

Study of Radioclinical and Risk Factors of Cerebral Venous Thrombosis: A Retrospective Analysis of Patients Presenting to a Tertiary Hospital in Mogadishu, Somalia

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Background: Cerebral venous thrombosis (CVT) is a rare but potentially life-threatening condition characterized by the formation of a blood clot in the dural venous sinuses or cerebral veins. CVT presents a diverse array of clinical symptoms, making its diagnosis challenging. Understanding regional variations and specific risk factors associated with CVT is crucial, especially in low-resource settings like Somalia, where epidemiological data is limited and healthcare resources are scarce.

Objective: This study aims to investigate the clinical and risk factors associated with CVT in patients presenting to Mogadishu Somali-Turkey Recep Tayyip Erdogan Research and Training Hospital, a tertiary hospital in Mogadishu, Somalia.

Methods: We conducted a retrospective observational study involving 68 patients diagnosed with CVT between January 2019 and December 2023. Data included demographic information, clinical presentations, risk factors, and anatomical thrombosis locations. Descriptive statistics and chi-square tests were used for analysis.

Results: The majority of patients were female (86.76%) and aged 20–40 years (86.76%). Significant risk factors included the postpartum period (77.94%) and pregnancy, with statistical analysis showing strong associations between CVT and the postpartum period ($\chi^2 = 62.96$, $p < 0.0001$) and pregnancy ($\chi^2 = 5.21$, $p = 0.022$). Postpartum CVT was linked to thrombosis location ($p = 0.025$). Headache was the predominant symptom (98.53%), followed by altered mental status (83.82%), focal motor deficits (80.88%), and seizures (70.59%). The superior sagittal sinus was the most commonly involved site (57.35%).

Conclusion: This study emphasizes the postpartum period as a significant risk factor for CVT in Somalia and highlights the need for clinical vigilance and early intervention strategies. Larger, multicenter studies are needed to validate these findings.

Keywords: cerebral venous thrombosis, CVT, postpartum, pregnancy, risk factors, Somalia, regional study

Introduction

Cerebral venous thrombosis (CVT) is an infrequent but grave disorder characterized by the formation of a blood clot in the dural venous sinuses or cerebral veins. Globally, CVT accounts for 0.5–1% of all strokes, with an estimated incidence of 3–4 cases per million annually. While predominantly affecting young to middle-aged women, the condition remains underdiagnosed due to its diverse clinical presentations.¹ Diagnosing CVT might be challenging owing to its extensive array of symptoms. CVT can be caused by a range of events, including as pregnancy, the postpartum period, oral contraceptive usage, recent major surgery, severe anemia, and other clinical disorders.² It is crucial to comprehend the

variations in regions and the particular variables that increase the risk of CVT in order to improve the diagnosis, treatment, and results for patients.³ In many low- and middle-income countries (LMICs), healthcare systems are often ill-equipped to handle complex conditions such as CVT, where advanced diagnostic tools are essential. For instance, in sub-Saharan Africa and Southeast Asia, pregnancy-related CVT, particularly in the postpartum period, is a well-recognized risk factor. This is primarily due to insufficient access to prenatal and maternal healthcare services, including the lack of routine thromboprophylaxis for at-risk populations.^{4,5} In Somalia, there is a scarcity of data on cerebral venous thrombosis (CVT), which underscores the overall deficiency of research in several low-resource settings.⁶ The lack of information in this area poses considerable difficulties for healthcare personnel, since they have to identify and treat this ailment without adequate data available in their immediate vicinity. Performing geographically focused investigations is essential for creating precise therapies and enhancing patient results.⁷ This study retrospectively examines patients who were admitted to Mogadishu Somali-Türkiye Recep Tayyip Erdoğan Eğitim ve Araştırma Hastanesi, a tertiary hospital in Mogadishu, Somalia. This study aims to identify radioclinical patterns and risk factors of CVT, with findings that could inform and improve clinical management in low-resource settings such as Somalia. Additionally, these findings have implications for public health strategies, including community education, antenatal care improvements, and targeted thromboprophylaxis programs for high-risk populations.⁸

Methodology

Study Design

The tertiary hospital in Mogadishu, Somalia, conducted this retrospective, observational study with the goal of examining the radioclinical and risk factors associated with cerebral venous thrombosis (CVT).

Study Setting and Population

The study was conducted at Mogadishu Somali, Turkey Recep Tayyip research and training hospital. All patients diagnosed with CVT and admitted to the hospital between January 2019 and December 2023 comprised the study population. We collected data retrospectively from the hospital's electronic medical records system.

Inclusion Criteria

The study included patients who meet the following criteria:

1. Diagnosed with CVT based on clinical presentation and confirmed by neuroimaging (MRI or CT venography). Specifically, Magnetic Resonance Imaging (MRI) with Magnetic Resonance Venography (MRV) or Computed Tomography (CT) with CT Venography (CTV) were employed, as these modalities are standard for identifying thrombosis in the cerebral venous sinuses.
2. Age 18 years and older.
3. Complete medical records are available, including demographic data, clinical presentation, and radiological findings.

Exclusion Criteria

We excluded patients from the study if:

1. Had incomplete medical records.
2. We were diagnosed with CVT but lacked radiological confirmation.
3. Were below the age of 18 years.

Data Collection

Data were collected retrospectively from electronic medical records. Variables included demographic data (age, sex), clinical presentations (headache, seizure, focal motor deficit, altered mental status, cranial nerve palsy, infection), risk factors

(pregnancy/postpartum, oral contraceptive use, recent major surgery, severe anemia, history of migraine headaches), and anatomical locations of thrombosis (superior sagittal sinus, transverse sinus, sigmoid sinus, cortical veins, inferior sagittal sinus, deep dural sinus, cavernous sinus, internal jugular vein). Data on malignancies, blood dyscrasias, diabetes mellitus, hypertension, cardiac disorders, and coagulation factors (eg, D-dimer, fibrinogen, thromboelastography) were not systematically collected due to the retrospective nature of the study and limitations in routine testing in our setting.

Statistical Analysis

Descriptive statistics were calculated for all variables. Means and standard deviations were calculated for continuous variables (eg, age). Counts and percentages were calculated for categorical variables (eg, sex, clinical presentations, risk factors, anatomical locations).

Chi-square tests were conducted to assess the associations between various clinical presentations, risk factors, and the occurrence of CVT. A p-value of less than 0.05 was considered statistically significant.

Results

The study included 68 patients diagnosed with cerebral venous thrombosis (CVT). The majority of patients were female 67 (98.53%) and the predominant age group was 20–40 years (59, 86.76%) (see [Table 1](#)). A significant number of patients (50, 73.53%) developed CVT in the postpartum period. Other risk factors included the use of oral contraceptives (5, 7.35%), recent major surgery (5, 7.35%), severe anemia (19, 27.94%), and a history of migraine headaches (8, 11.76%). The most common initial symptom was headache (67, or 98.53%), followed by seizures (48, or 70.59%), focal motor deficits (55, or 80.88%), and changes in mental status (57, or 83.82%) (see [Table 2](#)). The superior sagittal sinus

Table 1 Demographic Distribution of the Study Population

Age Group	Female	Male
Age 20–40 years	59	0
Age 40–60 years	4	1
Less than 20 years	4	0

Table 2 Frequency of Clinical Presentations and Risk Factors

Clinical Presentation	No	Percentages	Yes	Percentages
Pregnancy/Postpartum	15	22.06%	53	77.94%
Oral Contraceptives use	63	92.65%	5	7.35%
Recent Major surgery	63	92.65%	5	7.35%
Severe anemia	49	72.06%	19	27.94%
History of Migraine Headache	60	88.24%	8	11.76%
Headache at Presentation	1	1.47%	67	98.53%
Presenting with Seizure	20	29.41%	48	70.59%
Presenting with Focal Motor Deficit	13	19.12%	55	80.88%
Presenting with Altered Mental Status	11	16.18%	57	83.82%
Presenting with cranial nerve palsy	46	67.65%	22	32.35%
Presenting with Infection	63	92.65%	5	7.35%

Table 3 Anatomical Locations of Thrombosis

Anatomical Location	NO	Percentages	Yes	Percentages
Superior sagittal sinus involvement	29	42.65%	39	57.35%
Inferior sagittal Sinus involvement	66	97.06%	2	2.94%
Transverse sinus involvement	42	61.76%	26	38.24%
Sigmoid sinus involvement	60	88.24%	8	11.76%
Cortical veins involvement	64	94.12%	4	5.88%
Deep dural sinus involvement	66	97.06%	2	2.94%
Cavernous sinus involvement	66	97.06%	2	2.94%
Internal jugular vein involvement	66	97.06%	2	2.94%

Table 4 Chi-Square Test Results for the Association Between Risk Factors and Thrombosis Location in CVT Patients

Risk Factor	Chi-square Statistic	P-value
Developed CVT in the postpartum period	19.38	0.025
Pregnancy	10.85	0.022
Oral Contraceptives use	7.34	0.911
Recent Major surgery	8.56	0.835
History of smoking	0.00	1.000
Severe anemia	9.88	0.597
History of Migraine Headache	10.26	0.475

was the most commonly involved site (39, 57.35%), followed by the transverse sinus (26, 38.24%), and the sigmoid sinus (8, 11.76%) (see Table 3). The Chi-square test showed a significant association between postpartum period CVT and thrombosis location ($\chi^2 = 19.38$, $df = 8$, $p = 0.025$), indicating that specific anatomical sites, such as the transverse sinus, sigmoid sinus, and internal jugular vein, are more frequently affected in postpartum women. (see Table 4). This study elucidates the critical risk factors and clinical presentations associated with CVT in a Somali tertiary hospital setting. The significant associations found with the postpartum period highlight key areas for clinical focus. Although we included all CVT patients in our hospital, surprisingly, most were female (67 out of 68), predominantly in the postpartum and pregnancy periods. The study's limitations, such as sample size and potential data variability, warrant cautious interpretation of these findings. Future research with larger, more diverse populations is necessary to validate these results and further explore the underlying mechanisms.

Discussion

This study examined 68 patients diagnosed with cerebral venous thrombosis (CVT) at a tertiary hospital in Mogadishu, Somalia. The demographic analysis revealed that the majority of patients were female (86.76%) and within the age group of 20–40 years (86.76%). A significant number of patients developed CVT in the postpartum period (73.53%). The study found significant associations between CVT and both the postpartum period and pregnancy, while other factors such as oral contraceptive use, recent major surgery, and severe anemia did not show statistically significant associations. The significant association between the postpartum period and cerebral venous thrombosis (CVT) in our study can be

attributed to the well-documented hypercoagulable state that occurs during pregnancy and extends into the postpartum period. This state is characterized by increased levels of clotting factors and decreased levels of natural anticoagulants, which collectively enhance the risk of thrombotic events. Several studies have consistently demonstrated this association, highlighting the postpartum period as a critical time for the development of thrombotic conditions, including CVT.⁹ The hypercoagulable state in the postpartum period is physiologically driven by multiple factors, including hormonal changes, increased blood volume, and vascular injury that may occur during childbirth. Additionally, immobility and dehydration, which are more common in the postpartum period, further contribute to the risk of thrombosis.² This complex interplay of factors creates a prime environment for the development of CVT, necessitating vigilant monitoring and preventive measures in postpartum women. Our study also found that pregnancy, independent of the postpartum period, is a significant risk factor for CVT. The physiological changes during pregnancy, such as increased levels of estrogen and progesterone, lead to alterations in the coagulation and fibrinolytic systems, promoting a prothrombotic state. This state is compounded by increased blood volume and pressure on the venous system due to the growing fetus, which can result in venous stasis and increased likelihood of thrombus formation.¹⁰ The significance of pregnancy as an independent risk factor aligns with existing literature, which has documented similar findings. A study by Coutinho et al found that the risk of CVT is significantly elevated during pregnancy and the postpartum period, with the highest risk occurring in the first few weeks postpartum.¹¹ This emphasizes the need for heightened awareness and preventive strategies during both pregnancy and the postpartum period to mitigate the risk of CVT. In contrast to the significant associations with the postpartum period and pregnancy, our study did not find significant associations between CVT and other potential risk factors, such as oral contraceptive use, recent major surgery, and severe anemia. This lack of significant association may be due to several factors specific to our study population and methodology.

Oral contraceptive use has been widely recognized as a risk factor for CVT due to its influence on coagulation pathways, our study did not find a significant association. This discrepancy may be attributable to the low prevalence of oral contraceptive use in our study population, which could reduce the power to detect a significant association.¹² Major surgery is another recognized risk factor for thrombosis due to factors such as immobility, inflammation, and changes in blood flow. However, our study's lack of significant association with recent major surgery might reflect the specific characteristics of our cohort, including the type and frequency of surgeries performed.¹³ Furthermore, severe anemia, which can contribute to hypercoagulability through various mechanisms, did not show a significant association with CVT in our study. This may be due to the heterogeneity in the causes and severity of anemia among participants.¹⁴ In the context of Africa, and more specifically Somalia, there is limited data on the epidemiology and risk factors of CVT. Our study contributes to the existing body of knowledge by providing insights into the demographic and clinical characteristics of CVT patients in this region. Compared to data from other African regions, our findings on the prominence of the postpartum period as a risk factor align with those reported in studies from Nigeria and Sudan, where similar associations have been observed.¹⁵

However, there are notable differences. For instance, in some studies conducted in South Africa, HIV infection has been identified as a major risk factor for CVT, which was not assessed in our study due to the retrospective nature and lack of comprehensive testing for all patients.¹⁶ This highlights the need for region-specific studies to fully understand the epidemiological variations and risk factors pertinent to each population. Our study underscores the critical importance of the postpartum period as a risk factor for CVT in Somalia. This finding is consistent with global literature but adds specific regional data that can help tailor public health interventions and clinical practices in similar settings. By identifying the postpartum period as a significant risk factor, our study emphasizes the need for heightened vigilance and early intervention strategies for postpartum women in Somalia and potentially other regions with similar demographics.¹⁷

Our study also found a significant association between CVT occurring in the postpartum period and specific anatomical locations of thrombosis ($\chi^2 = 19.38$, $df = 8$, $p = 0.025$). Specifically, the superior sagittal sinus, transverse sinus, sigmoid sinus, were more frequently affected in postpartum women. Indicating that Diagnostic imaging should prioritize the superior sagittal sinus, transverse sinus, sigmoid sinus, in postpartum women to ensure early and accurate detection of CVT.

Surprisingly, although we included our study all CVT patients admitted to our hospital, our data suggests that most CVT patients seen in our tertiary hospital developed the condition during the postpartum period. This regional variation underscores the need for tailored healthcare strategies that address the specific risk profiles and healthcare needs of the local population. Understanding these regional variations can inform better healthcare policies and targeted interventions, ultimately improving patient outcomes in this high-risk group.

Additionally, our study highlights the need for further research into other potential risk factors, such as genetic hypercoagulability disorders and comorbid conditions like systemic lupus erythematosus and malignancies, which were not investigated in our study due to technical limitations. This gap presents an opportunity for future studies to explore these areas and provide a more comprehensive risk profile for CVT in the region.¹⁸ The clinical implications of this study underscore the importance of close monitoring and proactive management of women in the postpartum period to mitigate the risk of CVT. The significant association between the postpartum period and CVT suggests that healthcare providers should be particularly vigilant in monitoring for signs and symptoms of CVT in postpartum women.¹⁹ Early identification and intervention are crucial to prevent severe complications associated with CVT. Healthcare providers should consider implementing routine screening protocols for postpartum women, especially those presenting with symptoms indicative of CVT, such as headaches, seizures, focal neurological deficits, and altered mental status.²⁰ These symptoms should prompt immediate diagnostic evaluation, including neuroimaging, to confirm or rule out CVT. Early treatment with anticoagulant therapy, such as heparin, can significantly improve outcomes for patients diagnosed with CVT.¹ Educational initiatives aimed at healthcare professionals can also play a vital role in improving the early recognition and management of CVT. Training programs that focus on the risk factors, clinical presentations, and diagnostic approaches for CVT can enhance the clinical skills of healthcare providers, leading to better patient outcomes. Furthermore, public health strategies should include educating women about the signs and symptoms of CVT, particularly those who are pregnant or in the postpartum period. Raising awareness can empower women to seek medical attention promptly if they experience any concerning symptoms, thereby facilitating early diagnosis and treatment.

Study Limitations

The retrospective design may introduce information bias due to its reliance on existing medical records. Our study did not include data on malignancies, blood dyscrasias, diabetes mellitus, hypertension, cardiac disorders, or detailed coagulation profiles, such as D-dimer levels or thromboelastography. This limitation reflects the challenges of retrospective data collection in low-resource settings and underscores the need for prospective studies to explore these additional factors.

The relatively small sample size limits the ability to perform detailed subgroup analyses, but the dataset is still valuable for highlighting key regional findings. As a single-center study, findings may not be generalizable to other populations, underscoring the need for similar studies in diverse settings. Additionally, while retrospective studies are subject to potential confounding and selection biases, we mitigated this by including only patients with complete records and radiological confirmation of CVT. Future research should include larger, more diverse populations and prospective designs to enhance validity and generalizability.

Conclusion

This study sheds light on the radioclinical characteristics and risk factors of cerebral venous thrombosis (CVT) in a cohort of patients from a tertiary hospital in Mogadishu, Somalia. The findings highlight the significant association between the postpartum period and CVT development, with the majority of cases occurring in women within the reproductive age group. The prevalence of headaches, seizures, focal motor deficits, and altered mental status in clinical presentations emphasizes the need for increased awareness and prompt diagnostic evaluation in this population. The superior sagittal sinus emerged as the most frequently affected anatomical site for thrombosis. These insights call for increased clinical vigilance, especially in postpartum women, and highlight the need for early intervention strategies to mitigate the risk of CVT. Public health initiatives, such as maternal education campaigns and improved screening protocols, could further reduce the burden of CVT in postpartum women. Future research should expand on these findings by including larger and more diverse populations, and investigating genetic predispositions and other comorbid conditions to develop a comprehensive risk profile for CVT in the Somali context.

Abbreviations

CVT, Cerebral Venous Thrombosis; MRI, Magnetic Resonance Imaging; MRV, Magnetic Resonance Venography; CT, Computed Tomography; HIV, Human Immunodeficiency Virus; χ^2 , Chi-square test.

Data Sharing Statement

The data that support the findings of this study are available in Mogadishu Somali Turkey, Recep Tayyip Erdogan Training and Research Hospital information system. Data are however allowed to the authors upon reasonable request and with permission of the education and research committee.

Ethics Approval and Consent to Participate

The study was approved by the research ethics committee of Mogadishu Somali Turkey Training and Research Hospital. The study was performed in line with the principles of the Declaration of Helsinki. Due to the fact that our hospital is a research hospital a general informed consent is obtained from every patient admitted to obtain their data for retrospective research purposes from the hospital medical records, and this study did not disclose any personal information.

Consent for Publication

Due to the fact that our hospital is a research hospital a general informed consent is obtained from every patient admitted to obtain their data for retrospective research purposes and for publication. This study did not disclose any personal information.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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