

Neuro-Radiological Spectrum of Venous Sinus Thrombosis in a Tertiary Care Hospital

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Abstract

Original Research Article

Background: Cerebral venous sinus thrombosis (CVST) is the formation of blood clot in the dural venous and/or sinuses, which drain blood from the brain. It is one of the commonest causes of stroke in young. Primarily the diagnosis is confirmed by radiological evaluation (MRI with MR Venogram). **Materials & methods:** prospective observational hospital based study in the department of Neurology, S.C.B. Medical College & Hospital, Cuttack, Odisha from October 2015 to September 2017. Those patients with clinical diagnosis of CVST with magnetic resonance imaging and venogram confirmation were included in the study. The radiological evaluation was tabulated to identify commonest area and patterns of sinus involvement. All the data were analysed according to SPSS software version 20.0. **Results:** Total 52 patients were included in the study. Most common age group was 21-40 yrs. Parietal lobe involvement was found to be commonest, in 14 patients (26.9%). Occipital & frontal lobe were found to be 2nd & 3rd common region of brain. 12(23.1%) patients had single sinus involvement & 40 (76.9%) patients had combination of different sinus/venous channel involvement. Transverse sinus was the most common sinus. **Conclusion:** All the CVST patients must be exposed to radiological evaluation by MRI and MR Venogram. It will not only help diagnosis and treatment of the disease but also it will help in prognosticate the outcome. In our area transverse sinus was the most common sinus to be involved. Further large studies are needed to obtain further knowledge about the pathological features and their radiological correlation.

Keywords: CVST, MR Venogram, Parietal lobe, Transverse sinus, Haemorrhagic transformation.

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INTRODUCTION

Cerebral venous sinus thrombosis (CVST) is defined as the formation of blood clot in the dural venous sinuses, which drain blood from the brain. It is a rare and potentially deadly condition. It is an uncommon form of stroke, usually affecting young individuals [1]. Large sinuses such as the superior sagittal sinus are most frequently involved [2]. The incidence among CVST varies between the adult and paediatric population. Among adults, there are reportedly 3-4 cases per million people per year [3]. That number is significantly higher amongst the paediatric group, approaching 7 cases per million people per year [4]. MRI is more sensitive for the detection of CVT than CT at each stage after thrombosis [6-8]. CVT is diagnosed on MRI with the detection of thrombus in a venous sinus. Findings are variable but may include a "hyperintense vein sign [9]". The magnetic resonance signal intensity of venous thrombus varies according to the time of imaging from the onset of thrombus formation [6-8]. Acute thrombus may be of low intensity. In the first week, venous thrombus

frequently appears as isointense to brain tissue on T1-weighted images and hypointense on T2-weighted images owing to increased deoxyhemoglobin. By the second week, thrombus contains methemoglobin, which results in hyperintensity on T1- and T2-weighted images [9]. The objectives of the study are to evaluate all the patients who were admitted with clinical diagnosis of CVST and classify according to sinus involvement. To evaluate the commonest pathological aetiology causing the obstruction.

MATERIALS AND METHODS

Prospective observational hospital based study in the department of Neurology, S.C.B. Medical College & Hospital, Cuttack, Odisha from October 2015 to September 2017.

Inclusion criteria

- Admitted patients with diagnosis of cerebral venous sinus thrombosis (CVST), confirmed by imaging of

brain with MRI/MRV scan of brain, in the indoor of the neurology department.

Exclusion criteria

- Patients who were clinically diagnosed as having CVST, but had normal imaging of brain (i.e. MRI/MRV scan of brain– normal).
- Patients who were not admitted to in patient department of neurology.
- Patients who didn't give consent for the study.

Patients were included in the study after obtaining informed written consent. We included eligible participants qualifying the criteria. They were evaluated according to the clinical and radiological parameters. All data were tabulated in a prestructured format. MRI/MRV was done by 1.5 tesla MRI on day 2 of hospitalization. Treatment was done according to recent EAN guidelines. The study data was managed in MS Excel spreadsheet. Categorical data were expressed as number and percentage. Continuous data were expressed as number, mean and standard deviation depending on the distribution. Statistical significance was tested at 5% using the SPSS version 20.0. Ethical approval was obtained from institutional ethics committee.

RESULTS

- In this study, total 52 patients with Radiological confirmation of cerebral venous thrombosis were evaluated (n=52). Most common age group was 21-40 yrs.
- The incidence of CVST in our hospital is 2.58%.
- When we analysed individual lobe involvement in CVST patients (table-1), parietal lobe involvement was found to be commonest, in 14 patients (26.9%). Occipital & frontal lobe were found to be 2nd & 3rd common region of brain to be involved in 11(21.2%) & 10(19.2%) patients respectively. 1 patient had basal ganglia calcification, who was subsequently diagnosed as type2 diabetes mellitus with Fahr's disease. The basal ganglia calcification was unrelated to CVST & was probably an incidental radiologic finding. Isolated brain region involvement was found only in 7 patients (viz. 1 frontal, 2 parietal, 2 occipital, 1 thalamic & 1 basal ganglia involvement) out of total 23 patients with parenchyma abnormality. In rest 16 of the patients' more than one area of brains were affected simultaneously. Most common combination of parenchyma involvement was 'Fronto- temporo-parieto-occipital' & 'Parieto-occipital' lobe, each in 3 patients respectively (table-2).

Table-1: (parenchymal involvement: broad area)

Area affected	Number	Percentage (%)
Frontal	10	19.2
Parietal	14	26.9
Temporal	9	17.3
Occipital	11	21.2
Thalamus	2	3.8
Basal ganglia	2*	3.8*
Brainstem	1	1.9

Table-2: (parenchymal involvement: patient specific area)

Area of brain involved	Number	Percentage (%)
Fronto temporo-parieto-occipital	3	5.7
Fronto parietal	2	3.8
Fronto-parietal-thalamus	1	1.9
Parietooccipital	3	5.7
Fronto-parieto-temporal	2	3.8
Temporo-parieto-occipital	1	1.9
Temporooccipital	2	3.8
Brainstem&basalganglia	1	1.9
Frontotemporal	1	1.9
Thalamus	1	1.9
Parietal	2	3.8
Occipital	2	3.8
Frontal	1	1.9
BG-calcification	1	1.9
Normal brain parenchyma	29	55.7

- Normal brain parenchyma was seen in 29 (55.8%) patients & radiologic abnormality in brain parenchyma was seen in 23(44.2%) of total 52 CVST patient. Infarction with or without

haemorrhage and oedema was the most common type of parenchymal involvement seen in 36.5% (19/52) of patients & among these patient most patients had hemorrhagic infarction. Haemorrhage

with oedema, infarction with subarachnoid bleed, basal ganglia calcification and only oedema as parenchyma abnormality was seen in 1 patient each.

Table-3: (parenchymal involvement: broad area)

Type of parenchymal involvement	Number	Percentage (%)
Infarction±edema	8	15.4
Infarction with hemorrhage±edema	11	21.2
Hemorrhage+edema	1	1.9
Only edema	1	1.9
Infarction +subarachnoid bleed	1	1.9
Basal ganglia calcification	1	1.9

- Out of total 52 patients, 12(23.1%) patients had single sinus involvement & 40 (76.9%) patients had combination of different sinus / venous channel involvement. Transverse sinus was the most common sinus involved in 42(80.7%) patients. Out of 42 patients, it was found that single sinus involvement was seen in 6 patients & in 36 patients as combination with other sinuses. Superior saggital sinus involvement was the second common sinus involvement found in 29 (55.8%) patients, as a part of multisinus involvement in 36 & singly in 5

patients. sigmoid sinus was the 3rd common type of sinus seen in 24 (46.2%) patients, but in all patients it was found in combination with other sinuses. SSS with TS with Sigmoid Sinus (SIG.S.) was the commonest combination of sinus involvement found in 8 patients. Out of 52 patients, 6 patients had only Transverse sinus involvement & 6 patients had involvement of superior saggital sinus+transverse sinus in combination. Other combinations were also seen.

Table-4: (pattern of individual sinus involvement)

Sinus/ vein involvement	As a single sinus	As part of multisinus involvement	Total number of patient.	% among all CVST patients
SSS	5	24	29	55.8
Transverse sinus	6	36	42	80.7
Sigmoid sinus	0	24	24	46.2
Straight sinus	0	4	4	7.7
Int. Jugular vein	0	3	3	5.8
Cavernous sinus	0	2	2	3.8
Torcula	1	9	10	19.2
Deep veins	0	1	1	1.9
Sup.Cortical veins	0	3	3	3.8
Vein of labbe	0	1	1	1.9
Inf. Sag. Sinus	0	1	1	1.9
Pansinus involvement	-	1	1	1.9

DISCUSSIONS

Cerebral venous sinus thrombosis is a condition characterized by thrombosis of intracranial veins and sinuses. It may results in parenchyma damage and rise in intracranial pressure, but it can also present with signs & symptoms even without any radiological observable parenchyma damage. Radiological hallmark of this condition is the presence of thrombus in the intracranial sinuses and/or veins with or without associated haemorrhagic infarction, oedema & features of intracranial hypertension. Out of total 52 patients, brain parenchyma involvement was observed in 44.2% patients and normal brain parenchyma in 55.8%. In the present series, haemorrhagic infarction is the most common parenchyma involvement seen in 21.2 %

(11/52) of patients, followed by Infarction with or without oedema in 15.4% (8/52) patients. 1 patient had infarction with subarachnoid hemorrhage & 1 patient had only edema. The neuroimaging observations of the present series is similar to the descriptions of AHA/ASA, 2011 guidelines of CVST where focal parenchymal changes were seen, in up to 40% of patients with oedema and haemorrhage being a relatively common observation [9]. Narayan *et al.* 2012, also observed hemorrhagic infarct in 45.6%, of the cases out of 392 patients with CVST, in whom MRI was done[10,11]. In the majority of patients (30.8%) with abnormal brain parenchyma, more than one areas of brain were affected simultaneously. Most common combination of parenchymal involvement was

'Fronto-temporo-parieto-occipital' & 'Parieto-occipital' area. When we analyze individual lobe involvement in CVST patient, parietal lobe involvement was found to be the commonest, in 26.9%. Previous studies vary widely

in the field of lobar involvement in CVST [10]. This depends upon the predominant sinus involvement. This variation can be attributed to geographical variations as well as etiological differentiations.

Table-5: (pattern of single/multiple sinus involvement: individualized data)

Name of veins/sinuses	Number of patient	% out of total CVST patient(n=52)
SSS, TS, Sigmoid Sinus (SIG.S.)	8	15.4
TS (Transverse sinus)	6	11.5
SS S (superior saggital sinus)	5	9.6
TS,SIG. S	5	9.6
SSS,TS	6	11.5
SSS,TS,Trocula	2	3.8
SSS,TROC,TS,SIG.S	2	3.8
TS,SIG.S,IJV(internal jugular vein)	2	3.8
TS,SIG. S, Vein Of LABBE	1	1.9
TS,SIG.S.,Torcula	1	1.9
CVS,Trocula,TS	1	1.9
SSS,TS,SIG.S,Trocula	1	1.9
SSS,ST.S,TS,SIG.S	1	1.9
TS,Trocula	1	1.9
SSS,TS,IJV	1	1.9
SSS, ISS, SIG.S, ST.S, SUP. CORT. Vein	1	1.9
Torcula Herophoili	1	1.9
STR. S,TS,SIG.S	1	1.9
SSS, SUP. CORT. VEIN	1	1.9
Pansinus Thrombosis (Partial, Left Side)	1	1.9
IJV,TS	1	1.9
SUP.CORT. V,Trocula,TS,SIG.S	1	1.9
TS,SSS,CVS	1	1.9
Deep Veins,STR. Sinus	1	1.9
TTotal	52	≈100

Mrv-sss-superior sggital sinus, vein of tolrad, iss – inferior saggital sinus, smv-superficial middle cerebral vein, -vein of labbe, st.s-striaght sinus, trocula-trocula herophili, ts- trans. Sinus,ss-sigmoid sinus,ijv-internal jugular vein, su. Cort. V--superficial cortical vein, deep vein (internal cerebral vein,basal vein of rosenthal & tributaries), cvs-cavernous sinus.

The present series confirms the fact that isolated single sinus involvement (23.1%) was less common than multiple sinuses involvement (76.9%). Among the isolated sinus, most frequently involved were transverse sinus and superior saggital sinus. Thus in most cases, occlusion involved at least two sinuses or sinus and cerebral veins. Transverse sinus was the most common sinus involved both in isolated and combination in the present series. In most of the previous studies, Superior sagittal sinus was the most frequent sinus involved either alone or in combination with other sinus [12]. However in the present study although, isolated single sinus involvement of SSS and TS was almost equal (5 vs. 6), TS involvement was more commonly observed overall. This might be because of small study sample as well as geographical variations.

CONCLUSION

On neuroimaging of clinically suspected CVST abnormal brain parenchyma was seen in around half of patients, with hemorrhagic infarction being most

common. Out of the different anatomical areas of brain, Parietal lobe was found to be involved in more than one fourth of the patients. This was the most common area of brain to be involved. On MRV study, majority of the patients had combinations of sinus or venous involvement rather than single sinus involvement. Over all transverse sinus involvement was found to be more common, but isolated involvement of transverse sinus & superior sagittal sinus were almost equal.

The probability of CVST should be kept in mind in every patient having acute or subacute headache with or without visual changes after ruling out common etiological factors. Sensitivity of suspicion should be more when the patient possesses any risk factor. Early diagnosis and quick management can make great difference for the patient. MRI and MRV are the gold standard imaging modalities. In case of any doubt arises the probability of CVST should be ruled out by doing these modalities of imaging by one experienced radiologist. If there is monetary constraint of doing

imaging, then simple MRV can rule out presence of CVST.

healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2011 Apr;42(4):1158-92.

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