

Original Research Article

Dural venous sinus thrombosis after traumatic brain injury

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ABSTRACT

Background: Dural venous sinus thrombosis (DVST) is a subset of cerebral venous thrombosis, and its presentation depends mainly on the sinus involved. The use of modern imaging techniques allows earlier diagnosis of DVST. Aims and objectives were to study the outcome and prognosis of DVST after head injury.

Methods: This observational cross-sectional study was conducted in a tertiary care surgical intensive care unit (ICU) in central India on patients admitted to Gandhi Medical College, Bhopal, in the period from January 2020 to December 2020, suffering from traumatic brain injuries, suspected of dural venous sinus/cortical vein thrombosis. Glasgow coma scale (GCS) was recorded at the time of admission and regular follow-ups were every fortnightly done for 6 months. Statistical analysis was done with the help of Epi-Info 7 software.

Results: The mean age of the patients was 43.78 years. The most common computed tomography (CT) finding was that temporo-occipital hemorrhage/edema was present in 12 (24%) patients, followed by frontotemporal hemorrhage/edema in 10 (20%) patients. Out of 50 suspected cases based on CT findings only 15 patients were confirmed with the diagnosis of DVST by MRV. There was a shift of patients from moderate and severe GCS to mild GCS in subsequent follow-up.

Conclusions: Head trauma constitutes a potent risk factor for developing thrombosis of the dural venous sinus. Good imaging studies allow us to make an accurate diagnosis and timely management of these patients will give us good results.

Keywords: Traumatic brain injury, Dural venous sinus thrombosis, GCS, MR venography

INTRODUCTION

Dural venous sinus thrombosis is a condition that can cause various neurological symptoms and can have outcomes ranging from full recovery to death.^{1,2} It occurs when clots form in the dural sinus or cortical vein, leading to brain damage and increased pressure within the skull.³ Unfortunately, around 23% of patients with this condition experience a worsening of symptoms due to restricted blood flow and venous hypertension, and identifying these cases early on can be difficult.⁴ To address this, doctors often use flow-sensitive imaging techniques like 2D TOF or PC-MRV to assess the venous sinuses accurately.⁵ This study sought to examine the prognosis and outcome of dural venous sinus thrombosis.

METHODS

The study was done prospectively in the department of general surgery, Gandhi Medical College, Bhopal, on 50 patients admitted in the period from January 2020 to December 2020, suffering from traumatic brain injuries, suspected of dural venous sinus/cortical vein thrombosis.

The study was approved by the institutional ethical committee. All patients with traumatic brain injuries, suspected of dural venous sinus or cortical vein thrombosis based on computed tomography (CT) scan findings, aged >15 years were included in the study. Patients with serious extracranial injuries were excluded.

Study plan

MRV of 50 patients was done out of which, 15 patients were diagnosed with dural venous sinus thrombosis/cortical vein thrombosis with positive MRV findings. They were given treatment for sinus thrombosis and followed up till 6 months. Two patients were lost to follow-up after 2 months. The clinical and radiological findings were assessed to determine the outcome and prognosis of study the participants on their follow-up within a period of 6 months.

Statistical analysis plan

Data was entered in Microsoft excel 2010; analysis was done with the help of Epi-Info 7 software. Frequency and percentage were calculated and statistical test (Chi-square) was applied wherever applicable.

RESULTS

Mean age of the patients was 43.78. Most of the patients are between 21-40 years of age. Male to female ratio was found to be 3:2 (Table 1).

Table 1: Distribution of study participants according to age.

Age	Frequency (N)	Male	Female	Percentage
16-20	0	0	0	0
20-30	10	7	3	20
31-40	15	8	7	30
41-50	9	6	3	18
51-60	11	6	5	22
61-70	5	4	1	10
Total	50	31	19	100

Table 2: CT findings among the study participants.

CT findings of suspected cases	Frequency	Percentage
Frontal hemorrhage/edema/contusion	6	12
Fronto temporal hemorrhage/edema/contusion	10	20
Temporal hemorrhage/edema/contusion	7	14
Temporo-occipital hemorrhage/edema/contusion	12	24
Temporo-parietal-occipital hemorrhage/edema/contusion	4	8
Parietal and para sagittal hemorrhage/edema/contusion	8	16
Diffuse edema/contusion	3	6
Total	50	100

Temporo-occipital hemorrhage/edema was present in 12 (24%) of them, followed by fronto-temporal hemorrhage/edema in 10 (20%) patients, followed by parietal and parasagittal hemorrhage/edema in 8 (16%), temporal hemorrhage/edema 7 (14%), frontal hemorrhage/edema in 6 (12%), temporo-parietal-occipital hemorrhage/edema in 4 (8%) and least proportion showed diffused edema in 3 (6%) (Table 2).

Out of 50 suspected cases based on CT findings only 15 patients were confirmed with the diagnosis of CVST/DVST by MRV.

62% of patients had altered sensorium, 46% had seizures, 32% had FND (focal neurological deficit) and 26.7% had headache at the time of diagnosis. Patients showed significant improvement in clinical characteristics in subsequent follow up (Figure 1).

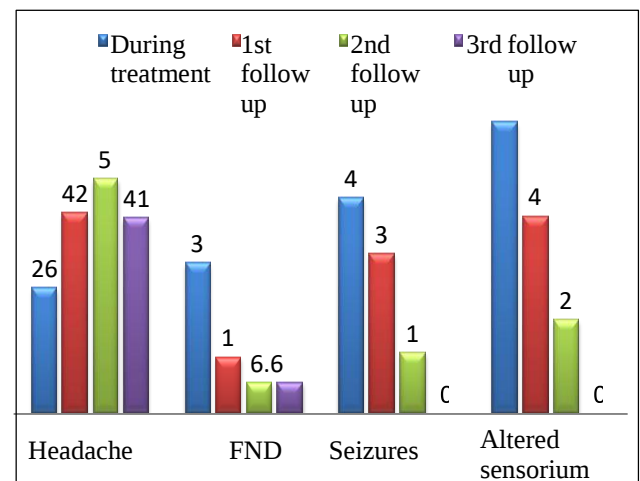


Figure 1: Proportional distribution of patients according to symptoms in subsequent follow-up.



Figure 2: MR Venography showing all dural venous sinuses.

On examining the MRV findings of 15 patients, 8 (53%) of them had superior sagittal sinus and transverse sinus thrombus, 2 (13%) had SSS thrombosis, 3 (20%) had SSS + cortical vein infarct and least proportion i.e. 2 (13%) had sigmoid sinus thrombosis (Table 3).

Out of 15 patients diagnosed with DVST/CVST on 3rd-month follow-up with MRV findings 10 patients had improved MRV findings as compared to the time of diagnosis, 2 patients showed persistent MRV findings as at the time of diagnosis. Two patients could not be followed up till 3rd month (before the repeat MR venogram) and one patient died during the hospital stay.

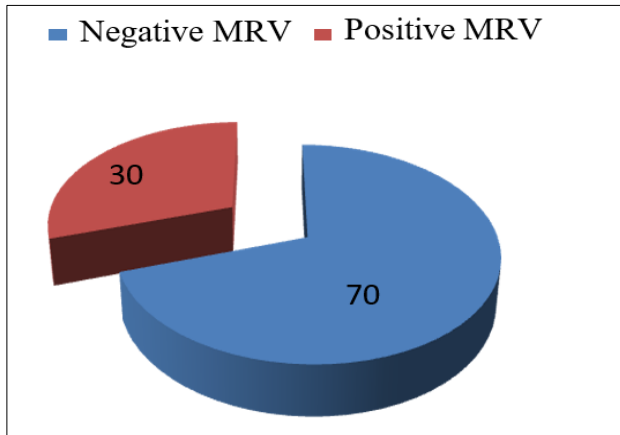


Figure 3: Distribution of diagnosed cases among the suspects.

Table 3: First MRV (thrombus location) findings in study participants.

MRV findings (location of thrombus)	Frequency	Percentage
SSS	2	13
TS+SSS	8	53
SSS + cortical veins	3	20
Sigmoid sinus	2	13

Nine (75%) out of 15 patients had shown clinical improvement at 6 months. Two (16.6%) of them showed no significant clinical improvement, while there was 1 mortality during the course of treatment in the hospital. Two patients were lost to follow-up after 2 months and follow-up MRV could not be done on these 2 patients.

Table 4: Comparison of GCS in patients with confirmed diagnosis on subsequent follow-up.

GCS at time of diagnosis	At diagn -osis	1st follow-up	2nd follow-up	3rd follow-up
Mild head injury (13-15)	2	4	7	10
Moderate head injury (9-12)	5	6	5	1
Severe head injury (3-8)	8	4	2	1
Total	15	14	14	12

Table 4 shows a majority of patients i.e. 8 had severe GCS at the time of diagnosis which was reduced to 1 on the last follow-up. There was shift of patients from moderate and severe GCS to mild GCS in subsequent follow-up. One patient died during ongoing treatment in the hospital.

DISCUSSION

Our study found that the majority of patients (50%) were between the ages of 21-40, with a mean age of 43.78. This age group is typically part of the working population and tends to have more outdoor activities, which may contribute to the higher incidence of accidents. Similar findings were reported by Delargo Almandoz et al in 2010, where the mean age of patients was 40.7.⁶ However, our study had a different demographic compared to Elkatatny et al in 2019, which found that most patients were younger.⁷ In our study, the majority of patients were male, with a male-to-female ratio of 3:2. This may be due to the fact that young males are more likely to work outdoors and be involved in road traffic accidents, which often result in head injuries. These gender biases were also observed in the study by Almandoz et al with a male-to-female ratio of 3:1.⁶ Additionally, the study by Elkatatny et al in found that males were more commonly affected by traumatic brain injuries.⁷ In our study, out of 50 suspected cases based on CT findings, only 15 patients were confirmed with the diagnosis of CVST/DVST by MRV. Similar to a study by Chiewvit clinical suspect, prompt investigation by non-invasive imaging magnetic resonance (MR) or advanced modalities such as cerebral venous thrombosis (CVT), MR venography (MRV) will be helpful in prompt diagnosis and treatment.⁸ 26.7% had headache in our study which was comparable to the study by Alvis et al in which headache was the main symptom.⁹ In a study by d'Avella et al the superior sagittal sinus occlusion was the most frequent finding and Lee et al conducted a study with forty-one patients were identified with CVST.^{10,11} The majority of cases involved the transverse sinus (75%), sigmoid sinus (58%), and superior sagittal sinus (29%) while we found the combination of superior sagittal sinus thrombosis and transverse sinus thrombosis to be the major finding. In our study, the majority of patients had severe head injuries (GCS 3-8) upon diagnosis. However, during subsequent follow-ups, many patients shifted from moderate and severe GCS to mild GCS. Unfortunately, one patient passed away during their hospital stay, resulting in a 12.5% mortality rate for severe head injuries. Comparatively, a study by Elkatatny et al in 2019 found a 60% mortality rate for patients with severe head injuries.⁷

In our study, after six months of treatment, ten out of fifteen patients in our study showed complete clinical improvement and improvement in MR venography findings. Two patients showed no significant change and two were lost to follow-up.

A case series analysis by Khaladkar et al in 2014 found that out of 40 patients, 10 were referred for follow-up imaging between one month to one year.¹² Six patients

showed complete clinical improvement and complete resolution on MR venography, while four patients showed partial clinical improvement and partial resolution on MR venography. These findings are similar to those in our study.

Limitations

The study size was small and follow-up of the patient not permissible enough to draw a definite line for dural venous thrombosis-associated morbidity and mortality. Also, the cost of MR venogram in developing countries hampers the study.

CONCLUSION

Suffering from head trauma puts an individual at high risk of developing thrombosis of dural venous sinus. With the help of advanced imaging studies, a precise diagnosis can be made and timely management can result in positive outcomes for these patients. MR venography showed that dural venous sinus thrombosis/cortical vein thrombosis occurred in only 1.3% of all patients with traumatic brain injury. MR venography was conducted only on those patients who showed signs of DVST in their CT scan head. MR venography is a highly beneficial tool for assessing patients suspected of dural sinus thrombosis/cortical vein thrombosis as it enables visualization of the thrombus, its size, extent, and location. Early diagnosis and prompt management are essential in improving the outcome of patients with traumatic head injuries.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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