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Original Article

Prevalent risk factors in Dural Venous Sinus Thrombosis patients – A hospital-based study

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Abstract

Introduction
Dural venous sinus thrombosis (DVST) is not quite a common thrombotic disorder. The incidence of DVST is around 1.3 per 100,000 cases a year in adults. The objective of this study was to determine the frequency of risk factors in dural venous sinus thrombosis patients.

Materials and Methods
It was a cross-sectional study conducted at the Department of Neurology, MTI/ Lady Reading Hospital, Peshawar. 139 patients with dural sinus thrombosis were included in the study. Confirmation of DST was done clinically and CT/MRI brain with contrast findings. History, examination, and investigations were performed for various risk factors including hypertension, DM, hypercholesterolemia, smoking, and obesity.

Results
According to the results, the mean age of the patient was 50.60 ± 7.548 years with the majority of the patients (68.7%) in the age group of more than 45 years. Male to female ratio was 1.8: 1. Hypertension was found in 49 patients (35.3%) followed by diabetes mellitus in 31 patients (22.3%).

Conclusion
Hypertension and diabetes were leading risk factors for dural sinus thrombosis. The disease mainly affects middle-aged males, although significant proportions of females were also affected.

Keywords
Dural Sinus Thrombosis, Risk Factors, Hypertension.

Introduction

Dural venous sinus thrombosis (DVST) is a rare thrombotic disease. The incidence of DVST is around 1.3 per 100,000 cases a year in adults (1, 2), which is about the same as splanchnic vein thrombosis (3), however, it is a lot lower (almost 100x) than venous thromboembolism (VTE), i.e, deep vein thrombosis (DVT) of the legs and pulmonary embolism (PE) (4). In contrast to VTE, in which the incidence greatly increases with age, DVST mostly occurs in children and young adults. Only less than 10% or fewer patients with DVST are older than 65 years (5). Similarly, the sex ratio in DVST shows a significant predilection towards women in young and middle-aged adults with a 3:1 ratio, while VTE has shown only a slightly greater incidence in women compared to men (4, 6, 7, 8).

The brain's venous system consists of dural venous sinuses which lie between the periosteal and meningeal layers of the dura. They receive blood from the cortical and deeper veins, ultimately draining into the two internal jugular veins. Most blood from the superficial cortical veins drains into the superior sagittal sinus, while the deeper veins drain into the straight sinus. Both these sinuses drain into the left and right transverse sinuses, and from there, blood is drained into internal jugular veins through sigmoid sinuses. Apart from their function of venous drainage, dural sinuses are also essential for CSF absorption via arachnoid villi. The DVST is mostly diagnosed by magnetic resonance imaging with venogram (MRI + MRV) by finding absent flow (loss of flow void or presence of a filling defect) in any of the dural venous sinuses.

According to previous studies, there are major roles of genetics, environmental factors, socioeconomic status, and differential distribution of vascular risk factors (hypertension, hyperlipidemia, diabetes, tobacco use, obesity, obstructive sleep apnea) in different racial or ethnic groups across the globe (9). Intracranial hypertension with symptoms (such as headache and visual blurring) may ensue after obstruction of the sinuses and, subsequently, lead to brain parenchymal lesions (9, 10). Although various risk factors have been associated with DVST, infection can be identified in about 85% of patients according to various cohort studies including Arterial hypertension (16.1%), hypercholesterolemia (46.9%), obesity (BMI $\geq$ 30) (47.5%), hyperhomocysteinemia (34.1%), pregnancy and puerperium (19%), diabetes (20%) and smoking habit (10%) (11, 12, 13, 14, 15). The objective of this study is to determine the frequency of risk factors in dural venous sinus thrombosis patients.

Methodology

This descriptive cross-sectional has been conducted in the neurology ward of Lady Reading Hospital, Peshawar from 10th November 2022 to 9th May 2023. The study was conducted after getting approval from the hospital ethics and research committee (IRB #).

Inclusion Criteria

- 20 to 70 years old patients of either sex with cerebral venous sinus confirmed according to the criteria mentioned in the operational definitions above having a duration of maximum 2 weeks since symptoms onset who are under treatment in the Neurology unit Lady Reading Hospital, Peshawar.

Exclusion Criteria

- Patients with prior epilepsy were not included in the study.
- Patients with known structural brain lesions, for example, a tumor, 65 shall not be included in the study.

Participants

Using the Non-probability consecutive sampling method, a total of 139 participants have been invited to be part of this study with a 95% confidence level and 5% margin of error. The patients meeting the inclusion criteria in the neurology ward of Lady Reading Hospital, Peshawar were recruited in the study after taking written informed consent. The purpose of the study and the details of what this study entails was explained to all the recruited patients.

Data Collection Procedure

The diagnosis of cerebral venous sinus thrombosis was made based on the criteria mentioned in the operational definitions above. These patients and the attendants were asked about whether they experienced any seizures since the onset of their illness. They were also observed during their stay in the Neurology ward and any witnessed seizure during their stay shall also be recorded. If there is uncertainty regarding whether the episode described by the patient and his attendants in history or the episode witnessed by the medical team during the patient‘s stay is a seizure or not, the patient was advised an EEG. All of these patients with cerebral venous sinus thrombosis were treated with therapeutic anticoagulation and hydration which is the routine treatment for such patients.

Data Analysis

The data was entered and saved in SPSS version 23. Descriptive statistics was used to analyse the data. Frequencies and percentages were calculated for categorical

variables such as hypertension, diabetes, hypercholesterolemia, smoking habits, and obesity. Mean and standard deviation were calculated for the numerical variables, for example, age, weight height, and BMI. Common risk factors (hypertension, diabetes, hypercholesterolemia, smoking habit, obesity) were stratified according to age, gender, and duration of symptoms to control effect modification. Post-stratification chi-squared test was applied in which a p-value of 0.05 or less will be considered significant.

Result

This cross-sectional study comprised 139 participants. The mean age of the population was 50.60 ± 7.54 years. Based on age, the participants were divided into two categories i.e. patients with age less than or equal to 45 years and patients with age more than 45 years. The observed average height, weight, and BMI of the population were 75.14 ± 5.87 kg, 172.89 ± 6.49 cm, and 25.20 ± 2.29 kg/m^2 respectively (**Table 1**). According to the results, males have a large ratio i.e. 90 (64.4 %) than females i.e. 49 (35.6 %) out of the total participants i.e. 139 (100%). 95 (68.7 %) patients have an age more than 45 years and 44 (31.3 %) patients have an age less than or equal to 45 years according to the reports (**Table 2**).

Table 1. Mean ± standard deviation of patients according to age, weight, height, and BMI

Demographics And Baseline Characteristics (N = 139)	Mean ± Std. Deviation
Age (years)	50.60 ± 7.54
Weight (kg)	75.14 ± 5.87
Height (cm)	172.89 ± 6.49
BMI (kg/m^2)	25.20 ± 2.29

Table 2. Frequency and percentage of patients according to gender and age groups of the patient

Variable (N=139)	Frequency	Percentage
Gender		
Male	90	64.4 %
Female	49	35.6 %
Total	139	100 %
Age group		
≤ 45 years	44	31.3 %
> 45 years	95	68.7 %
Total	139	100 %

The risk factor present in higher frequency was Hypertension. It was present in 49 (35.3%) patients followed by diabetes present in 31 (22.3%) patients, obesity present in 25 (18.0%) patients, Hypercholesterolemia present in 25 (18.0%) patients and lastly smoking with the least frequency i.e. 9 (6.4%) patients (**Table 3**).

Table 3. Frequency and percentage of patients according to risk factors

Risk Factors		
	Frequency	**Percent**
Hypertension	49	35.3
Diabetes	31	22.3
Hypercholesterolemia	25	18.0

Smoking	09	6.4
Obesity	25	18.0
Total	139	100.0

The results also include the prevalence of hypertension in both genders and both age groups indicating p-values of 0.31 and 0.1 respectively. According to the results, 30 (33.3%) out of 90 male patients possessed hypertension while 19 (38.8%) out of 49 female patients presented with the same risk factor. However, only 11 (25.0%) out of 44 participants with age less than or equal to 45 years have hypertension while 38 (40%) out of 95 participants with age more than 45 years have hypertension (**Table 4**).

Table 4. Stratification of hypertension concerning gender and age of the patient

Hypertension * Gender					
		HTN			
		Yes	**No**	**Total**	**p-value**
Patient Gender	**Male**	30 (33.3%)	60 (66.7%)	90 (100.0%)	0.31
	Female	19 (38.8%)	30 (61.2%)	49 (100.0%)	
Total		49 (35.3%)	90 (64.7%)	139 (100.0%)	
Hypertension * Age					

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		HTN		Total	p-value
		Yes	No		
Age (years)	45 or below	11 (25.0%)	33 (75.0%)	44 (100.0%)	0.10
	More than 45	38 (40%)	57 (60%)	95 (100.0%)	
Total		49 (35.3%)	123 (64.7%)	139 (100.0%)	

As measured by the observations, diabetes mellitus was present in 20 (22.2%) out of 90 males and 11 (22.4%) out of 49 females with a p-value of 0.93. 11 (25.0%) patients out of 44 with an age less than or equal to 45 years had DVST due to the presence of diabetes mellitus while 20 (21.0%) patients out of 95 having an age more than 45 presented with diabetes mellitus with a p-value of 0.82 (**Table 5**).

Table 5. Stratification of diabetes concerning gender and age of the patient

Diabetes * Gender					
		DM		Total	p-value
		Yes	No		
Patient	Male	20 (22.2%)	70 (77.8%)	90 (100.0%)	0.93

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Gender	**Female**	11 (22.4%)	38 (77.6%)	49 (100.0%)	
Total		31 (22.3%)	108 (77.7%)	139 (100.0%)	
Diabetes *Age					
		DM			
		Yes	**No**	**Total**	**p-value**
Age (years)	**45 or below**	11 (25.0%)	33 (75.0%)	44 (100.0%)	0.82
	More than 45	20 (21.0%)	75 (79.0%)	95 (100.0%)	
Total		31 (22.3%)	108 (77.7%)	139 (100.0%)	

As per the results, Hypercholesterolemia was present in 17 (18.9%) male patients and only 08 (16.3%) female patients with a p-value of 0.74 while it is present in 06 (13.6%) participants with age less than or equal to 45 years and 19 (20%) participants with age more than 45 years manifesting a p-value of 0.39 (**Table 6**).

Table 6. Stratification of hypercholesterolemia concerning gender and age of the patient

Hypercholesterolemia * Gender				
	Hypercholesterolemia			
	Yes	**No**	**Total**	

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					p-value
Patient Gender	**Male**	17 (18.9%)	73 (81.1%)	90 (100.0%)	0.74
	Female	08 (16.3%)	41 (83.7%)	49 (100.0%)	
Total		25 (18.0%)	114 (82.0%)	139 (100.0%)	

Hypercholesterolemia * Age

		Hypercholesterolemia		**Total**	**p-value**
		Yes	**No**		
Age (years)	**45 or below**	06 (13.6%)	38 (86.4%)	44 (100.0%)	0.39
	More than 45	19 (20%)	76 (80%)	95 (100.0%)	
Total		25 (18.0%)	114 (82.0%)	139 (100.0%)	

Smoking was relatively a less prevalent factor in all the participants. 6 (6.7%) male out of 90 were smokers and 3 (6.1%) female out of 49 were smokers prior diagnosis (p-value=0.89). Only 4 (9.1%) patients out of 44 with the age of less than or equal to 45 years and 5 (5.3%) patients with an age more than 45 years had presented with a history of smoking (p-value=0.26) (**Table 7**).

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Table 7. Stratification of smoking with respect to gender and age of the patient

Smoking *Gender					
		Smoking		Total	p-value
		Yes	No		
Patient Gender	Male	6 (6.7%)	84 (93.3%)	90 (100.0%)	0.89
	Female	3 (6.1%)	46 (93.9%)	49 (100.0%)	
Total		09 (6.4%)	130 (93.6%)	139 (100.0%)	
Smoking *Age					
		Smoking		Total	p-value
		Yes	No		
Age (years)	45 or below	4 (9.1%)	40 (90.9%)	44 (100.0%)	0.26
	More than 45	5 (5.3%)	90 (94.6%)	95 (100.0%)	
Total		09 (6.4%)	130 (93.6%)	139 (100.0%)	

The results indicated obesity as the second most prevalent risk factor among the whole population. According to sex, obesity was present in 17 (18.9%) males out of total 90 and in

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only 08 (16.3%) females out of total 49 with a p-value of 0.74. While in age groups, it was present in 06 (13.6%) participants with the age less than or equal to the 45 years and in 19 (20%) participants with age more than 45 years (p-value=39) (**Table 8**).

Table 8. Stratification of obesity with respect to gender and age of the patient

Obesity * Gender					
		Obesity		**Total**	**p-value**
		Yes	**No**		
Patient Gender	**Male**	17 (18.9%)	73 (81.1%)	90 (100.0%)	0.74
	Female	08 (16.3%)	41 (83.7%)	49 (100.0%)	
Total		25 (18.0%)	114 (82.0%)	139 (100.0%)	
Obesity * Age					
		Obesity		**Total**	**p-value**
		Yes	**No**		
Age	**45 or below**	06 (13.6%)	38 (86.4%)	44 (100.0%)	0.39

(years)	**More than 45**	19 (20%)	76 (80%)	95 (100.0%)
Total		25 (18.0%)	114 (82.0%)	139 (100.0%)

Discussion

Our key ffindings suggested that approximately a quarter of Dural sinus thrombosis patients can have underlying hypertension as a risk factor. The average age for most large-scale cerebral venous sinus thrombosis (CVST) studies is more than 45 years, although this can affect any age. Males constituted the majority of the patients with a percentage of 64.4% and exceeded the females in almost all the risk factors evaluated. The age and gender distribution were not so relevant to a study which was done in Sudan which showed a mean age of 33.9 ± 11.8 years, and female predominance of 80% (16). Also, the same as other studies conducted in regional areas such as Iran, Oman, and Saudi Arabia, concluded that Cerebral Venous Sinus Thrombosis (CVST) occurs predominantly in young females (17, 18, 19, 20). Only two studies from India revealed a male predominance similar to the present study (21, 22), one of them attributed this probably to rising consumption of alcohol by men, improvement in obstetric care, and a higher level of clinical suspicion and detection of Cerebral Venous Sinus Thrombosis (CVST) at an early stage (21).

Although, hypertension was the most prevalent risk factor in the population of the present study. Intracranial hypertension mimics headache which eventually worsens and disturbs the patient's lifestyle. One case report from Turkey with a case of Cerebral Venous Sinus Thrombosis (CVST) has been misdiagnosed as subarachnoid hemorrhage because he was presenting with headache only (23), so headache must be taken seriously and should be

investigated thoroughly, especially in high-risk groups. According to Ding et al., there is a definite link between intracranial pressure magnitude and vision loss; a pressure of 330mmH_2O may be a cut-off value that predicts visual impairment in CVST patients (24).

Diabetes is also a significant risk factor according to the present study. Previous studies also manifest that diabetes, acute diabetic hyperglycemia, and ketoacidosis might provoke DVST (25, 26, 27). There are some indications that people with type 2 diabetes have unusually high red blood cell adhesion to endothelium. However, it is unclear if this is a coincidence or a causative relationship (25). Hypercholesterolemia, obesity, and smoking also had profound effects on the severity of the DVST (28). There were some limitations regarding the study. First of all, the cohort was somewhat small (n = 139) due to the incidence of DVST, and there was a lack of complete follow-up data for several DVST patients. The reason for the lack of follow-up data remains unclear. Also, there could be inclusion of more risk factors was possible to widen the novelty of the study.

Conclusion

The study concluded that Dural Venous Sinus Thrombosis (DVST) is mainly a disease of middle-aged males, although significant proportions of women were also affected. Hypertension and diabetes were found to be the most common predisposing factors for Dural Venous Sinus Thrombosis (DVST).

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