CASE SERIES

Cerebral Venous Sinus Thrombosis: Case Series across Various Age Groups, Presentations, and Imaging Characteristics

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Abstract

Cerebral venous sinus thrombosis (CVST) is a relatively rare and potentially life-threatening condition among different age groups with multiple etiological factors. The following report illustrates three cases of CVST representing a variety of demographics and risk factors for this condition, highlighting the importance of radiological imaging in its recognition. Case 1 a 13-year-old female with measles who was confused and found to have meningoencephalitis, had imaging evidence of deep venous sinus thrombosis. Case 2 is that of a 51-day-old newborn who presented with lethargy, and seizures and was found on CT to have global ischemic venous infarction that was contributed to by anemia and dehydration; Case 3 is of a 30-year-old female without past illness who had a feverish headache and vomiting, as CT imaging revealed thrombosis in multiple venous sinuses. This discussion also points to the intricate pathophysiology of CVST, triggered by infection, dehydration and coagulopathy as the constituents for a deep understanding that requires immediate imaging in cases of suspicion in all age populations.

Keywords: *Cerebral venous sinus thrombosis, computed tomography, magnetic resonance imaging, stroke, infarction.*

INTRODUCTION

Of all strokes, CVST accounts for 0.5%, and incidence varies greatly between adults and children. In adults, it occurs in 3-4 cases per million, whereas among children and neonates, it reaches 7 cases per million. In the main, infants under six months of age are affected. Interestingly, 75% of cases in adults are women; reasons may include pregnancy and contraceptive use [1]. The incidence of CVST is maximum in the age group of 20 to 40 years. The clinical presentation varies according to age; newborns are mostly seen to present with seizures and irritability, whereas older children may experience manifestations including headache, vomiting, dizziness, seizures, and increased intracranial pressure. Risk factors include infections, such as meningitis, dehydration, blood clotting disorders, and anemia. Its diagnosis chiefly depends on neuroimaging techniques, especially MRI and venography. Treatment is based on anticoagulation, management of intracranial pressure, and elimination of the underlying cause. Recent interventions such as endovascular thrombolysis are under investigation with variable success. Advances in recent times in the field of diagnosis and treatment of CVST have increased the survival rate and reduced complications of CVST [1, 2].

We present here three cases of CVST with varying clinical signs and symptoms.

CASE 1

A 13-year-old female was brought to the emergency department with a history of altered sensorium (GCS 8/15) and confirmatory measles. Clinically meningoencephalitis was suspected. Contrast CT brain imaging showed hypodense, enlarged thalami and hyperdensity seen in intra-cranial venous sinuses supporting a diagnosis of deep venous sinus thrombosis

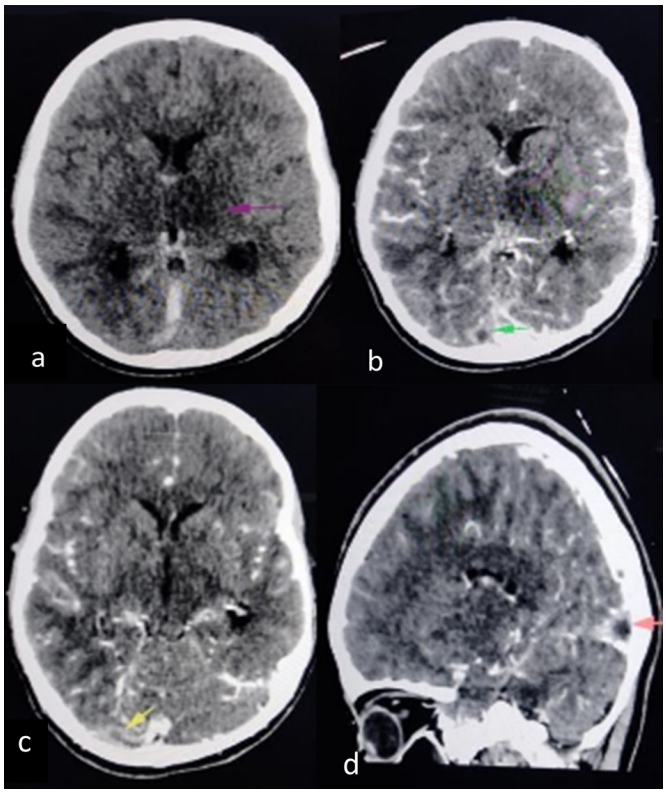

Fig. (1): CT scan axial and sagittal images. (**a**, **b**, **c** and **d**) show both thalami appearing hypodense and swollen, filling defects are seen in the inferior sagittal, right transverse and sigmoid sinus respectively representing thalamic infarcts with venous sinus thrombosis.

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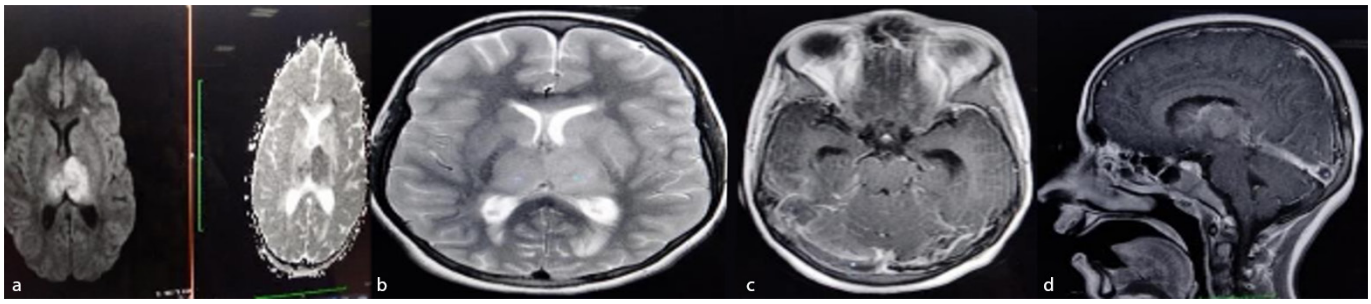

Fig. (2): MRI, WI, ADC, T2&T1 PC images. (**a**, **b**, **c** and **d**) shows restricted diffusion in both thalami and filling defect seen in the confluence of venous sinuses, right transverse, sigmoid sinus and in right internal jugular vein representing CVST with thalamic infarcts.

due to viral illness with precipitating infarction in the thalamus (**Fig. 1**). This case highlights how infectious diseases, specifically viral infections such as measles may be associated with severe neurological sequelae and the importance of rapid imaging to establish the diagnosis (**Fig. 2**).

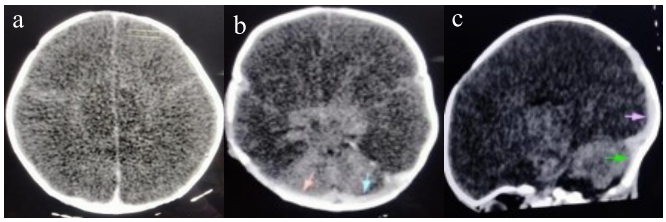

Fig. (3): CT scan axial and sagittal cuts. (**a**, **b** and **c**) show high density is seen in both transverse sinuses and superior sagittal sinus representing CVST with Diffuse hypo density seen involving both cerebral hemispheres with loss of grey and white matter differentiation representing global ischemia.

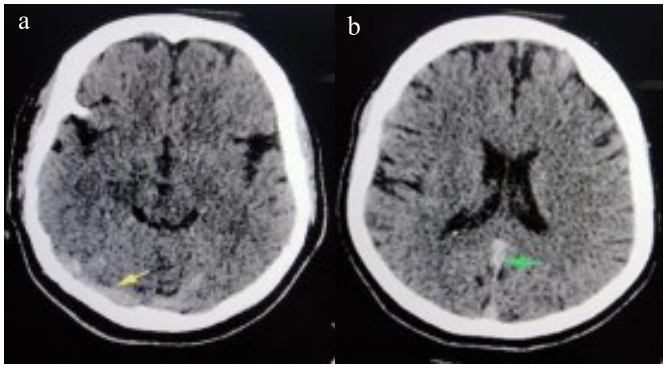

Fig. (4): CT scan axial images. (**a** and **b**) show high density in the superior sagittal sinus, straight sinus and right transverse representing CVST.

CASE 2

We present a 51-day-old neonate brought to the emergency department for lethargy, dehydration, poor oral intake and focal seizures. Laboratory studies revealed low haemoglobin levels, suggesting anaemia secondary to dehydration. The CT scan revealed high-density areas in the superior sagittal, straight, and bilateral transverse sinuses, compatible with thrombosis; as well as diffuse hypo density of both cerebral hemispheres, compatible with global ischemic venous infarction. This case demonstrates the importance of an early imaging work-up in neonates with less specific presentations, as well as emphasises that dehydration and anemia are major risk factors for infants (**Fig. 3**).

CASE 3

A 30-year-old female patient presented in the emergency with complaints of severe occipital headache and vomiting. Her lab workup was sent and she underwent a CT brain to rule out any underlying pathology. CT brain of the patient revealed high density in the superior sagittal sinus, straight sinus and right transverse sinus favoring the diagnosis of thrombosis (**Fig. 4**).

CASE 4

A 38-year-old female patient came to OPD with complaints of depression, migraine and numbness with on and off fits. On further taking history she said that she is a known case of sickle cell anemia. Her laboratory workup was performed which shows raised ESR and CRP and Hb was 7.5g/dl. Other than that whole workup

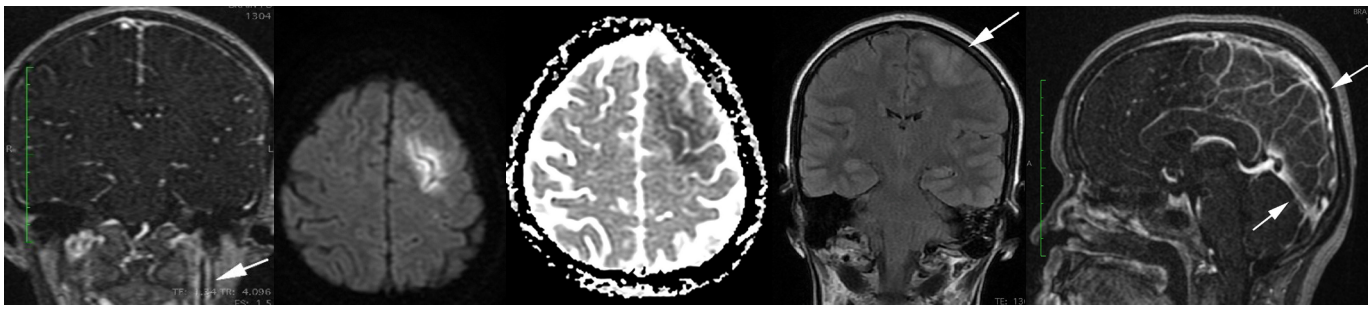

Fig. (5): These images show a cortical infarct in the left superior frontal lobe giving restricted diffusion and filling defects noted in sinuses as marked by an arrow representing thrombosis.

was normal. No history of similar symptoms was provided. Surgical history revealed cholecystectomy 10 years back.

According to the history provided the primary team of neuro medicine referred her to the radiology team for an MRI and MRA of the brain including MRV with contrast.

In MRI, there is an area of restricted diffusion with T2 high signals seen involving the cortex of the left frontal lobe. MRA was unremarkable and MRV shows filling defects in the central part of the superior sagittal, straight, bilateral transverse, sigmoid sinuses and internal jugular vein representing central venous sinus thrombosis.

The conclusion of this case is thrombosis due to Hb and possibly underlying infection (**Fig. 5**).

DISCUSSION

Cerebral venous sinus thrombosis is an emergent challenge of medical science, in which cerebral venous sinuses get blocked due to the formation of a thrombus. In a majority of cases, this condition usually presents with a range of neurological symptoms; hence, a high suspicion index is important in diagnosing it on time and treating the patients accordingly. Except for headache, the most common complaints, other than headache, in CVST patients are seizures and focal deficits. Given its multifaceted etiology and wide symptomatology, recognizing CVST warrants a comprehensive understanding of its epidemiology, demographics, signs and symptoms, imaging modalities, etiology, and treatment options [1, 2].

The etiology is complex and varies among the age groups. In infants, infection remains the most common risk factor. In neonates, dehydration and anemia represent significant triggers. Adults show heterogeneous triggering events such as hormonal fluctuations, coagulopathies, and acute infections. These conditions predispose to intraluminal clot formation through alteration of the coagulation cascade and often by superimposition of inflammatory damage [2, 3]. As seen in our cases with three different age groups and different causes.

It can have severe morbidity and mortality if not promptly diagnosed and treated. Many studies report that headache is the most frequent symptom with about 75%-90% prevalence among adults, whereas recent findings have reported a prevalence as high as 47.51%. The condition often affects individuals of various ages while presenting different risk factors and etiological factors. Awareness about this condition has to be enhanced, and prompt action is to be taken when the symptoms arise [1, 3].

This affects a wide age range and demographics. For infants, infections, especially measles, are a leading risk factor. In neonates, dehydration and anemia are critical contributing factors. Adults might suffer from CVST because of a wider range of precipitating events, such as hormonal changes, coagulopathy, and viral infections. It is remarkable that despite these known predisposing factors up to 80% of the patients may not have identified causative factors [4, 5].

The clinical presentation is quite variable, typically one of gradual onset of symptoms over days or weeks as the thrombus forms. Headache is almost always present and commonly accompanied by papilledema which may be indistinguishable from benign intracranial hypertension. Other symptoms may include seizures and focal neurological deficits related to venous edema or infarction. Specific sinus occlusions can cause unique presentations; thus, for example, lateral sinus occlusion can present as diplopia or hemianopia. Even in the absence of an obvious risk factor, CVST should be suspected in patients with this clinical presentation [4, 5].

Imaging is an important method of diagnosis. Usually, unenhanced helical CT serves as an initial imaging method. This modality also helps to rule out other acute conditions such as a subarachnoid hemorrhage. An acute clot may be seen as a hyper-dense area, often referred to as the “cord sign.” MRI, especially conventional spin-echo T1/T2 sequences, is much more sensitive for detecting CVST, revealing flow voids within patent cerebral veins as being of low intensity. The several methods of MR venography, including 2D time-of-flight and 3D phase contrast, offer better visualization of the venous system and diagnose and follow the extent of disease. Digital subtraction angiography is rarely used but still useful in excluding other causes of bleeding [5, 6].

The differential diagnosis for cerebral venous sinus thrombosis is very broad and includes all the possible intracranial events, including pseudotumor cerebri, intracranial abscess, neurosarcoidosis, meningitis, and abducens nerve palsy [6, 7].

In patients diagnosed with CVST, standard treatment plays the most important role, which is usually anticoagulant, starting after discarding intracranial haemorrhage. Patients with reversible risk factors should be addressed accordingly and severe cases may be subjected to thrombectomy interventions. In the case

study, all patients were given low molecular weight heparin that stabilized conditions in most, showing that early intervention is effective. In suspected infectious etiology, speedy administration of broad-spectrum antibiotics in combination with antithrombotic therapy is indispensable to reduce related morbidity and mortality [7, 8].

CONCLUSION

Cerebral venous sinus thrombosis represents one of the unique neurology dilemmas requiring high grades of clinical suspicion and appropriate imaging for early diagnosis and treatment. This disease is moderately difficult to determine etiologically with variability in clinical presentation. It thus calls for vigilance within health circles, especially as one perceives the patients that present with headaches, altered consciousness, and other neurological symptoms as shown in our three cases. Its outcome can be greatly boosted by a multidisciplinary approach together with new diagnostic imaging technology such as MRI and MRV. Understanding this condition as multi-factorial would allow us to improve our therapies and ultimately achieve better outcomes in the management of these patients.

CONSENT FOR PUBLICATION

The patients' permission has been obtained.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORS' CONTRIBUTION

Dr. Hina Naseer: manuscript writing
Dr. Saleha Shahzad: case identification
Dr. Uzma Panhwer: manuscript drafting
Dr. Ambreen Shaikh: collected data and manuscript drafting
Dr. Rabia Ahmed: manuscript drafting
Dr. Muhammad Ayub Mansoor: granted final approval for submission

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