$ 6290    | 128 (72.7%) | 48 (27.3%)   |
| Platelets (cells/mm <sup>3</sup> ) | 176 | 233339 $\pm$ 109351 | 129 (73.3%) | 47 (26.7%)   |
| INR                                | 176 | 1.2 $\pm$ 0.4       | 101 (57.4%) | 75 (42.6%)   |
| PT (sec)                           | 176 | 12.9 $\pm$ 1.7      | 132 (75%)   | 44 (25%)     |
| aPTT (sec)                         | 176 | 33.2 $\pm$ 6.3      | 124 (70.5%) | 52(29.5%)    |

## 5.5 Treatment and outcome

Anticoagulation therapy was initiated in 90.9% of patients. ICU care was required in 10.8%, while 86.9% were managed without ICU admission. In-hospital complications occurred in 50% of patients. The most frequent complication was infection (62.5%), followed by major bleeding (44.3%) and recurrent thrombosis (28.4%). Mixed complications were observed in 35.2% of those with complications.

At discharge, 68.2% of patients were discharged improved, 12.5% worsened, 13.6% showed no clinical change, and 5.7% died during hospitalization

Table 7 Treatment and outcome of respondents

|                           |                      | Count | %     |
|---------------------------|----------------------|-------|-------|
| Anticoagulation Started   | No                   | 16    | 9.1%  |
|                           | Yes                  | 160   | 90.9% |
| ICU Care Required         | No                   | 153   | 86.9% |
|                           | Unknown              | 4     | 2.3%  |
|                           | Yes                  | 19    | 10.8% |
| In Hospital Complications | None                 | 88    | 50.0% |
|                           | Infection            | 32    | 18.2% |
|                           | Major Bleeding       | 15    | 8.5%  |
|                           | Recurrent thrombosis | 10    | 5.7%  |
| Discharge status          | Improved             | 120   | 68.2% |
|                           | No Change            | 24    | 13.6% |
|                           | Worsened             | 22    | 12.5% |
|                           | Died                 | 10    | 5.7%  |

## 6. Discussion

This study assessed the prevalence and clinical characteristics of cerebral venous thrombosis (CVT) among patients admitted to St. Paul's Hospital Millennium Medical College over a five-year period.

In this study, cerebral venous thrombosis accounted for 2.49% of all medical admissions over a five-year period, indicating that CVT is not an uncommon condition in this tertiary care setting. The higher prevalence observed in this study can be largely attributed to the role of St. Paul's Hospital Millennium Medical College as a major referral center, to which complicated and suspected CVT cases are frequently referred from peripheral hospitals. Consequently, this referral pattern results in a concentration of more severe and diagnostically complex cases, thereby inflating hospital-based prevalence estimates compared with population-level data.

The marked female predominance observed in this study, with nearly three-quarters of patients being women, is consistent with the well-documented association between CVT and female-specific risk factors such as pregnancy, puerperium, and hormonal therapy use. This finding aligns with studies from Tunisia and USA, although the female proportion in this study was lower than that reported from Somalia, where postpartum CVT accounted for the vast majority of cases (28,33). The relatively lower female predominance in the present study may reflect a more heterogeneous risk factor profile, including a higher burden of comorbid conditions such as hypertension, diabetes mellitus, and HIV infection, which affect both sexes.

The predominance of young adults, particularly those aged 26–35 years, is consistent with findings from study across India and Netherland studies that identify cerebral venous thrombosis as a condition predominantly affecting young and middle-aged individuals. (13,40). This age distribution underscores the substantial socioeconomic impact of CVT, as it affects individuals in their most productive years.

Headache was the most frequent presenting symptom, occurring in more than three-quarters of patients, which is consistent with previous studies reporting headache in up to 90% of CVT cases, describing headache as the hallmark symptom of cerebral venous thrombosis. Focal neurological deficits, seizures, and altered level of consciousness were also common, occurring

in approximately one-third of patients, a pattern that closely parallels findings from studies in Norway and Africa (5,33). The frequent coexistence of multiple symptoms highlights the diagnostic challenge of CVT and supports existing recommendations that CVT should be considered in young patients presenting with atypical headache and neurological deficits, even in the absence of traditional vascular risk factors.

The majority of patients presented with preserved consciousness, as evidenced by a Glasgow Coma Scale score of 13–15 in over 60% of cases, which is comparable to reports from Asia hospital-based studies and suggests that many patients were identified before progression to severe neurological deterioration (40). However, nearly 40% of patients presented with moderate to severe impairment of consciousness, highlighting the potential for delayed diagnosis in a subset of cases.

A key finding of this study is the high prevalence of comorbid conditions, with more than 80% of patients having at least one comorbidity. Hypertension and diabetes mellitus were particularly common, a pattern that contrasts with many studies in Latin America and USA where inherited thrombophilia and oral contraceptive use are the dominant risk factors (33,34). This difference likely reflects the growing burden of non-communicable diseases in Ethiopia and suggests that cardiovascular risk factors may play a more significant role in CVT pathogenesis in this population. The relatively low frequency of diagnosed thrombophilia may be due to limited access to specialized laboratory testing, a challenge that has also been reported in other African studies. In contrast, studies from Europe report higher rates of thrombophilia, likely reflecting more comprehensive diagnostic evaluations.

Pregnancy and puerperium were important risk factors in this study, with more than one-quarter of female patients presenting in the postpartum period, consistent with findings from Somalia and Tunisia where obstetric-related CVT remains prominent (28). However, the proportion of postpartum CVT was lower than that reported in the Somali study, suggesting possible differences in obstetric care, referral patterns, and population characteristics. Oral contraceptive and hormonal therapy use was also common but predominantly of short duration, differing from study conducted in Italy and Norway where long-term OCP use is more frequently reported

(5,16). These variations may be influenced by differences in contraceptive practices, access to healthcare, and cultural factors.

Imaging findings in this study showed predominant involvement of the superior sagittal sinus, followed by the transverse and sigmoid sinuses, which is consistent with study across Asia (41). The widespread use of MR venography reflects adherence to current diagnostic standards and likely contributed to improved case detection. Laboratory abnormalities, particularly coagulation disturbances and anemia, were frequently observed and may reflect the combined effects of systemic illness, infection, and underlying comorbidities, which are common in low-resource settings.

Most patients in this study received anticoagulation therapy in accordance with international guidelines, and the majority showed clinical improvement at discharge (3). The in-hospital mortality rate of 5.7% is within the range of reported mortality rates of 5–15% in study conducted across 21 countries, suggesting that outcomes in this setting are similar to those observed in other countries (42). The relatively high rate of in-hospital complications, particularly infections and bleeding, may be related to delayed presentation, severity of illness at admission, and the high burden of comorbid conditions, emphasizing the need for early diagnosis and multidisciplinary management.

Overall, this study provides important evidence that CVT in Ethiopia shares many clinical characteristics with CVT reported elsewhere, while also demonstrating distinct patterns related to comorbidities and risk factors. These findings highlight the importance of maintaining a high index of suspicion for CVT in young adults, particularly women and patients with systemic comorbidities, and underscore the need for improved diagnostic capacity and targeted preventive strategies in this setting.

## 7. Strength and limitation of the study

- ✓ The strength of the study was the use of both quantitative and qualitative data, including comprehensive clinical, imaging, laboratory, and procedural information, which allowed for a detailed assessment of the prevalence and clinical characteristics of cerebral venous thrombosis.
- ✓ The study has the following limitations:
  - Single-center study at a tertiary referral hospital, limiting generalizability.
  - Some data relied on patient recall, which may introduce reporting bias.
  - long-term follow-up data on functional recovery and recurrence were not included.

## 8. Conclusion and recommendation

### 8.1 Conclusion

- ✓ This study provides assessment of cerebral venous thrombosis in Ethiopia, revealing a prevalence of 2.49% among medical ward admissions at St. Paul's Hospital. CVT predominantly affected young adults, particularly women, with the highest burden among those aged 26–35 years. Headache was the most common presenting symptom, often accompanied by focal neurological deficits, seizures, or altered consciousness. Superior sagittal sinus involvement was most frequent, and anticoagulation therapy was successfully initiated in the majority of patients. Although in-hospital mortality was relatively low (5.7%), complications such as infections and bleeding were common, highlighting the importance of early recognition, timely treatment, and careful monitoring. The study also underscores the contribution of comorbidities, postpartum state, and lifestyle factors to disease severity and outcomes.

### 8.2 Recommendation

Based on this study, the following recommendations were forwarded:

#### **Ethiopia Ministry of Health and Regional Health Bureaus:**

- Strengthen capacity for CVT diagnosis and management at tertiary hospitals, including access to neuroimaging and laboratory investigations.
- Support training programs for clinicians and healthcare providers on CVT risk factors, presentations, and management.

#### **St. Paul's Hospital Millennium Medical College Administrative Department:**

- Ensure early recognition of CVT by maintaining high clinical suspicion in young adults, particularly women with headache and neurological deficits.
- Implement standardized protocols for anticoagulation and multidisciplinary management to minimize complications.

#### **Researchers and Academic Institutions:**

- Conduct multicenter and population-based studies to better understand CVT epidemiology, risk factors, and long-term outcomes in Ethiopia.

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## 10. Annexes

### Annex I: CVT data extraction form

**Study ID:** \_\_\_\_\_

**Date of Data Collection:** \_\_\_\_\_

**Data Collector:** \_\_\_\_\_

| No.  | Part I: Socio-demographic information       | Response                                                                                                                                                |
|------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 101. | Age                                         |                                                                                                                                                         |
| 102. | Gender                                      | A. Male<br>B. Female                                                                                                                                    |
| 103. | Address                                     | A. Rural<br>B. Urban                                                                                                                                    |
| 104. | Occupation                                  | A. Office worker<br>B. Farmer<br>C. Factory worker<br>D. Student<br>E. Retired<br>F. other(specify):_____                                               |
|      | <b>Part II: Clinical Picture</b>            |                                                                                                                                                         |
| 201. | Presenting complaint (check all that apply) | A. Headache<br>B. Seizure<br>C. Focal neurologic deficit<br>D. Vomiting<br>E. Altered consciousness<br>F. Visual disturbance<br>G. Other(specify) ..... |
| 202. | GCS on admission                            |                                                                                                                                                         |
| 203. | Duration of symptoms before admission       |                                                                                                                                                         |

|                                    |                                                                      |                                                                                                               |
|------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 204.                               | Comorbidities (check all that apply)                                 | A. Hypertension<br>B. DM<br>C. Malignancy<br>D. HIV/AIDS<br>E. Thrombophilia<br>F. Other: _____<br>G. Unknown |
| 205.                               | Presence of infection                                                | A. None<br>B. Yes (site: _____)<br>C. Unknown                                                                 |
| 206.                               | Recent head trauma or neurosurgical procedure                        | A. Yes<br>B. No<br>C. Unknown                                                                                 |
| 207.                               | Pregnant or within 6 weeks postpartum at presentation (Females only) | A. Pregnant<br>B. Puerperium<br>C. Neither<br>D. Unknown                                                      |
| <b>Part III: Lifestyle factors</b> |                                                                      |                                                                                                               |
| 301.                               | Alcohol use                                                          | A. Current<br>B. Former<br>C. Never<br>D. Unknown                                                             |
| 302.                               | Cigarette smoking                                                    | A) Current<br>B) Former<br>C) Never<br>D) Unknown                                                             |
| 303.                               | Current/recent OCP or hormonal therapy (Females only)                | A. Yes<br>B. No                                                                                               |

|      |                                                  |                                                                                                                                                                                          |
|------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                                                  | C. Unknown                                                                                                                                                                               |
|      | <b>Part IV: Investigation results</b>            |                                                                                                                                                                                          |
| 401. | Hemoglobin (g/dL) closest to admission           |                                                                                                                                                                                          |
| 402. | WBC count (cells/mm <sup>3</sup> )               |                                                                                                                                                                                          |
| 403. | Platelets (cells/mm <sup>3</sup> )               |                                                                                                                                                                                          |
| 404. | INR/PT/aPTT                                      |                                                                                                                                                                                          |
| 405. | Imaging modality used                            | A. CT venography<br>B. MR venography<br>C. Conventional angiography<br>D. Other: _____                                                                                                   |
| 406. | Location/venous sinuses involved seen on imaging | A. Superior sagittal sinus involvement<br>B. Transverse sinus involvement<br>C. Sigmoid sinus involvement<br>D. Deep venous system involvement (internal cerebral veins, straight sinus) |
|      | <b>Part V: Treatment and Outcome</b>             |                                                                                                                                                                                          |
| 501. | Anticoagulation started                          | A) Yes<br>B) No<br>C) Unknown                                                                                                                                                            |
| 502. | ICU care required                                | A. Yes<br>B. No<br>C. Unknown                                                                                                                                                            |
| 503. | In-hospital complications                        | A. Recurrent thrombosis<br>B. Major bleeding<br>C. Infection<br>D. Other: _____                                                                                                          |
| 504. | Length of hospital stay (days)                   |                                                                                                                                                                                          |

|      |                  |                                                       |
|------|------------------|-------------------------------------------------------|
| 505. | Discharge status | A. Improved<br>B. No change<br>C. Worsened<br>D. Died |
|------|------------------|-------------------------------------------------------|

## Declaration

I the undersigned investigator declare that this proposal paper is my original work, to be submitted to the School of Public Health, St. Paul Hospital Millennium Medical College in Partial fulfillment of the requirements for Medical Doctors Degree. Up to my knowledge, it has never been presented in this or any higher institution and all the resources and materials used in this proposal preparation have duly acknowledged. I also agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will communicate in a timely to my advisors and all stakeholders involved in the study, including any source of funding for this research.

Name of the investigator: Dr. Biruk Wubneh Tsige

Signature: 

Date: March, 2026 G.C

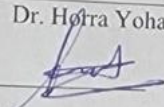
### Approval of Advisors:

Name of the primary advisor: Mr. Getachew Tilahun

Signature: 

Date: March 2026 G.C

Name of the Co-Advisor: Dr. Haila Yohanis

Signature: 

Date: March 2026 G.C

