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ACUTE CEREBRAL VENOUS SINUS THROMBOSIS: PLAIN COMPUTED TOMOGRAPHY VERSUS MAGNETIC RESONANCE IMAGING

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ABSTRACT

INTRODUCTION: The most common cause of CSVT was septic process in preantibiotic era. Cerebral sinus venous thrombosis shows wide clinical spectrum and it is difficult to diagnose because of its variable aetiologies and prognosis. Clinical findings of CSVT can be due to Occlusion in cerebral veins or Occlusion of venous sinuses. Most patients with CVST present with nonspecific signs and symptoms and are likely to undergo nonenhanced head computed tomography (NCT) and in these cases undergo nonenhanced head computed tomography may be normal in up to two-thirds of patients with venous sinus thrombosis. Magnetic resonance imaging (MRI) is considered as the choice of imaging but MRI may not be available in many of the setting or cannot be afforded by the patients. **MATERIAL AND METHODS:** In this study two groups two groups were formed, first in which sinus thrombosis confirmed by MR venography and second group consist of control had normal NCT study and having seizures and headache . In both the group 30 each patients were selected and included whose symptoms were < 3 days old. Measurement of Hounsfield unit (HU) verses haematocrit (H) was calculated. HU: H ratio of each patient was also calculated. The haemoglobin, haematocrit (HCT), and HU:H (HU to HCT) ratio of both groups were calculated and compared. **RESULTS:** 30 patients in MR venography were included in the study while 30 patients in control group were included. In MRI group in which thrombosis was observed mean age was 35.4 ± 14.2 while in control group it was 41.3±12.4. Average haemoglobin concentration in MR and control group was 14 ±2.6 and 11.6±3.4 respectively. In MR group HCT was 48.2±7.6 while in control group it was 37.5±8.4. HU in MR group was 74 ±2.9 and in control group it was 44.8±7.8. HU: H ratio was calculated in both the group in group MR it was 1.6±0.5 and in control group it was 1.2±0.3. **CONCLUSION:** Thus acute CVST can be diagnosed accurately in plain CT scan with the help of HU: H ratio and the treatment can be started early to reduce the future complications.

Keywords: HU to HCT

Introduction

Regulation of intracranial pressure (ICP) in adults results from the dynamic interaction between the arterial, venous, cerebrospinal fluid (CSF), and brain parenchyma compartments[i]. In the intracerebral venous system Cerebral venous thrombosis (CVT) can be considered as a model of dynamic disorder[ii]. Cerebral sinus venous thrombosis (CSVT) is a form of venous thromboembolism (VTE0 occurs in about 0.5 % to 3% of all types of strokes and affecting the younger people[iii],[iv],[v].

The most common cause of CSVT was septic process in preantibiotic era. Cerebral sinus venous thrombosis shows wide clinical spectrum and it is difficult to diagnose because of its variable aetiologies and prognosis. In most of the developing and underdeveloped countries it is found to be associatedwith puerperium because of inappropriate perinatal care, metabolic derangements, and infections associated to childbirth[vi].

Cerebral venous drainage has two systems, the superficial and the deep venous systems. Due to the high proportion of anastomoses in the superficial venous system it is difficult to diagnose in cases of occlusion.

Clinical findings of CSVTcan be due to Occlusion in cerebral veins or Occlusion of venous sinuses. In Occlusion in cerebral veins two types of oedema is developed cytotoxic and vasogenicedema and the magnetic resonance (MR) could differentiate the type of oedema present during the CSVT event[vii],[viii].Intracranial hypertension (ICH) is the predominant characteristic of **Occlusion of venous sinuses. In thrombosis** the venous pressure raises due to delaying in the venous emptying, altering the CSF absorption, and thereby raising the intracranial pressure[6].

There are many causes of CSVT, there may be acquired and inherited risk factors for thrombosis. There is Virchow triad of thrombogenesis i.e. hypercoagulability, vessel wall damage and blood stasis[ix]. Inherited prothrombotic risk factors include homocysteinemia, factor V Leiden homozygous mutation, protein C and S and anti-thrombin III deficiency, and positive anti-cardiolipin or anti-phospholipid antibodies[x],[xi]. Acquired risks factors include head trauma, brain tumours, central nervous system infections, extracerebralneoplasia, neurological surgery, lumbar puncture, puerperium, pregnancy etc[xii].

Most patients with CVST present with nonspecific signs and symptoms and are likely to undergo nonenhanced head computed tomography (NCT) and in these cases undergo nonenhanced head computed tomography may be normal in up to two-thirds of patients with venous sinus thrombosis, as the sinus is hyper dense in acute stage the sensitivity of diagnosing the thrombosis increases[xiii]. Magnetic resonance imaging (MRI) is considered as the choice of imaging modality for diagnosing CVST[xiv]but MRI may not be available in many of the setting or cannot be afforded by the patients, so treating doctor has to look for the alternate diagnostic modalities for confirmation of the CVST. Recently CTV and MR venography (MRV) have now replaced digital subtraction cerebral angiography as the diagnostic test of choice for CVST[xv]. CT venography (CTV), may be one of the diagnostic modality and CTV may give good results as MRI or in some cases may give better results[xvi]. So early detection of CVST is important for initiation of anticoagulation therapy which will prevent the propagation of thrombus and subsequent venous infarcts and haemorrhage[xvii].

The present study was conducted to compare and evaluate whether CVST can be diagnosed in acute conditions by CT venography. Measurement of Hounsfield unit (HU) verses haematocrit (H) was calculated

MATERIAL AND METHODS

This observational comparative study was conducted in the department of Neurology in collaboration with Radio-diagnosis. Measurement of Hounsfield unit (HU) verses haematocrit (H) was calculated

In this study two groups two groups were formed, first in which sinus thrombosis confirmed by MR venography and second group consist of control had normal NCT study and having seizures and headache . In both the group 30 each patients were

selected and included whose symptoms were < 3 days old. Measurement of Hounsfield unit (HU) verses haematocrit (H) was calculated. Patients with a history of trauma, intracranial surgery, and intracranial artefacts were excluded from the study.

In first group of MR venography HU of individual thrombotic segments was measured and in case multiple sinus thrombosis, average HU of all thrombosed sinuses was taken for comparison. HU measurement of second group was also calculated. HU: H ratio of each patient was also calculated. The haemoglobin, haematocrit (HCT), and HU:H (HU to HCT) ratio of both groups were calculated and compared.

Statistical analysis was done by SPSS software, average HU, between patients with and without thrombosis were compared

RESULTS

30 patients in MR venography were included in the study while 30 patients in control group were included. Baseline parameters were compared in each group.

Table 1: Comparison of baseline parameters

Parameters	MRI group (n=30)	Control (n=30)	CI, P value
Average age(mean±SD)	35.4 ± 14.2	41.3±12.4	-0.9897 to 12.7897, P = 0.0918
Haemoglobin	14 ±2.6	11.6±3.4	-3.9642 to -0.8358, P = 0.0032
HCT	48.2±7.6	37.5±8.4	-14.8399 to -6.5601, P < 0.0001
HU	74.6±2.9	44.8±7.8	-32.8412 to -26.7588, P < 0.0001
HU: H ratio	1.6±0.5	1.2±0.3	-0.6131 to -0.1869, P = 0.0004

In MRI group in which thrombosis was observed mean age was 35.4 ± 14.2 while in control group it was 41.3±12.4, with confidence interval (CI) -0.9897 to 12.7897 and P = 0.0918. Which was not statistically significant. Average haemoglobin concentration in MR and control group was 14 ±2.6 and 11.6±3.4 respectively, CI:-3.9642 to -0.8358, it was statistically significant.P = 0.0032. In MR group HCT was 48.2±7.6 while in control group it was 37.5±8.4, with confidence interval (CI) -14.8399 to -6.5601, P < 0.0001. HU in MR group was 74 ±2.9 and in control group it was 44.8±7.8. CI -32.8412 to -26.7588, P < 0.0001, statistically these values were highly significant. HU : H ratio was calculated in both the group in group MR it was 1.6±0.5 and in control group it was 1.2±0.3,CI -0.6131 to -0.1869, P = 0.0004, highly significant.

It is observed that HU values were higher in MR group and all patients HU values were above 70. HU values in control group it was below 46.

DISCUSSION AND CONCLUSION

As CVT is serious and life-threatening cause of stroke. The head computed tomography (CT) and routine brain magnetic resonance imaging can assess any parenchymal lesion secondary to the venous thrombosis and reveal direct signs of intraluminal thrombus[xviii]. But if the parenchymal lesions are not specific for direct visualization of a thrombus on MRI, venography can be done[xix].

In acute stages of thrombosis hyper-attenuation of cerebral sinuses can be seen. This increase in attenuation occurs is due to elimination of water, clot retraction, and increased concentration of red blood cells and haemoglobin, which results in high HU values. Attenuation gradually decreases because of degradation of red blood cells and haemoglobin[xx].

In our study HU > 70 can be considered significant for diagnosis of thrombosis and HU value < 46 can be considered to rule out thrombosis. Similar results were observed by Digge P et al[xxi]they showed that HU>70 is highly valuable for diagnosing thrombosis (sensitivity 92% and specificity 100%), and further investigation is not required to confirm the diagnosis. Similarly, HU value of <64 is very specific in ruling out thrombosis. If the HU values are intermediate then it is advised to go for venography. Besachio et al[xxii]. showed sensitivity of 84% and specificity 95% with a HU cut off value of 65.also Black *et al*. noted that patients with CVST often had a HU of >70, also a correlation between the patient's HCT and venous sinus density was demonstrated also he found mean HU: H values of 2.20 in patients with CVST and 1.44 in patients without CVST[xxiii].

Buyck et al[xxiv] showed that an HU: H ratio of >1.52 suggests a strong likelihood of a clot (sensitivity 95%, specificity 100%.in our study also statistically significant difference was observed in both the groups.

79%–83% of sensitivity was seen in some studies for diagnosing intraluminal thrombus by MRI and might be related to the variable interval between the onset of thrombus formation and the time of imaging[xxv]. In acute cases CT is preferred by most of the treating doctor as early detection and treatment is must for thrombosis patients. Negative part about MRI is it is time consuming and patient cooperation is required also in poor settings MRI may not be available or affordable. Thus acute CVST can be diagnosed accurately in plain CT scan with the help of HU: H ratio and the treatment can be started early to reduce the future complications. But it is important that normal HU value does not exclude the presence of thrombosis in such high risk cases MRI should be advised.

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