

Abusive head trauma: don't overlook bridging vein thrombosis

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Few paediatric diagnoses generate as much controversy as abusive head trauma (AHT), also known as shaken baby/shaken impact syndrome (or SBS). Major signs such as multifocal subdural haematomas, cerebral injury, retinal haemorrhage and skeletal fractures are exhaustively described in myriad radiological reports, and are the result of extremely violent trauma. While bruises have significant diagnostic value, they may be missed when located in hidden areas like behind the ears and in the axilla. In some cases, subdural haematomas appear to be isolated, with no other apparent signs, making diagnosis difficult. We would like to stress the need for careful vertex screening to look for bridging vein thrombosis, which—as some pathologists have pointed out—has high diagnostic value [1].

The bridging veins are draining veins that arise from the coalescence of the superficial cortical venous net-

work at the midline, within the subarachnoid space. They extend, bridge-like, at intervals along the midline, from their attachment to the arachnoid at the medial border of the cerebral hemispheres to the superior sagittal sinus of the dura mater, into which they flow after having traversed the arachnoid space and the deep layers of the dura mater [2]. These veins constitute a short, non-tortuous, perpendicular pipeline between the

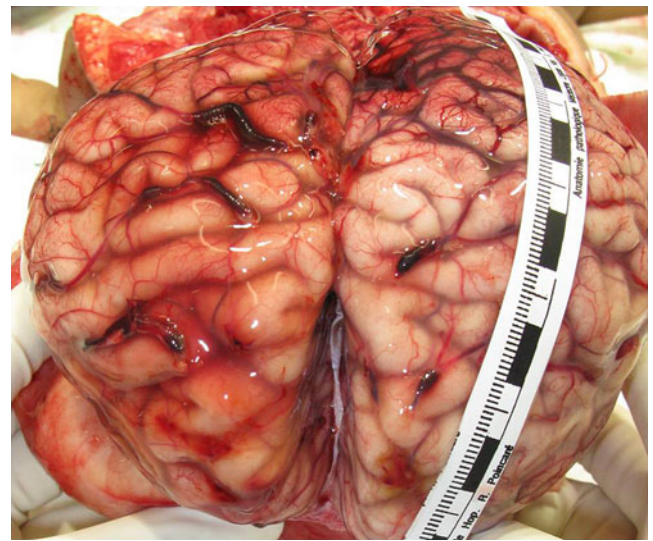


Fig. 1 Multiple bridging vein thrombosis in a case of confessed abusive head trauma (AHT) with subdural diffuse haematoma. Macroscopic view. The baby died after 12 days in the intensive care unit. No pre-mortem imaging available

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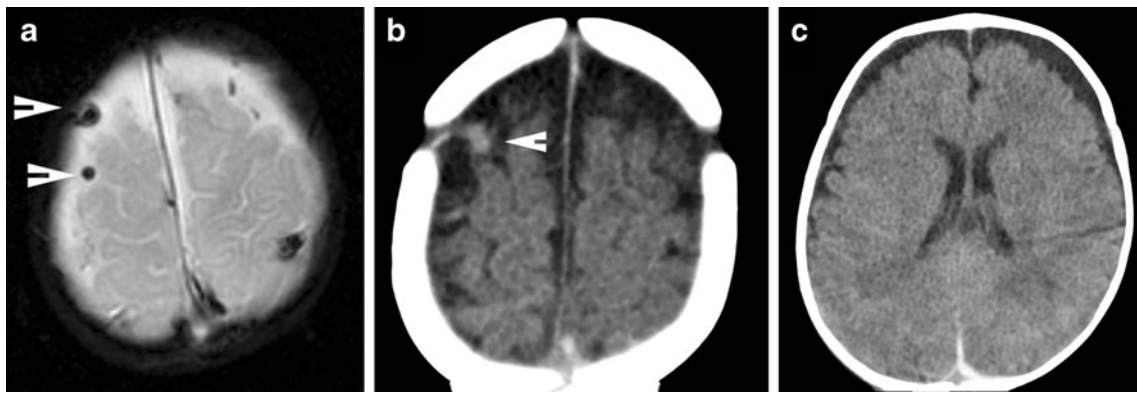


Fig. 2 Images in a 5-month-old boy presenting with seizures, loss of consciousness and multiple classic metaphyseal fractures. Probable multiple bridging vein thrombosis (*arrowheads*), seen on T2*

weighted axial MRI (**a**) and on axial CT (**b**). Chronic bifrontal subdural haematoma (hypodense) associated with hyperdense, acute interhemispheric subdural haematoma (**c**)

arachnoid and the dura, making them particularly vulnerable to rupture during anteroposterior movements of the brain within the cranium [1]. In the absence of a clotting disorder, such ruptures lead to thrombosis within a few hours (Fig. 1). However, standard autopsy procedures may damage the bridging veins and thereby the demonstration of their rupture and/or thrombosis is often difficult [2, 3].

Anatomically, the subdural portion of the bridging veins is particularly fragile. The veins vary in number and diameter among individuals, with the diameter inversely proportional to the number [4]. These anatomical variations may explain why some individuals are more susceptible to injury than others with similar trauma. In any case, the existence of ruptured bridging veins confirms the traumatic nature of the subdural haematoma,

Fig. 3 A case of confessed AHT in a 4-month-old boy. Chronic bilateral subdural haematoma (hypodense) with acute thrombosis of a right bridging vein (*arrowhead*), i.e. hematoma of different ages. **a**, **b** nonenhanced axial CT, **c** T2*-weighted coronal MRI. **d** MRI after gadolinium injection

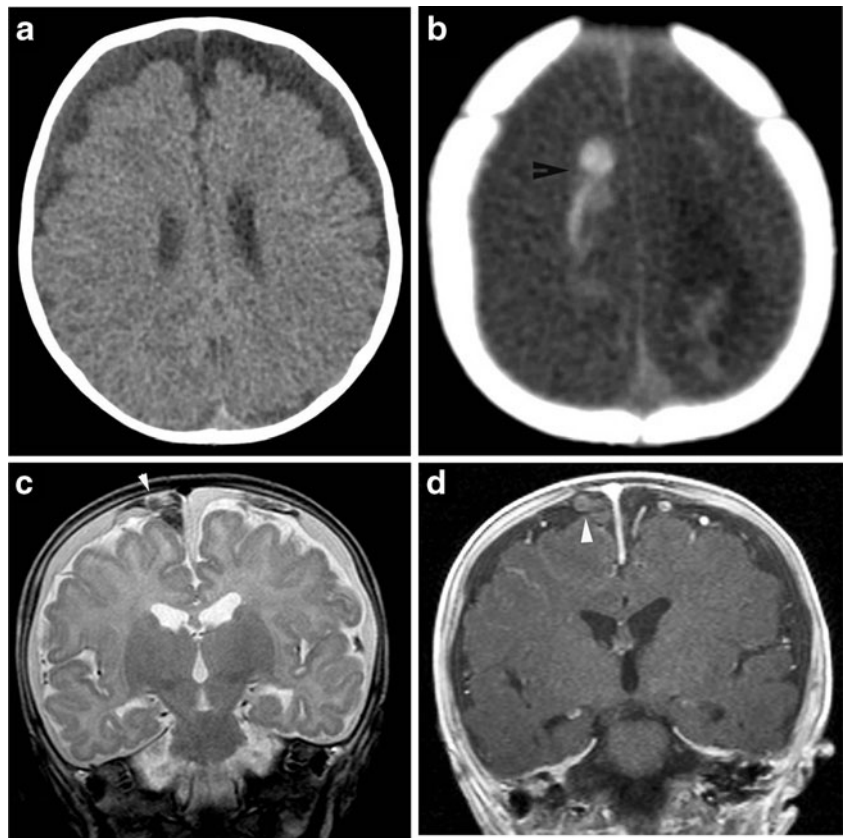
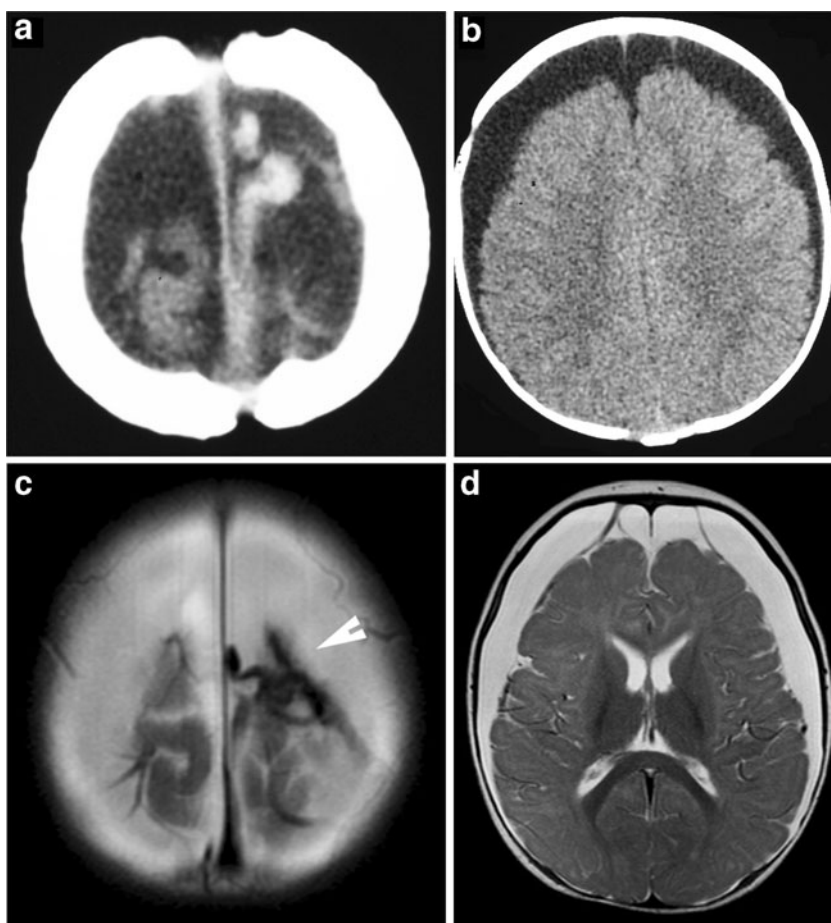


Fig. 4 A case of confessed AHT in a 7-month-old boy presenting with recurrent vomiting. Chronic bilateral subdural haematoma (hypodense) with acute thrombosis of left bridging veins (*arrowhead*), i.e. hematoma of different ages. **a, b** Axial CT images. **c, d** T2-weighted axial MR images



and in a non-accidental context offers a significant diagnostic element in favour of violent anteroposterior movements [5].

In some cases, analysis of the vertex by CT, or even better by MRI, may directly show clots with a tubular shape typically suggestive of acute bridging vein thromboses (Figs. 2, 3 and 4). Even though these tubular clots could also correspond to clotted blood in the subarachnoid space, they should be considered in any case as markers of acutely disrupted veins. Though rarely mentioned in the radiological literature, this sign is very important to recognise, given its crucial diagnostic value [6, 7]. New susceptibility-weighted imaging (SWI) should help and, if in doubt, gadolinium injection—which is not typically administered in trauma—may be used as a solving tool (Fig. 3).

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