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Radiological Quiz – Neuroradiology

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A three month old child was referred for CT scan of the head with complaints of fever and convulsions. Plain CT scan study (not shown) revealed normal findings, except for minimal chinking of the ventricles. Possibility of febrile convulsions with minimal generalized associated cerebral edema was raised. The child was again referred for a repeat CT scan study one month later at the age of four months with history of gradually increasing head size with hypotonia in all the limbs.

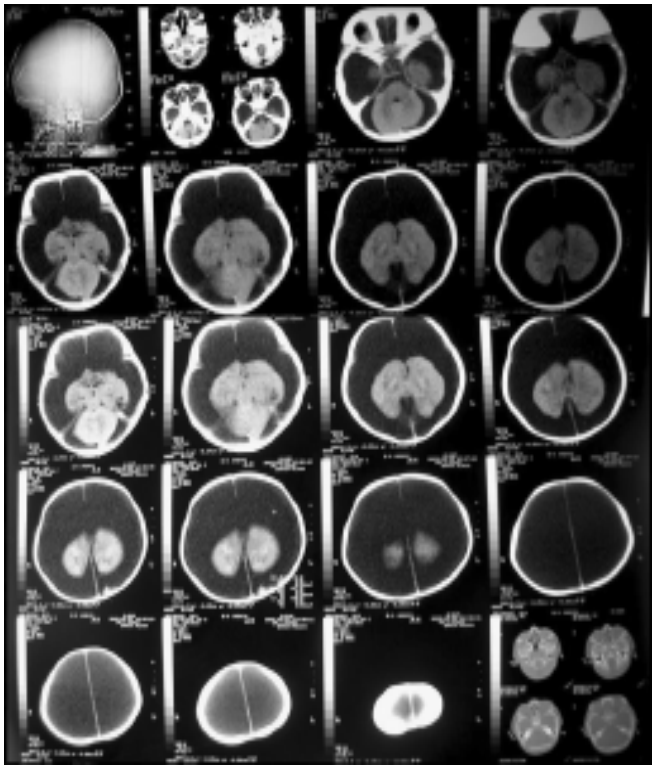

Fig 1.

Clinical suspicion was that of a meningitic etiology, causing communicating hydrocephalus. Lumbar punctures were difficult and revealed blood tap on three occasions. This reddish colored CSF revealed plenty of RBCs. Plain CT scan study of the brain (Figures. 1,2) was performed. Sonography was also performed (Figure. 3). Closer clinical inspection of the child revealed enlarged head size and bandages over the right arm.

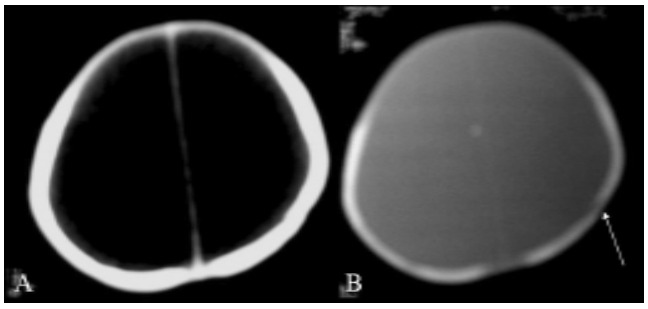

Fig 2.

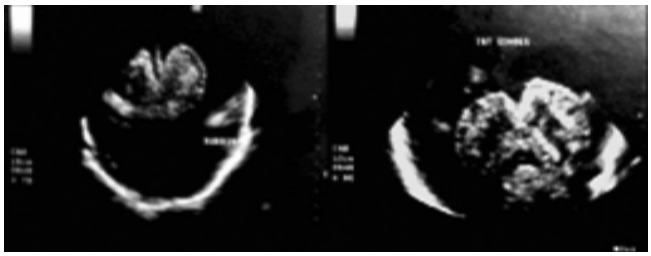

Fig3.

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Radiological Diagnosis

BATTERED CHILD SYNDROME.

The CT scan images (Figure. 1) show bilateral very large subdural collections, causing "disappearing brain" like pictures! The ventricles were markedly chinked. Hence, the possibility of meningitic exudates was unlikely. One of the images revealed thickening of the calvarium, which on bone window images was due to a linear non-displaced fracture involving the left parietal bone (Figure. 2B, white arrow). Hence, possibility of chronic subdural hematomas with left parietal fracture was raised. CSF report was also well correlating with plenty of RBCs. Possibilities of Menke's Kinky hair disease and Alper's disease, in view of bilateral extensive subdural hematomas at this age were not sustainable in view of almost normal findings on first CT scan, done one month ago. Child's accompanying mother however refused any history of trauma initially. On further questioning about bandages over the right arm, she told that child had right humeral fracture, which was due to accidental fall from the bed with height of about 2 feet, just once, 24 days ago. The right humeral fracture and left sided skull fractures were difficult to explain with single fall from the bed. Hence, the possibility of battered baby syndrome was raised and information was asked from the referring physician. Further questioning revealed that his father, who was from different religion, was admitted to hospital with multiple fractures in the limbs, due to alleged vehicular accident. Finally, it was accepted by mother that in-laws of the mother had actually beaten the child and his father repeatedly. To prevent legal actions against the culprits (who were close relatives), wrong history was being provided by parents of the child. On further ophthalmic examination, a few tiny retinal punctate hemorrhages were seen in the left eye in the temporal region. The subdural hematomas were evacuated with punctures through the frontenalles.

Caffey in 1946 reported a series of patients with multiple fractures and a chronic subdural hematoma, which fit the profile of what today is defined as the shaken baby syndrome (SBS). Kempe et al coined the term battered child syndrome. In 1967, Gilkes and Mann first reported the fundoscopic findings of battered babies. In 1972, Caffey wrote on the syndrome of shaken infants. This study brought attention to this form of child abuse (1). Other names are non-accidental injuries, child abuse, Caffey-Kempe syndrome, maltreatment syndrome of children etc. (1,2,3). Risk factors for non-accidental injuries in children include young parents, unstable family situations, low socio-economic status, disability / prematurity of the child, lack of education, single parenthood, alcohol, sibling rivalry, improper baby sitter, excessive crying, drug abuse etc. (1,2,3,4).

Shaken baby syndrome should be suspected in all children younger than one year of age who present with drowsiness, coma, seizures or apnea. A combination of subdural hematomas, retinal hemorrhages with minimal or no trauma and no coagulopathy is almost pathognomonic of this syndrome. The findings are caused by shaking with or without impact. Physical signs of violence are often absent and the syndrome may easily be mistaken for a serious infection or seizure disorder (4). Papilledema indicates the presence of increased intracranial pressure, and retinal hemorrhage strongly points to the diagnosis of SBS (5). The infant is held by the thorax and shaken. This causes a repetitive acceleration deceleration trauma which leads to the typical intracranial bleeding, eye injuries and paravertebral rib fractures. Many cases are fatal or lead to seizures and neurological disability including blindness. Cerebral palsy, mental retardation or epilepsy may occur in about 60% of the children (3,4). These shaking injuries were thought to be caused by the easily torn bridging veins of infants head. The infants head and blood vessels are particularly vulnerable to shaking and whiplash because of the relatively large head and weak neck muscles of the child, the abundance of unmyelinated brain tissue which permits excessive stretching of the brain and vessels, and the increased pliability of the skull as compared to the rigidly fixed internal soft tissue structures such as falx cerebri (2). The infant skull is extremely malleable and elastic and it can undergo significant deformation and dural laceration without obvious fractures. Because the sutures are open, neurological symptoms may ensue late with even larger collections, as in our case (6). It is a form of abuse that can cause severe head injuries such as small skull fractures, subdural hematoma, subarachnoid hemorrhage, hemorrhagic contusion, cerebral edema, diffuse axonal injury, nerve avulsions etc., which can be easily detected with CT or MRI (7,8,9). Meningeal enhancement may be seen with chronic SDH. Sonography can detect many of these abnormalities, but a negative sonogram does not rule out intracranial pathology (3).

In conclusion, whenever features suggestive of head injury in a child are seen on imaging, possibility of child abuse must always be considered, even though the history may be suggestive of something else.

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