**RADIOLOGY CASE OF THE MONTH**

**A Case of Idiopathic Basal Ganglia Calcification and Brief Review of the Literature**

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A 39-year-old woman was incidentally found to have extensive bilateral basal ganglia calcifications after a motor vehicle accident. Laboratory work-up was unremarkable. She was diagnosed with idiopathic basal ganglia calcifications, formerly known as Fahr’s disease. A brief review of the literature is presented.

**CASE PRESENTATION**

A 39-year-old woman was referred to the Louisiana State University Health Sciences Center Neurology clinic for follow-up of abnormal imaging findings. One month prior, she had been in a motor vehicle collision where she briefly lost consciousness. She was taken by ambulance to the emergency department where she was assessed and subsequently cleared of injuries. Non-contrast head computed tomography (CT) showed large areas of bilateral calcification within the basal ganglia, cerebellum, and subcortical white matter (Figure 1). Her past medical history was positive for migraines for the past five years, photophobia for over ten years, anxiety, cervical cancer, and hysterectomy. Her family history included a sister with epilepsy, a father who died of stroke at age 52, and a paternal grandmother with Alzheimer’s dementia.

Physical exam revealed an obese woman who was fully oriented with an appropriate affect. She scored a 28/30 on the Montreal Cognitive Assessment. She wore sunglasses during the visit due to light sensitivity. Cranial nerve examination was normal, including a normal fundoscopic examination. A mild action tremor was present in her hands. Her gait was normal but with an in-toed stance. Laboratory studies, including complete blood count, comprehensive metabolic panel, thyroid studies, intact parathyroid hormone levels, total and ionized calcium levels, serum lactate, antinuclear antibodies, and heavy metal screen, were within normal limits. Electroencephalogram (EEG) demonstrated normal awake and asleep patterns. The presumptive diagnosis of idiopathic basal ganglia calcification was made based on the extensive and strikingly characteristic bilateral calcifications seen on the CT.

**FIGURE 1.** Axial Non-contrast Head CT. Image A shows bilateral symmetrical calcifications in the bilateral basal ganglia and posterior thalami. Image B shows similar calcifications in the cerebellar dentate nuclei and white matter.
DISCUSSION

Idiopathic Basal Ganglia Calcification (IBGC), also known as Fahr’s syndrome, refers to abnormal bilateral calcium deposits in the basal ganglia and other regions of the brain. This rare condition can present with a wide array of neurological and psychiatric symptoms. Prevalence is unknown, but review of 19,080 CT scans in three studies reported the average incidence of basal ganglia calcification as 6.6 per 1,000. The age of symptomatic onset ranges from 20 to 60 years old, and clinical presentation of the disease includes movement disorders, cognitive impairment, and psychiatric symptoms. Some patients remain asymptomatic despite the presence of extensive brain calcification, with some studies reporting up to a third of individuals with confirmed CT findings. One report, similar to our patient’s case presentation, describes the incidental finding of bilateral basal ganglia calcification in a seven year old boy discovered after a motor vehicle accident. Investigators found six more affected family members, across multiple generations; all of which were asymptomatic.

Parkinsonism is the most common presentation of movement disorder symptoms, but dystonia, tremor, and chorea have also been described. Cognitive impairment can also occur, progressing in some patients to the level of dementia. While all cognitive domains can be affected, several reports have indicated that frontal executive function may be predominantly impaired. Personality changes and psychosis has been reported. Other symptoms include seizures, chronic headache, abnormal gait, and speech disorders. A recent case report describes the unique presentations of two brothers with IBGC - one presented as gait abnormality, dysarthria, and memory loss; the other experienced vertigo, ataxia, and headaches. Reports such as this demonstrate the extreme variance among affected individuals with IBGC in general and within families.

IBGC is primarily associated with an autosomal dominant pattern of inheritance, prompting some to suggest a new name, Primary Familial Brain Calcification. By examining the genetics of families and individuals with IBGC, researchers have identified 2 main genes implicated in its development: sodium dependent phosphate transporter 2 (SLC20A2) on chromosome 8 and platelet derived growth factor receptor beta (PDGFRB) on chromosome 5. SLC20A2 appears to be involved in maintaining phosphate homeostasis by coding for an inorganic phosphate transporter expressed in many tissues, including the brain and vascular smooth muscle cells. Mutation in this gene accounts for 40 percent of all cases of IBGC. PDGFRB has been shown to have a role in regulating the blood brain barrier by coding for a tyrosine kinase receptor expressed in the brain. Mutations in PDGFRB have been shown in mice models to result in increased vascular permeability. It has been speculated that this fluid escape into the CNS may lead to tissue damage and precipitate calcinosogenesis. This proposed pathogenesis of capillary leakage may fit with the early linear radiographic pattern of calcification described by Lazar et al. Also, one recent study has shown that the ligand for receptor PDGFRB is capable of modifying the velocity of inorganic phosphate uptake by sodium dependent phosphate transporter 1, the product of SLC20A1. This interaction may provide a link between the recently explicated genetics and the progressive calcinosogenesis seen in this rare disease.

The diagnosis of IBGC is considered when a characteristic CT is obtained and all other causes, including biochemical abnormalities, metabolic disorders, infection, toxicity, and trauma, have been ruled out. Disorders of calcium metabolism, such as hyperparathyroidism and pseudohypoparathyroidism, are important to exclude, as are prenatal TORCH infections that can produce similar imaging findings. A positive family history would also strongly support the diagnosis. Although X-ray is capable of demonstrating brain calcifications, CT scan is the superior method of evaluating for IBGC. Besides the basal ganglia, other areas likely to be affected are the thalamus, cerebellum, and subcortical white matter. Radiographic characteristics on CT most specific for Fahr’s disease are symmetric calcifications that appear “cloudy” and follow a “thin linear pattern” early in disease giving way to massive symmetric calcifications as the disease progresses. The degree of calcification has been shown to be greater in symptomatic patients when compared to asymptomatic; however, the clinical picture of a patient cannot be elucidated from extent of calcification alone. While radiological penetrance nears 95 percent by age 50, the degree of clinical symptoms varies widely among those affected.

Since no definitive treatment exists, medical management varies with character and degree of symptomology. Standard medical treatment for symptoms is appropriate. However, antipsychotics should be used with caution due to the potential for worsening extrapyramidal symptoms. Also, the use of levodopa for Parkinsonism has not been shown to be effective. One report described patient improvement after treatment with a bisphosphonate, in which the patient’s gait and speech improved but without accompanying a reduction in degree of brain calcification. Despite a lack of treatment options, patients with suspected IBGC should be followed with annual neurological assessment.

Although the pathophysiology is not fully understood, IBGC, formerly Fahr’s disease, represents a rare cause of neurological and psychiatric symptoms in patients with characteristic CT scans.

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