Original Research Paper

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Radiodiagnosis

A COMPARATIVE STUDY BETWEEN CONVENTIONAL MAGNETIC RESONANCE (MR) SEQUENCES (INCLUDING TIME OF FLIGHT MAGNETIC RESONANCE VENOGRAPHY) AND CONTRAST-ENHANCED MAGNETIC RESONANCE VENOGRAPHY IN DIAGNOSING CEREBRAL VENOUS SINUS THROMBOSIS (CVT)

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ABSTRACT CVT is not an uncommon condition with extremely varied clinical presentation and is the potentially treatable cause with low mortality and timely intervention bears better prognosis hence neuroimaging plays a pivotal role in diagnosis, management, and outcome.Its clinical presentation is varied and often dramatic. It often affects young to middle-aged patients, and more commonly women.Although recognized for more than 100 years, it has only in recent years come to be diagnosed frequently ante-mortem.This is partly due to greater awareness among physicians and neurologists, and partly due to improved imaging techniques.

AIMS & OBJECTIVES: To compare the accuracy between conventional MR sequences (including TIME OF FLIGHT MR VENOGRAPHY) and contrast-enhanced MR VENOGRAPHY in diagnosing CVT, there by trying to avoid exposure of the patient to contrast and also save time in diagnosing CVT. So, as to start early treatment at an appropriate time.

MATERIALS AND METHODS:

- **Place :** Department Of Radiodiagnosis, Alluri Sita Ramaraju Academy of Medical Sciences (ASRAM), Eluru.
- **The Study Duration:** 18 months (between October 2016 and March 2018).
- **Source Of Data:** All patients with signs and symptoms of Headache, Pallor Convulsions, Altered sensorium, Focal neurological deficit like Hemiparesis, Paraparesis, Monoparesis, and Cranial nerve palsy referred to our Department, for MRI scan of the head (MRV and Contrast MRV).
- **Study Population:** 60 cases sent for MRI scan of BRAIN(MRV and Contrast MRV) with signs and symptoms.

INCLUSION CRITERIA: Patients suspected to have cerebral venous thrombosis.

EXCLUSION CRITERIA:

- Patients with absolute contraindications for magnetic resonance imaging (MRI).
- Patients not willing for the study.

Pre contrast images were taken followed by post contrast images after administration of 0.1 mmol/kg body weight of gadolinium intravenously. The standard imaging protocol was used.

KEYWORDS : MRV, Contrast MRV, Thrombosis

INTRODUCTION

Cerebral venous thrombosis is an important cause of stroke in young[1]. Cerebral venous thrombosis is an uncommon condition. The annual incidence is currently estimated to be 3-4 cases per million in adults and 7 cases per million in children or neonates. 3 out of 4 people with CVT are women.

It accounts for 10-20 % of the etiology of young strokes in India [2]. More than 100 causes of cerebral venous thrombosis have been recorded in the literature[3]. However, even with extensive investigation, no cause is identified in 20-25% of the cases. 50% of the strokes in Indian women are related to pregnancy and puerperium and 95.5% of these are due to cerebral venous thrombosis [4].

The first epidemiological study of hemiplegia due to stroke in South India showed that the majority of strokes in young women occurred in the puerperal period[5]. In a subsequent study, cerebral venous thrombosis was found to be the second common cause of strokes in young women[6]. The diagnosis of CVT requires a high index of suspicion because of its varied presentations. Neuroimaging is the corner stone in the diagnosis of cerebral venous sinus thrombosis. Imaging modality of choice in CVT is MRI with MR venogram. MRI with MR contrast venography is almost 100% diagnostic[7].

Accurate and prompt diagnosis of cerebral venous thrombosis is crucial because timely and appropriate therapy can reverse the disease process and significantly reduce the risk of acute complications and long-term sequelae.

ANATOMY OF VENOUS SYSTEM IN BRAIN

- **The supra tentorial venous system:**

Cerebral veins: There are three groups of veins that draw blood supply from the brain, they are:

- Superficial cerebral
- Deep cerebral and
- Veins of posterior fossa

Superficial cerebral veins:

The superficial cerebral veins depending on venous sinuses into which they empty are divided into 3 types[8]:

- Dorso-medial system: Drain into superior sagittal sinus.
- Postero inferior system into lateral sinus.
- Anterior system into cavernous sinus or pterygoid venous plexuses via Sylvian vein.

Deep Cerebral Veins:

- Three veins unite just behind the interventricular foramen of Monro to form the internal cerebral vein. These include choroid vein, septal vein, and thalamo striate vein. This choroid vein runs from the choroid plexus of the lateral ventricle.
- The septal vein runs from the region of the septum pellucidum in the anterior horn of the lateral ventricle and the thalamo striate vein runs anteriorly in the floor of the lateral ventricle in the thalamo striate groove between the thalamus and lentiform nucleus. The point of union of these veins is called venous angle.

- **VEINS OF POSTERIOR FOSSA:**

They are extremely variable in the course and the angiographic diagnosis of their occlusion is extremely difficult.

- Superior veins draining into the Galenic system.
- Anterior veins draining into petrosal sinuses and
- Posterior veins draining into the torcular or neighboring SS and LS.

Lateral MIP image from contrast-enhanced MR venography, with editing of the deep veins to improve the visibility of the ascending veins that drain into the superior sagittal sinus from the lateral hemispheric cortex (the fronto polar , anterior frontal, and posterior frontal veins; Trolard vein [superior anastomotic vein]; and anterior parietal veins and the larger named veins on the lateral surface of the cerebrum (the superficial Sylvian vein [superficial middle cerebral vein], which typically drains into the spheno parietal sinus or the cavernous sinus, and the Labbe´ vein , which drains into the transverse sinus). The relative luminal diameters of the Trolard vein, Labbe´ vein, and superficial Sylvian veins are reciprocal.

Cerebral venous thrombosis:

ETIOLOGY:

- Anti-thrombin deficiency.
- Protein C and S deficiency.
- Pregnancy.
- Puerperium.
- Nephrotic syndrome.
- Neck, face, mouth infection.
- Paroxysmal nocturnal hemoglobinuria.
- Heparin-induced thrombocytopenia.
- CNS tumors.
- Solid tumors outside CNS.

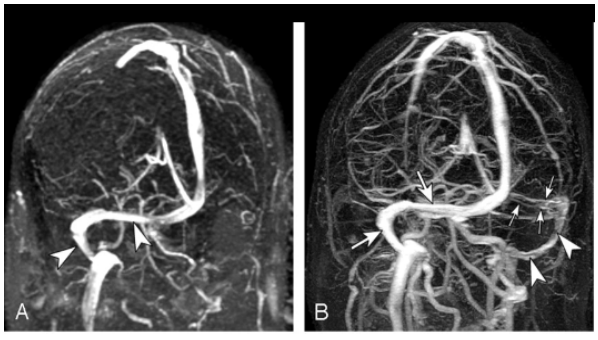
PATHOGENESIS:

- Infective.
- Embolism.
- Local endothelial damage.
- Hypercoagulability.

MAGNETIC RESONANCE IMAGING IN CVT:

- Unenhanced MR imaging is more sensitive than unenhanced CT for the detection of venous thrombi. The primary finding of sinus thrombosis on MR images is the absence of a flow void and the presence of altered signal intensity in the sinus on routine T1 and T2 sequences.
- GRE/SWAN imaging sequences may be an important diagnostic aid in acute-stage thrombosis, when the signal intensities on T1- and T2- weighted images may be more subtle[9].
- This stage of formation is the easiest stage at which to detect a thrombus on MR images. The finding of increased signal intensity on both T1- weighted images and T2- weighted images is consistent with the sub-acute onset of thrombus.
- Chronic thrombosis with incomplete recanalization of the sinus may present a diagnostic challenge at MR imaging. As many as 15% of patients in whom sinus thrombosis is diagnosed at MR imaging may have a chronic (15-day-old) thrombus[10].
- Compared with the MR signal in normal brain parenchyma, the signal in a chronic thrombus is typically isointense or hyperintense on T2-weighted images and isointense on T1-weighted images; however, significant variability in thrombus signal intensity exists[10-14]. The signal intensity may be similar to that of very slowly moving oxygenated blood.

Representative cases

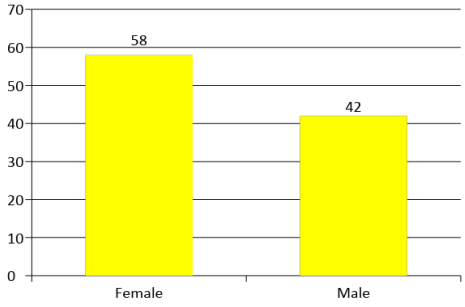


A case of Partially recanalized thrombosis of the left transverse and sigmoid sinuses. Shown is a TOF-MRV oblique MIP (A), a CE-MRV oblique MIP (B) There was normal flow-related signal intensity in the right transverse and sigmoid sinuses (arrowheads, A). The morphology of the partially recanalized sinuses is better depicted on CE-MRV (B). Small irregular recanalized channels were seen within the left transverse sinus (small arrows, B). The sigmoid sinus opacifies more completely; however, focal and linear irregular filling defects are visualized (arrowheads, B). The left transverse and sigmoid sinuses enhance less prominently than the normal right transverse and sigmoid sinuses (large arrows, B)

DISCUSSION & RESULTS

The present study was carried out to compare the accuracy of conventional magnetic resonance sequences (including time of flight MR venography) and contrast-enhanced Magnetic resonance venography in diagnosing a clinically suspected case of cerebral venous thrombosis (CVT).

Our study showed a high prevalence of cases in the age group of 20-29 yrs accounting for 36(60%) of cases, followed by age group of >30yrs which were 16(27%) and age group of <20 yrs which were 8(13 %) cases.



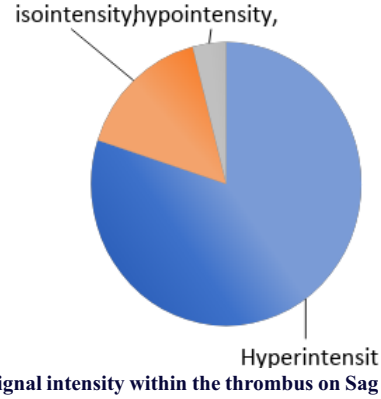
Showing sex distribution of Patients

- Our study showed a high prevalence of CVT amongst female patients accounting for 35(58%) of cases, outnumbering male patients 25(42%) by about 16%.

Clinical Symptoms	Frequency	Percentage
Headache	50	83
Vomiting	35	58
Convulsions	20	33
Hemiparesis	18	30

Showing clinical Symptoms at the time of presentation

In our study headache was the most common symptom (in 50 patients-83%), followed by vomiting (in 35 patients-58%), convulsion (in 20 patients-33%) and hemiparesis (in 18 patients-30%).



Showing signal intensity within the thrombus on Sag T1 weighted images for acute/early subacute cases

In our study group of 60 patients, 50 cases were in acute/sub-acute stage accounting for 83% of cases and 10 cases were in chronic stage accounting for 17% of cases.

In our study most commonly involved sinus was superior sagittal sinus (in 37 patients-62%), followed by Transverse sinus (in 29 patients-48%), sigmoid sinus (in 20 patients-33%),internal jugular vein involvement (in 11 patients-18%), cortical vein involvement (in 19 patients -32%), Vein of Galen involvement (in 4 patients -6%), internal cerebral vein involvement (in 2 patients -3%). In 6 chronic cases, complete recanalization was noted.

CONCLUSION

- Most common age group was between 20-29 yrs of age accounting for 60% of the study population. Amongst female patient high incidence was seen in women with pregnancy and puerperal phase accounting for 57% as compared to non-pregnant women who

accounted for 43% of the female population of our study.

- Superior sagittal sinus was most common sinus to be involved in 62% of cases, followed by transverse sinus in 48% of cases. Complete recanalization was seen in 60% of chronic CVT cases
- Sensitivity and positive predictive value of plain MRI including non-contrast MR venography in diagnosing acute CVT was 100% and 96% respectively. Specificity could not be calculated in acute cases as there were no false negative cases on plain MRI.
- The sensitivity of non-contrast MR venography for chronic cases was 50%. Specificity was 100% and the positive predictive value was 100%.
- Overall sensitivity and specificity of plain MRI with MRV in diagnosing CVT as compared to contrast MRV in our study was 96% and 75%.

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