The pseudodelta sign in acute head trauma

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ON contrast-enhanced computerized tomography (CT) scans, the “empty triangle” or delta sign has been described as an indication of sagittal sinus thrombosis. It consists of a triangular area of high density related to contrast enhancement in the superior sagittal sinus which contains a low-density center corresponding to the thrombosis (Fig. 1). We describe a “pseudo empty triangle” or “pseudodelta sign,” which has a similar radiographic appearance but which is seen on CT scans without contrast enhancement (Fig. 2 left). This appearance is found after trauma and is due to parafalcine interhemispheric hematoma and/or posterior parafalcine subarachnoid hemorrhage (SAH). When abnormal density is found on only one side of the posterior falx, we have termed this a “hemipseudodelta sign.” We have noted confusion in the interpretation of these signs. Our purpose is to establish criteria for identifying the pseudodelta sign, and to clarify its significance.

Clinical Material and Methods

A retrospective review was conducted of 100 randomly selected CT scans of the head without contrast enhancement which were interpreted as demonstrating SAH in a search for the pseudodelta sign. Two neuroradiologists had to agree independently that the pseudodelta sign was present before a scan was recorded as showing the sign. The neuroradiologists were not informed of the etiology for the SAH at the time the scans were interpreted. Since that time, at least 50 CT scans showing the pseudodelta sign have been identified in trauma cases with or without other radiographic evidence of posttraumatic SAH, intraparenchymal hemorrhage, or other extracerebral blood collections.

Results

Table 1 summarizes the results of the retrospective study. Of the 100 cases of SAH, there were nine examples of the pseudodelta sign and eight of the hemipseudodelta sign. The signs were noted only in trauma-related cases and were not seen in any case of spontaneous SAH. Since completion of the retrospective study, we have prospectively observed triangle-shaped areas of increased density along the posterior falx with central low density (pseudodelta sign) in more than 50 additional cases of acute trauma. No pseudodelta signs have been found in cases of spontaneous SAH (not related to trauma), but a pseudodelta sign was observed in one case where water-soluble contrast...
material applied during a stereotaxic surgical procedure reached the posterior parafalcine subarachnoid space. Several additional cases have been prospectively identified in which blood was seen unilaterally along the posterior falx (hemipseudodelta sign). The majority were trauma-related, but two cases of a hemipseudodelta sign were thought to be related to spontaneous intracranial hemorrhage rather than to trauma.

Discussion

Buonanno, et al., 1 first described in 1978, the “empty triangle” or “delta sign” as a sign of sagittal sinus venous thrombosis. This sign is seen on contrast-enhanced CT scans of the head, and its recognition depends on contrast enhancement of the sagittal sinus which is seen as a triangular area of density on conventional axial CT images. A central region of low density is seen within the contrast-enhanced sinus and represents thrombus within that structure. Recent literature has further elaborated the frequency and significance of this sign in dural sinus thrombosis. 2 On the other hand, a similar radiographic appearance of a dense triangle with a lucent center may be seen in the area of the posterior falx on CT scans without contrast enhancement (Fig. 2 left). We have termed this a “pseudodelta sign.” With the exception of the case noted above that was due to water-soluble contrast material, this sign was identified only in cases of trauma. Frequently, there were other manifestations of trauma such as epidural or subdural hematoma, hemorrhagic intraparenchymal contusions or hematomas, or shearing injuries.

Conceivably, the pseudodelta sign could be related to posterior parafalcine interhemispheric hematoma or posterior parafalcine SAH. Either could produce the dense outer portion of the triangle, with unclotted blood in the sagittal sinus representing the lucent center. Administration of contrast material will opacify the lumen of the sagittal sinus, thus obliterating the “lucent center” of the pseudodelta sign (Fig. 2 right). This finding is contrary to that of the “true” delta sign in which the dense triangle with a lucent center is seen only after contrast administration.

In order for the pseudodelta sign to be useful as a diagnostic sign, differentiation must be made from an inherently dense falx. This may not always be possible, but a thick outline, a wavy contour, and lack of identification of thin areas of lucency representing the subarachnoid space on either side of the dense falx may be helpful. Continuity of the area of parafalcine density with posterior convexity or tentorial subdural hematoma will confirm that the pseudodelta sign is related to posterior parafalcine interhemispheric hematoma. Care should be taken that low-density artifacts related to the occipital protuberance are not misinterpreted as the region of central lucency of the pseudodelta sign. Evolutionary change with time may also be seen, with disappearance of the pseudodelta sign and a return to the normally expected thin, sharply margined falx outline.

When properly interpreted, the pseudodelta sign strongly indicates the presence of intracranial hemorrhage related to trauma. This is due to interhemispheric subdural hematoma or posttraumatic SAH. This sign has not been seen in any case of spontaneous SAH due to aneurysm, arteriovenous malformation, or vasculitis, although it could occur with these conditions.

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References