Evolution of epileptic encephalopathy in an infant with non-accidental head injury

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ABSTRACT

أدخل المستشفى طفل يبلغ من العمر خمسة أشهر بسبب نوبات متكررة من التشنجات التصلبيه وقد كان في حالة صحية جيده قبل ذلك .تمت السيطرة على التشنجات بالدواء المضاد للصرع، لكن أهل الطفل لم يعطوا الدواء بعد خروجه من المستشفى. ونتيجة لذلك تم تنويم الطفل عدة مرات بسبب التشنجات. ومع مرور الوقت أصبحت السيطره على التشنجات غيرممكنة. كما كشفت الفحوصات العصبية والأيضية والاشعاعية للتشنجات غير المسيطر عليها بوجود إصابه غير عرضية في الرأس (متلازمة الطفل المرتّج) وهي السبب الكامن للتشنجات. كما أن أول تخطيط للدماغ كان طبيعي وتغير بعد ذلك إلى نمط الاعتلال الدماغي الصرعي بسبب التشنجات المتكرره وغير المسيطر عليها. وعليه فالطفل الطبيعي أصبح يفقد المهارات المكتسبه وتراجع بشدة في التنويم الاخير بالمستشفى. هذه الورقة تلقي الضوء على تطور التغيرات في تخطيط دماغ طفل يعاني من إصابة في الرأس غير عرضيه. كما تسعى لتسليط الضوء على إصابات الرأس غير العرضيه في الأطفال صغار السن كأحد الاسباب للصرع الدماغي الغير مبرر.

A 5-month-old child, previously healthy, was hospitalized with frequent episodes of tonic seizures. The seizures were controlled with antiepileptic medication. However, the parents did not continue medications after discharge from the hospital. The child was admitted several times with breakthrough seizures. Over time the seizures became refractory to treatment. Neurometabolic work up and imaging studies for uncontrolled seizures revealed non-accidental head injury (shaken baby syndrome) as the underlying cause. His first EEG was normal and changed from normal to an epileptic encephalopathy pattern during his several admissions for uncontrolled seizures. From a normal child at the first admission, the child was severely regressed at the last admission. The present paper highlights the evolution of EEG changes in a child with non-accidental head injuries. This report also highlights considering non-accidental head injury as the underlying cause in younger children presenting with unexplained epileptic encephalopathy.

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Child abuse is reported from all over the world with varying incidence, depending upon the culture and diagnosis rate in a country.[1] It is very well reported from western countries, but there are only few reports of child abuse from Gulf countries.[2,3] Non-accidental head injury (shaken baby syndrome) is one of the forms of child abuse, and is less often seen and reported from the Gulf region and Asian countries.[3] The children with shaken baby syndrome present with neurological features, varying from irritability to comatose state.[4] Seizures of different semiology are common at presentation in infancy, and epilepsy is reported on long-term follow-up.[5] The evolution of epileptic encephalopathy with corresponding EEG changes has not been previously reported, and there are few reports of an association between infantile spasms and the shaken baby syndrome in the literature.[6,7] We report an infant with shaken baby syndrome whose seizures were refractory to treatment and EEG revealed epileptic encephalopathy in the form of burst suppression and hypsarrhythmia on serial EEGs following repeated insult. Child abuse in the form of non-accidental head injury should be considered as a rare underlying cause when a child presents with refractory seizures without identified cause.

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Case Report. A 5-month-old male child was brought to the emergency services of our hospital with a 10-day history of repeated episodes of stiffness of all 4 limbs, with up rolling of eyes and frothing of saliva. Each attack lasted approximately 2 minutes. After the episodes, the child would develop postictal deep sleep and was noted to be tired and less active after waking up. He had several such attacks daily. He was seen in a peripheral hospital and routine blood tests including blood sugar, calcium, phosphorus, alkaline phosphate, and electrolytes were normal. A CT brain was reported as prominent cerebrospinal spaces. His development was normal for age before the onset of the symptoms. He was born at 41 weeks of gestation with a birth weight of 4.34 kgs, height of 51 cms, and head circumference of 37 cms. He had Apgar scores of 8 at one minute, and 9 at 5 minutes. His development was consistent with age. He was diagnosed at birth as congenital hypothyroidism and was on 37.5 micrograms thyroxine daily. His elder 3 siblings were normal. There was no history of seizures in the family.

In view of the repeated seizures, he was given intravenous phenytoin sodium (18 mg/kg) as an emergency and later observed in the ward. His examination was essentially normal other than mild hypertonia in the lower limbs and exaggerated deep tendon jerks. The blood work up for glucose, calcium, phosphorus, alkaline phosphatase, vitamin D, parathormone, tandem mass spectrometry, lactate, and ammonia was normal. A routine EEG was normal (**Figure 1**). He was discharged on levetiracetam and tapering doses of phenytoin. The child presented after 2 months in an obtunded state. The parents had discontinued levetiracetam. The parents also denied any seizures at home. During this time, the child was seen abroad and topiramate was advised. However, the parents were not using any medication. The parents complained that the child had lost milestones and was not smiling. He had poor feeding, a weak cry and had lost weight. On examination, the child was not responding to any painful stimulus. There was no visual following with eyes open. The cranial nerves were normal. There was generalized hypotonia with a power of grade 3/5 in upper and lower limbs. All deep tendon reflexes were exaggerated. Some choreiform like movements were seen in the hands and sometimes in the legs. An urgent metabolic work up in the form of tandem mass spectrometry, lactate, ammonia, and creatine kinase were carried out to rule out a metabolic encephalopathy. All the results were normal. A repeat EEG showed bilateral high amplitude slow waves. A brain MRI revealed a right side subdural hematoma (**Figure 2**). In view of the subdural hematoma, other metabolic work up (serum copper, urine organic acids) and coagulation work up were carried out, which were all normal. Microscopic examination of the hair (kinked hair) was normal. In view of no underlying cause found, a suspicion of non-accidental head injury (shaken baby syndrome) was considered. Ophthalmic examination was normal. He was restarted on levetiracetam and observed in the ward. The parents refused further work up for shaken baby syndrome, particularly skeletal survey, and left against medical advice. Two months later, the child presented with tonic clonic status epilepticus and swelling of

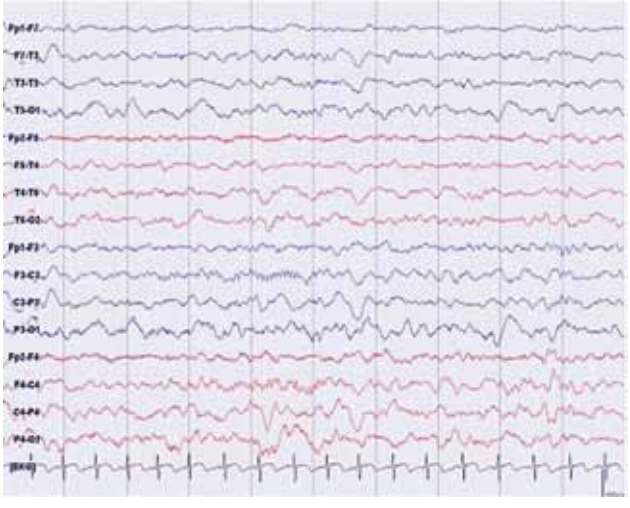

Figure 1 - Ten seconds EEG epoch, sleep record at 5 months age, shows a normal sleep EEG with mildly asynchronous sleep spindles.

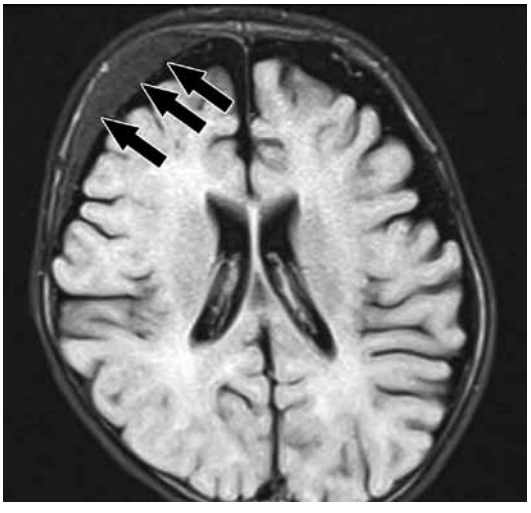

Figure 2 - Axial MRI brain (FLAIR), showing right subdural hematoma (arrow).

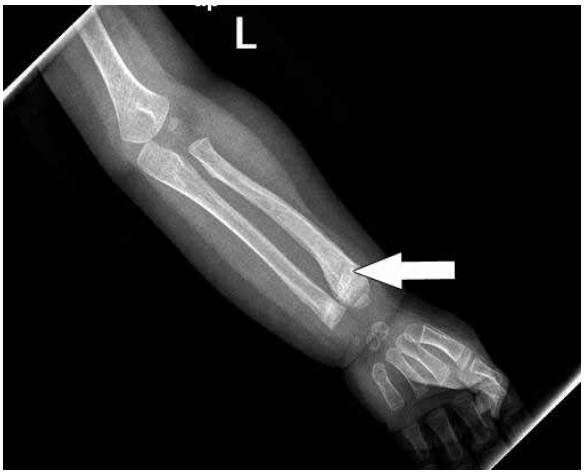

Figure 3 - Plain x-ray of forearm shows old healing fracture at the lower end of the radius (arrow).

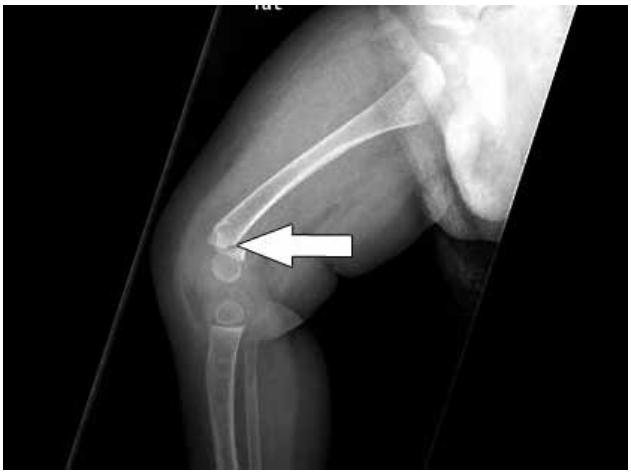

Figure 4 - Plain x-ray of right thigh shows recent fracture of the femur (arrow).

the right knee. The parents had discontinued the oral antiepileptic drug (levetiracetam). On this admission, he was given intravenous phenytoin sodium 18 mg/kg followed by daily maintenance. Since the seizures were not controlled, intravenous midazolam infusion was also started. Levetiracetam was administered via nasogastric tube. The epileptic status was refractory, and topiramate was also added to the treatment. The status epilepticus became controlled over 5 days time. On further questioning regarding the type of seizures, the parents reported that in addition to generalized stiffness, the child was getting brief myoclonus as well. This time, the parents agreed to further work up for shaken baby syndrome. The skeletal survey revealed an old healed fracture in the right radius (**Figure 3**), and a recent fracture of the right lower end of the femur (**Figure 4**). An EEG revealed features of epileptic encephalopathy in the form of hypsarrhythmia, and burst suppression (**Figures 5 & 6**). This EEG was carried out at the age 10 months and 20 days, 5 months after the first EEG. The brain MRI was repeated and it showed brain atrophy and resolution of the previous subdural hematoma (**Figure 7**). On monitoring the anthropometry, the head size increase was slow. At birth it was 37 cms, at first

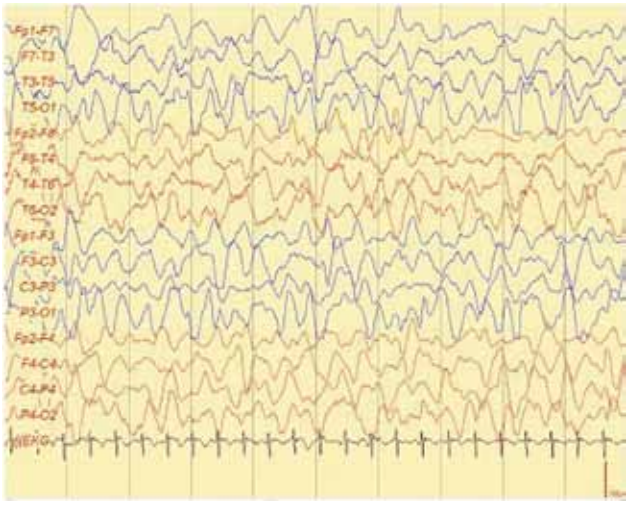

Figure 5 - Ten second sleep EEG epoch (10 months and 20 days age) of a hypsarrhythmia pattern, consists of high amplitude chaotic slow wave background with intermixed sharp waves.

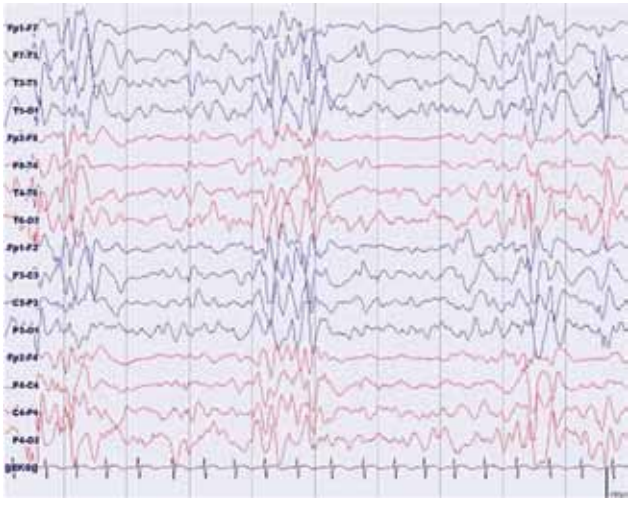

Figure 6 - Sleep record at the age of 10 months and 20 days showing burst-attenuation pattern in a 10 seconds epoch. Bursts consist of high amplitude spike, polyspike, and slow wave discharges.

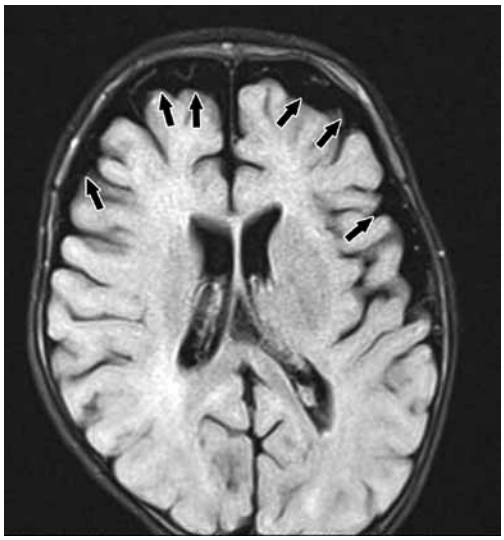

Figure 7 - Repeat MRI brain showing bilateral cortical atrophy and disappearance of subdural hematoma.

admission 44 cms, at second admission 45 cms, and last admission 45.5 cms, showing normal increase in the first 5 months, and very slow increase in head size after non-accidental injury. The child protection team and social welfare department became involved in the further management of the child. The parents agreed to follow the treatment this time. Even on detailed discussion with the parents, we could not identify the underlying reason for child abuse. On recent follow-up, the child had gained milestones and was corresponding to the age of 6 months for motor milestones. The head circumference was 48 cms, an increase of 2.5 cms in 6 months. He had a breakthrough seizure once only. He was on 3 antiepileptic drugs (levetiracetam, topiramate, and phenytoin sodium). A repeat EEG was planned, but the parents did not attend. The social welfare department and child protection committee were also making home visits.

Discussion. Child abuse or maltreatment is seen throughout the world and can present as physical, sexual, or emotional abuse, and neglect.[1] Over the years cases of child abuse have been reported from this region, considered to be uncommon in the past.[2,3] Non-accidental head injury (shaken baby syndrome) is a form of child abuse and a relatively new diagnosis, predominantly affecting neurological functions.[4,7] Shaken baby syndrome is mainly seen in infancy and these children present with neurologic features depending on the severity and continuation of the abuse. Irritability, bulging fontanel, hemiparesis, seizures, developmental regression, and even death are reported. Symptoms usually occur immediately after the insult, an important indicator of diagnosis.[8] Shaken baby syndrome is under recognized and under reported and remains a diagnostic challenge. The diagnosis must be considered in any infant or young child who collapses with no obvious cause.

A careful medical and social history supplemented by appropriate investigations will help in diagnosis.[9] The diagnosis is usually based on patient history that does not correlate with the clinical features. In addition, supportive laboratory and imaging studies suggest child abuse.[2,3] Seizures at presentation are uncommon, though epilepsy is reported in 20% children on long-term follow-up.[4,8] If shaken baby syndrome is diagnosed early and protection is given, chances of further injury and insult to the brain could be prevented. Any type of seizures could be seen at the onset in shaken baby syndrome.[5] Infantile spasms and epileptic encephalopathy are rare. Only two reports describe an association between infantile spasms and shaken baby syndrome.[6,7] We observed progressive EEG changes with each admission. From a normal EEG at first admission, hypsarrhythmia and burst suppression (epileptic encephalopathy) were noted on the last admission. Was this a natural evolution of the epileptic encephalopathy after the first abuse, or occurred after repeated abuses? We believe it was later, based on observations and different age long bone fractures. The parents did not continue antiepileptic medications after each discharge from hospital. This could be another form of child abuse and a reason for the seizures to become refractory. The child returned back to normal condition after first admission and had normal baseline EEG. After the second admission following seizures, the child started lagging behind in milestones. Long bone fractures of different ages favors repeated abuse of the child. The diagnosis of shaken baby syndrome was based on parents not giving a clear history, and poor correlation between history and examination. Non-treatment of a child with antiepileptic drugs at home and evidence of subdural hematoma on MRI confirmed the diagnosis of child abuse and shaken baby syndrome. All the causes for seizures including metabolic disorders were ruled out on detailed metabolic investigations when the child presented at the initial 2 admissions. Retinal hemorrhages were not seen in our child, important evidence to confirm the diagnosis of shaken baby syndrome. However, 20% of children with shaken baby syndrome do not have eye abnormalities. Other rare conditions like glutaric aciduria type I, and bleeding diathesis were excluded before shaken baby syndrome was diagnosed.

Evolution of the EEG in shaken baby syndrome in our case is an interesting electro-clinical association. It was by coincidence and with repeated EEGs on each admission that we could see the changes developing in EEG after each admission following seizures and insult. Evolution of EEG from normal to epileptic encephalopathy is not uncommon in this age group irrespective of underlying cause.[10] Our case highlights the use of sequential EEGs in the management of seizures in infancy.[11]

A wide range of neurologic sequelae have been seen in survivors of shaken baby syndrome in the form of cognitive and behavioral disturbances, cerebral palsy, blindness, and epilepsy. One third of shaken baby syndrome patients die, and 60% of survivors have moderate to grave morbidity.[1,5,12] Severe cerebral atrophy is seen in these children on follow-up, as was found in our case.[12]

In conclusion, we did not find any other cause in this child for epileptic encephalopathy other than shaken baby syndrome. Child abuse should be considered in the underlying causes when an infant presents with refractory seizures, and the known causes are excluded. It is worthwhile to perform skeletal survey to rule out non-accidental head injury.

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