Diagnosis of superior sagittal sinus thrombosis by computerized tomography

Report of two cases

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Superior sagittal sinus thrombosis was diagnosed on computerized tomography (CT) scanning and was subsequently confirmed by angiography in two patients. Small ventricles and filling defects occurring within the sinus (the empty triangle sign) appeared to be highly suggestive of superior sagittal sinus thrombosis, and the association was confirmed angiographically. Potential pitfalls in the CT diagnosis of local obstruction of cerebral venous outflow are described and correlated with the natural history of the disease. The need for improved awareness of the CT appearance of occlusive disease of the dural venous sinuses is stressed.

KEY WORDS • computerized tomography • sagittal sinus thrombosis • intracranial pressure

Oclusive disease of the superior sagittal sinus with clinical manifestations may occur more frequently than is suspected, and affects patients of all ages. Towbin found dural sinus thrombosis in 9% of 182 consecutive autopsies on adult subjects. Scotti, et al., identified cerebral venous thrombosis in 3.7% of cases in a series of patients of pediatric age who underwent cerebral angiography.

Aseptic thrombosis of the superior sagittal sinus is associated with a wide variety of neurological manifestations. Clinically, it can present with slight neurological deficits or with an acute onset that is rapidly fatal. Diagnosis is usually difficult and delayed, but prompt appropriate treatment may result in a decreased risk of mortality and morbidity. Computerized tomography (CT) is indicated as the preliminary diagnostic study, but a number of potential pitfalls in the diagnosis of superior sagittal sinus thrombosis by this means have been described.

This report is based on our experience with two angiographically verified cases of thrombosis of the superior sagittal sinus. We are presenting these cases to draw attention to the CT findings in cases of cerebral venous occlusive disease.

Case Reports

Case 1

This 34-year-old woman presented 5 hours after the onset of headache and vomiting. On admission she had mild confusion and papilledema. Lumbar puncture disclosed an opening pressure of over 30 mm Hg. She underwent CT scanning 24 hours after onset, which revealed, on contrast enhancement, small ventricles and the empty triangle sign indicative of superior sagittal sinus thrombosis (Fig. 1). Cerebral angiography 3 days later showed lack of filling of the superior sagittal sinus. Instead of the normal pattern of ascending veins, flow inversion was revealed, with venous drainage to the vein of Labbé and the cavernous sinus (Fig. 2).

Corticosteroid and anticonvulsant therapy was instituted. Two repeat CT scans 24 and 46 days after onset of the disease demonstrated normal ventricles. There was also partial progressive resolution of the empty triangle sign (Fig. 3). The patient is now alive and well.

Case 2

This 45-year-old woman came to our institution for evaluation of headache and sluggish mentation of 2 days duration. She had papilledema and hemiparesis.
FIG. 1. Computerized tomography (CT) scanning on admission in Case 1. Left: Contrast-enhanced CT section at a window level of 100 and a window width of 150. The empty triangle sign is indicative of superior sagittal sinus thrombosis. This appearance could not be appreciated when the sections were observed at standard exposures. Right: Small ventricles, reminiscent of pseudotumor cerebri, were also disclosed by the initial CT study.

FIG. 2. Case 1. Carotid angiogram showing lack of filling of the superior sagittal sinus. Instead of the usual pattern of ascending veins, drainage is to the vein of Labbé and the cavernous sinus.

FIG. 3. Case 1. Computerized tomography (CT) scan, carried out 46 days after the initial CT examination, showing partial resolution of the empty triangle sign. The filling defect is still recognizable.

Lumbar puncture revealed an opening pressure of over 20 mm Hg. A CT scan performed on admission showed small ventricles and an empty triangle sign (Fig. 4). Cerebral angiography 3 days later confirmed superior sagittal sinus thrombosis, with an appearance similar to that seen in Case 1.

The patient was started on a course of corticosteroid and anticonvulsant therapy. Two subsequent CT scans 26 and 50 days after onset of the disease showed progressive resolution of the empty triangle sign. There was no evidence of delayed ventricular enlargement. The patient is now alive and well.

Discussion

The CT appearance of cerebral sinovenous thrombosis includes multiple focal bilateral parasagittal hemorrhages, intense tentorial or gyral enhancement, and edema with large areas of enhancement indicative of infarction. The most reliable CT feature of superior sagittal sinus thrombosis, however, is the empty triangle sign associated with small ventricles on the contrast-enhanced scan.

Small Ventricles

In our two cases, the ventricular system appeared smaller than normal, suggesting a pseudotumor cerebri, on CT studies obtained within 48 hours of the clinical onset. The cisternal spaces also appeared compressed and poorly visualized. This appearance corresponds to the elevated manometric values we found when monitoring cerebrospinal fluid pressure via the lumbar subarachnoid spaces. It is essentially due to congestion and to cerebral edema following the acute block of venous cortical drainage. This is a nonspecific sign of venous sinus thrombosis. Other possible diagnoses to be considered on the basis of these findings include pseudotumor cerebri, diffuse posttraumatic edema, benign intracranial hypertension, and bilateral isodense subdural collections.

The ventricular system did not dilate in our cases, as shown from the follow-up CT scans carried out up to 50 days after the clinical onset of the disease. These observations confirm previous reports by d'Avella and coworkers with a long-term neuroradiological follow-up review. A few cases of thrombosis of the longitudinal sinus have been reported as developing ventricular dilation. It is possible that in these cases the development of venous infarcts and the subsequent necrosis of cerebral parenchyma caused expansion of the ventricles, making a type of hydrocephalus ex vacuo that is not necessarily symptomatic.

Empty Triangle Sign

The empty triangle sign seen in CT scans after intravenous administration of contrast material (Figs. 1 and 4) represents an isodense clot within the longitudinal sinus. The high-density sides of the triangle represent the wall of the sinus itself, which, being crossed by fenestrated capillaries, normally shows enhancement on contrast scans. The center of the triangle becomes less and less dense with the reduction of the hemoglobin contained in the clot. In a recent series of 11 cases of sinus thrombosis studied with CT, the empty triangle sign was present in most of the patients. However, to our knowledge the finding of the empty triangle has
been confirmed by angiography or necropsy in only 13 previous cases.

An accurate technique is needed to recognize this CT appearance correctly. It is necessary to identify the empty triangle in cuts carried out at different levels, so as to exclude the presence of a high bifurcation of the sinus simulating the presence of the triangle. Defects in refilling the sinus, not appreciable on scans carried out with standard window values, can be visualized on scans with higher values. Such scans should therefore be routinely performed in cases of suspected pathology of the sinus. Some apparent defects in sinus refilling are really artifacts due to the proximity of the skull, particularly in patients with a local alteration of the contours of the skull. If artificial, such apparent defects in refilling are, however, limited in area.

A recanalized sinus does not give the appearance of an empty triangle and is indistinguishable on CT scanning from the normal situation. Recanalization of the sinus can take place in the space of a few days. Therefore, the possibility of showing the empty triangle does not last long, and every attempt to study the patient should be made as soon as the diagnosis of thrombosis of the longitudinal sinus is suspected.

Conclusions

Cerebral sinovenous occlusive disease is a more frequent cause of neurological symptoms than is generally assumed. The recent literature has highlighted some CT aspects peculiar to intracranial venous thrombosis. Our experience indicates that the occurrence of small ventricles in combination with the empty triangle is highly suggestive of superior sagittal sinus thrombosis, and its association has been confirmed angiographically. This sign is valuable for early diagnosis of this disorder. We therefore emphasize careful CT scrutiny of the sagittal sinus in a search for filling defects whenever the clinical history suggests sinovenous involvement. Both of our cases also show that a thrombosed superior sagittal sinus may not be suspected from the standard window scans, and that the use of expanded window settings is required for the diagnosis.

Cerebral angiography remains the key to definitive diagnosis. Further expedients, such as delayed angiographic series with simultaneous bilateral injections of the internal carotid artery or with compression of the contralateral vessel and oblique projections, can prove indispensable in visualizing the course of the sinus. The role of CT is of particular interest in patients with mild neurological symptoms who might not receive full neuroradiological evaluation at an early stage.

References


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