

trauma (Stang PE et al. **Neurology** 1992;42:1657-1662). Headache after hospitalization for closed head injury in children followed for 6 years did not appear to be accident related. (Lanser JBK et al. **Headache** 1988;28:176-179). Several investigators allude to the onset of migraine following mild TBI.

## **METABOLIC DISORDERS**

### **CARBONIC ANHYDRASE TYPE II DEFICIENCY SYNDROME**

Researchers at King Saud University, Saudi Arabia and other centers describe the neurological, neuro-ophthalmological and neuroradiological features of 23 patients (10 male, 13 female; age at final exam 2-29 years) from 10 unrelated consanguineous families with carbonic anhydrase type II deficiency syndrome due to homozygous mutation (the 'Arabic mutation'). All patients had osteopetrosis, renal tubular acidosis, developmental delay, short stature, and craniofacial disproportion with large cranial vault and broad forehead. Two-thirds had mental retardation, mild to severe, associated with spastic quadriparesis in 2. Optic atrophy was bilateral in 10 patients and unilateral in 3, associated with pendular nystagmus in 6. Neuroimaging studies in 18 patients showed thickened skulls, small paranasal sinuses, small optic canals, and intracranial calcifications involving the basal ganglia and thalami bilaterally, usually progressive, but less severe in patients with more severe mental retardation. Early treatment of systemic acidosis with bicarbonate slowed the progressive course of the disease. (Bosley TM, Salih MA, Alorainy IA, et al. The neurology of carbonic anhydrase type II deficiency syndrome. **Brain** Dec 2011;134:3499-3512). (Respond: Dr Khaled K Abu-Amero, Department of Ophthalmology, College of Medicine, King Saud University, PO Box 245, Riyadh 11411, Saudi Arabia. E-mail: abuamero@gmail.com).

COMMENT. This autosomal recessive disorder may be diagnosed prenatally by direct CA2 gene sequencing, testing for the causative Arabic mutation identified in 70% of patients of Arabic descent. Early treatment with bicarbonate in the present cohort could explain the reduced phenotypic severity compared to most reports. Carbonic anhydrase type II is a cytoplasmic enzyme, 1 of 14 known isoenzymes, with the highest catalytic activity. The physiological functions of CAII include electrolyte and water balance, pH homeostasis, CO<sub>2</sub> and HCO<sub>3</sub> transport, and production of cerebrospinal fluid, aqueous humor, gastric acidity and pancreatic secretions.

Levels of carbonic anhydrase in the rat brain are low at birth. The rapid development of the enzyme is associated with a maturation of experimental seizure patterns from subtle, swimming movements to clonic, and generalized tonic-clonic patterns by 1 month of age. (Millichap JG. Seizure patterns in young animals. Significance of brain carbonic anhydrase. II. **Proc Soc Exp Biol and Med.** 1958;97:606-611). The anticonvulsant activity of the carbonic anhydrase inhibitor, acetazolamide, is directly related to the inhibition of brain carbonic anhydrase (**J Pharmacol & Exper Therap** 1955;115(3):251-258; **Neurology** 1956;6(8):552-559). It is noteworthy that seizures are not included in the phenotype of patients with CA deficiency syndrome.