THE ROLE OF MAGNETIC RESONANCE VENOGRAPHY IN HEADACHE DUE TO SUSPECTED CEREBRAL VENOUS SINUS THROMBOSIS IN THE PRESENCE OF NORMAL T1 AND T2 DURAL SINUS SIGNAL

Muhammad Imran Khan[1] , Ujala Afridi[2] , Fariha Afzal[3] , Alia Bangash[4]

Correspondence

[3]Fariha Afzal, Assistant Professor, Northwest General Hospital, Peshawar
: +92-334-9089923
: pakradiologist@yahoo.com
[1]Assistant Professor, Department of Radiology, Lady Reading Hospital, Peshawar
[2]Fellowship Trainee, Department of Radiology, Lady Reading Hospital, Peshawar
[4]Fellowship Trainee, Department of Radiology, Lady Reading Hospital, Peshawar

How to cite this article

Khan MI, Afridi U, Afzal F, Bangash A. The Role of Magnetic Resonance Venography in Headache Due to Suspected Cerebral Venous Sinus Thrombosis in the Presence of Normal T1 and T2 Dural Sinus Signal. J Gandhara Med Dent Sci. 2023;10(3): 8-11
https://doi.org/10.37762/jgmds.10-3.394

ABSTRACT

OBJECTIVES

Cerebral venous sinus thrombosis (CVST) is an important but uncommon aetiology of stroke. The presentation of CVST is extremely variable clinically, moreover its onset can be either acute or subacute, and less frequently, chronic. Headache is the most common symptom of CVST. The headache is typically diffuse and progressing in severity over days to weeks. Magnetic resonance imaging (MRI) and magnetic resonance venography (MRV) have very high sensitivity and specificity and have become the modality of choice to confirm the diagnosis of CVST. The aim of this study was to weigh the benefits of added MRV in patients with headache, after a negative MRI for CVST.

METHODOLOGY

The total number of patients included was 207, with chief complaints of headache and suspicion of CVST. The MRV sequence used was dynamic coronal by using the time-of-flight technique. The diagnosis of CVST was made by the loss of normal signal void both on T1WI and T2WI as well as on non-visualization on MRV.

RESULTS

Out of these 207 patients, CVST was present in 52 patients. Superior sagittal sinus was involved in 8 cases, right transverse sinus in 2 cases, left transverse sinus in 7 cases, left sigmoid sinus in 3 cases, and multiple sinuses in 32 cases. 34 cases out of 52 had infarction which was mostly haemorrhagic i.e. 27. A total of 97 cases (46%) had aplastic/hypoplastic transverse segments which were mostly the left one (87, 42%) and 10 cases (4.8 %) on the right side. In none of the patients, CVST was picked by MRV alone after a negative T1 and T2 MRI.

CONCLUSION

In patients presenting with headache and suspected CVST additional MRV is only required if the routine MR sequences are not able to pick up the thrombus and the suspicion of CVST is very high.

KEYWORDS: *Cerebral Venous Sinus Thrombosis, Headache, MR Venography*

INTRODUCTION

Cerebral venous sinus thrombosis (CVST) is an important but uncommon cause of stroke. Although it can effect all age groups, indivisuals < 40 years of age (young and middle-aged) are most commonly affected, and has a female predominance.[1] The risk factors for CVST are , genetic or acquired prothrombotic conditions, oral contraceptives, pregnancy, puerperium, infection, and malignancy.[2] No underlying etiology can be identified in 30% of cases.[3] In children and neonates the incidence has been found to be 7 per million as compared to adults in whom it is 3-4 cases per million.[4] It is now realized that CVST is more prevalent in the Asian population than in the West. About 10– 20% of young strokes in India are due to CVST. However, it is a less frequent cause of stroke than arterial pathologies.[5] The presentation of CVST is extremely variable clinically, moreover its onset can be either acute or subacute, and less frequently, chronic. Clinically, CVST can be grouped into three syndromes that occur frequently: 1) isolated intracranial hypertension syndrome: headache with or without vomiting, papilledema, and visual symtoms 2) focal syndrome: focal deficit presenting as any or all of paresis, aphasia and seizures and 3) encephalopathy: bilateral/multifocal signs, delirium, dysexecutive or consciousness disturbances.[6] Headache is nonspecific but is mostly accompanied by other neurological signs like papilledema, focal deficits, fits, altered consciousness, or cranial nerve palsies.[7] The International Study on Cerebral Venous and Dural Sinuses Thrombosis [ISCVST] also showed that headache was the most frequently encountered symptom in CVST, present in around 90% patients.[2] It is typically diffuse and progressing in severity over

days to weeks.[8] The type of headache shows no correlation with the location of the involved venous sinus except for occipital headache in transverse sinus thrombosis. It is recommended to use the criteria of the international headache society in patients suspected of CVST i.e. 1. Headache that has developed in close temporal relation to other symptoms and/or clinical signs of CVST, and 2. Either or both of a). Headache has significantly worsened in parallel with clinical or radiological signs of extension of the CVST, b). Headache has significantly improved or resolved after the improvement of the CVST.[9] Due to the variable anatomy of the venous sinuses, it is not always possible to exclude CVST with imaging. Variants of normal venous anatomy like sinus atresia/hypoplasia, asymmetrical drainage, and filling defects due to prominent arachnoid granulations or intra-sinus septa, might mimic thrombosis.[8] Traditionally, the gold standard for the diagnosis of a CVST used to be Digital Subtraction Angiography.[1] However, it is rarely required for diagnosis now and is mainly performed when the diagnosis is doubtful or to exclude a dural arteriovenous fistula or distal aneurysm, especially in the presence of subarachnoid hemorrhage.[6] Features of CVST on the unenhanced CT include "the dense vein sign" and "the cord sign", representing increased density of the thrombosed venous sinuses and cortical vein, respectively, in acute phase. However, these findings have less sensitivity or specificity.[1] CT venography delineates the whole of venous circulation in detail and demonstrates thrombosis in the dural sinuses and cortical veins along with sinus wall enhancement, and any collateral drainage.[10] However, CT presents the added risks and hazards of radiation exposure and IV contrast administration and is therefore reserved for patients where MRI is contraindicated. MRI and magnetic resonance venogram (MRV) has proved to be very sensitive and specific and is now the modality of choice for confirmation of the diagnosis of CVST.[11] The combination of an abnormal signal in the sinus with corresponding absence of flow on MRV support the diagnosis of CVST.[6] MRI and MRV techniques have proved to be effective method and it has become the modality of choice for the evaluation of CVST.[12] The magnetic resonance appearance of the thrombus within the cerebral venous system varies and is largely dependent on the age of the thrombus.[13] In the first 5 days after thrombosis, the thrombus appears isointense on T1 images and hypointense on T2 images due to the increased deoxyhemoglobin, making it difficult to pick on these two basic sequences. Subsequently, during the subacute stage (days 5 to 15), the thrombus becomes hyperintense on both T1- and T2-weighted images, progressing to homogeneously hypointense on all MR sequences after day 15. In Lady Reading Hospital there is frequent use of MRI with additional MRV in patients presenting with headache and suspicion of CVST. The aim of this study was to weigh the benefits of added MRV in patients with headaches after a negative MRI for CVST.

METHODOLOGY

The study was approved by the ethical committee of Lady Reading Hospital and the study duration was from November 2018 to September 2020. A total of 207 patients were included prospectively. All patients were referred for MRI brain from indoor mainly neurology and gynaecology wards as well as from OPD of Lady Reading Hospital. Informed consent was taken to be included in the study. All the included patients were primarily sent with chief complaints of headache and suspicion of CVST. The patients with previously diagnosed CVST were excluded from the study. MRI was performed on a 1.5T scanner (Toshiba ventage model). Routine MRI brain was done with MRV and contrast-enhanced MRI in a few selected cases. The MRV sequence used was dynamic coronal by using the time-of-flight technique. The data was collected in the prespecified proforma. The diagnosis of CVST was made by the loss of normal signal void both on T1WI and T2WI as well as on non-visualization on MRV.

RESULTS

Headache was the most common feature present in all patients. However, the duration and nature of the headache were not noted. Out of these 207 patients, 140 were females and 67 were males. The age range was from 7-88 years. CVST was present in 52 patients (25%) on both T2WI and MRV, as given in the table. The gender distribution of the CVST patients was 40 females (77%) and 12 males (23%). Superior sagittal sinus was involved in 8 cases, right transverse sinus in 2 cases, left transverse sinus in 7 cases, left sigmoid sinus in 3 cases, and multiple sinuses in 32 cases. 9 of the CVST cases also had cortical vein thrombosis most of which were associated with multiple dural venous segment thrombosis. Only 1 case was isolated cortical vein thrombosis. 34 cases out of 52 had infarction which was mostly hemorrhagic (27, 79%) with an overall 52 % of the total CVST cases. Generally, Infarction was present in 116 cases out of a total of 207 cases, with 82 cases having infarction without CVST (39.6%). Out of these non-CVST infarctions majority were ischemic (50, 62%) as given in table 1. A total of 97 cases (46%) had aplastic/hypoplastic transverse segments which were mostly the left one (87, 42%) and 10 cases (4.8 %) on the right side. Sinusitis was present

in 91 cases; the majority were in the non-CVST group (68, 32.8%). 3 cases had cerebral masses out of which only 1 case had to accompany CVST.

Table 1: CVST vs Infraction Types

DVT on T2WI	Infarction	Infarction Type			Total
		Ischemic	Haemorrhagic	None	
Yes	Yes	08	27		35
	No			17	17
No	Yes	50	32		82
	No			73	73
Total		58	59	90	207

DISCUSSION

The percentage of hemorrhagic infarction in our study was 52%. A study conducted in India by Gyle et al, also quotes a similar percentage of hemorrhages and Hemorrhagic venous infarct (43.8%) as the most common brain parenchymal lesion, furthermore, brain parenchyma was normal in 33% of the cases which is also comparable to the same study where the percentage was 35.9%.[15] The most frequent sites of thrombosis were lateral (79 %) and superior sagittal sinus (77%). The lateral sinus involvement is close to the frequency mentioned by Damak et al, of nearly 80%. Multiple sinuses were thrombosed in 32 cases (61%) as compared to in approximately 75% of cases reported, the most frequent combination being SSS + LS.[16] The left transverse segment was aplastic /hypoplastic in 46% of cases which is also the most common aplastic segment reported by Goyle et al, i.e. 36%, while the right one in our study was 4.8 % compared to 14 % in the same study.[17] In our study, the most common findings were isolated infarction (39.6 %) and sinusitis (32.8%), while CVST was the third with 25 %. CVST was effectively picked by both T2WI with no added advantages of MRV. The sequence takes extra 5 minutes which is almost comparable to a separate lumbar study. A study carried out on 123 patients over the course of 4 years showed that only 17 patients (13.8%) showed headache as the isolated symptom with no associated finding on CT/MRI, and CVST only picked on MRV.[18] We, therefore, recommend using MRV in patients presenting with headaches only when the clinical suspicion is high and the usual sequences are not diagnostic.

LIMITATIONS

The type and duration of the headache were not recorded.

CONCLUSIONS

In patients presenting with headache and suspected CVST additional MRV is only required if the suspicion of CVST is very high and the routine MR sequences are not able to pick up the thrombus.

CONFLICT OF INTEREST: None

FUNDING SOURCES: None

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CONTRIBUTORS

1. ***Muhammad Imran Khan -*** *Concept & Design; Data Analysis/Interpretation; Drafting Manuscript; Supervision; Drafting Manuscript*
2. ***Ujala Afridi -*** *Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript*
3. ***Fariha Afzal -*** *Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval*
4. ***Alia Bangash -*** *Concept & Design; Data Acquisition*