CASE REPORT

Fahr's disease in an older adult: a geriatric view

Milagros Damián-Mucha[1,c]; Graciela Takami-Angeles[1,a]; Carla Arroyo-Zevallos[1,a]; María Gamarra-Samaniego[1,a,b]; Carlos Torres-Salinas[2,3,d]

1 Hospital Nacional Edgardo Rebagliati Martins, Unidad de Geriatría (Geriatrics Unit). Lima, Peru.
2 Hospital Nacional Ramiro Prialé. Huancayo, Peru.
3 Universidad Continental, School of Human Medicine. Lima, Peru.
[a] Geriatrician; [b] Internist; [c] Geriatrics resident; [d] Doctor of Medicine, professor.

ABSTRACT

Fahr's disease is an unusual condition, characterized by bilateral and symmetrical intracranial calcifications. We present the case of a 75-year-old man who was admitted to the emergency room due to a biliary obstruction following a periampullary neoplasm. During his stay, the patient fell after an episode of psychomotor agitation without apparent cause; therefore, it led to a computed tomography (CT) scan of the brain, which revealed bilateral calcified lesions in the basal nuclei and globus pallidus. The disease was managed exclusively, but there were shortcomings in the integrated approach to the older adult. Subsequently, during the comprehensive geriatric assessment, it was detected that he was a frail elderly patient, with acquired deconditioning, malnutrition, social vulnerability, and caregiver burden.

This suggests that the approach to frail older adult patients in hospitalization areas is alarmingly insufficient and is reflected in a critical gap in the training and development of specialized geriatric practices. The lack of adequate knowledge about the complexities and specific needs of this vulnerable population results in suboptimal care, prolonged hospital stays, and an increase in complication and readmission rates, not only due to the disease but also because of the overlooked social context. This deficiency highlights the urgent need to prioritize the comprehensive management of older adults across all specialties and geriatrics, promoting more robust training for healthcare professionals and the development of specific protocols that ensure integrated, safe, and dignified care.

Keywords: Delirium; Calcinosis; Frailty; Aged (Source: MeSH NLM).

INTRODUCTION

Fahr's disease is a rare degenerative neurological condition characterized by idiopathic calcification of the basal ganglia. It was first described by Karl Theodor Fahr in 1930, in an article titled *Idiopathic calcification of the cerebral vessels*, which referred to the bilateral and symmetrical accumulation of calcium in the basal ganglia, thalamus, dentate nucleus, and centrum semiovale. The clinical presentation may include neuropsychiatric, extrapyramidal, and cerebellar symptoms, as well as seizures, parkinsonian features, dementia, and speech disturbances [1,2].

Although Fahr's syndrome and Fahr's disease are often used interchangeably, the diagnostic criteria for Fahr's syndrome is defined by bilateral basal ganglia calcification, progressive neurological dysfunction, absence of biochemical abnormalities, and a family history consistent with autosomal dominant inheritance. On the other hand, the term Fahr's disease is used when there is a hereditary-familial component—either autosomal dominant or recessive—after secondary causes have been ruled out [3-5].

In Peru, few reports of either condition have been documented. Some cases were secondary to other disorders, such as primary or postsurgical hypoparathyroidism, while others occurred without known underlying conditions or etiologies [6-9].

CLINICAL CASE

We present the case of a 75-year-old male patient with a history of cholecystectomy five years earlier, type 2 diabetes mellitus, and hypertension under treatment (insulin lispro, glargine, and metformin for diabetes, and irbesartan and atorvastatin for hypertension), both treatments followed irregularly by the patient. He also received tamsulosin for benign prostatic hyperplasia and quetiapine plus haloperidol for schizophreniform disorder and delusional disorder, combined with mild cognitive impairment for the past three years. At that time, a non-contrast CT scan of the brain was performed, which revealed confluent calcifications in the basal ganglia, predominantly on the right side, without further comments on these findings at his care center (Figure 1a).

Corresponding author:
Carlos Hugo Torres Salinas
ctorress@continental.edu.pe

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The current episode began when the patient was brought to the emergency room by a family member because of jaundice, colicky abdominal pain in the right hypochondrium, and vomiting that had started two weeks earlier. In addition, they reported unquantified weight loss over approximately three months. He was evaluated by the medical team, and serological tests revealed elevated bilirubin levels, predominantly direct. Other tests conducted while the patient was hospitalized are detailed in Table 1. The probable diagnosis was cholestatic syndrome (to rule out neoplasm of the biliary tract and/or pancreas) and moderate acute cholangitis. Appropriate treatment was initiated and an abdominal CT scan was performed, which showed moderate dilatation of the intra- and extrahepatic bile tract up to the level of the suprapancreatic common bile duct, caused by an expansile intraluminal nodular lesion.

Table 1. Summary of laboratory blood test results during the patient's hospital stay

Laboratory tests											
Date	3/20/2024	3/21/2024	3/26/2024	3/30/2024	3/31/2024	4/4/2024	4/6/2024	4/8/2024	4/9/2024	4/16/2024	4/22/2024
Hb	10.4		10.6	9.51	9.53	10.6	9.68	10.3		9	9.,2
WBC	7.41		7.45	7.43	6.17	9.38	8.32	5.96		9.87	8.18
PLT	358		308.4	283	299	453	613	613		417	642
CRP			6	14	15	11	9.5	3.94		12	3.23
PCT				0.24	0.188						
Cr	0.79			0.71	0.8		0.6	0.61		0.66	0.74
Glu	74				200		193			126	132
Lipase	48	41									
PTH								59 (15-68)			
Mg							1.82	1.84		1.94	2.05
Amylase		89									
Alb	4.79		3.5	3.2	3.2	3.2	3.3	3.68			3.66
TB	7.53		11		5.5		3.6	4.24		2.12	1.44
DB	5.87		6.1		2.8		1.8	3.34		1.67	1.16
IB	1.66		4.5		2.6		1.8	0.9			0.28
FA			1,024			1,012				242	330
TP	8.58			6.6						6.72	7.38
AST	383		151	67	51	134	114				101
ALT	383		189	110	88	129	157				97
LDH	283									162	
PT	13.68		15.33				12.29	15.6	12.22	13.3	13.6
aPTT	40.11		39.55				32.17	33.9	27.73	34.9	37
Ca				8				9.2	9.4	8.5	9.1
P				1.8				2.5	2.8	1.8	3.1
CEA								5.7			
AFP								2.64			
Total PSA								7.07			
Free PSA								1.12			
CA19-9								1,200			

Legend: Hb, hemoglobin; WBC, leukocytes; PLT, platelets; CRP, C-reactive protein; PCT, procalcitonin; Cr, creatinine; Glu, glucose; PTH, parathyroid hormone; Mg, magnesium; Alb, albumin; TB, total bilirubin; DB, direct bilirubin; IB, indirect bilirubin; APL, alkaline phosphatase; TP, total protein; AST, aspartate aminotransferase; ALT, alanine aminotransferase; PT, prothrombin time; aPTT, activated partial thromboplastin time; Ca, calcium; P, phosphorus; CEA, carcinoembryonic antigen; AFP, alpha-fetoprotein; PSA, prostate-specific antigen; CA19-9, carbohydrate antigen 19-9.

Considering these results, a gastroenterology consultation was requested. It should be noted that, until that moment, the patient had not been receiving the psychiatric medication prescribed, which explains the events on the second day of hospitalization: an episode of agitation followed by a fall and subsequent mild traumatic brain injury with fluctuating level of consciousness. A non-contrast CT scan of the brain was performed to assess lesions from the fall. Incidentally, prominent confluent calcifications were found in the right basal ganglia, predominantly lenticular (Figure 1b). In the context of this patient, these findings were consistent with Fahr's disease.

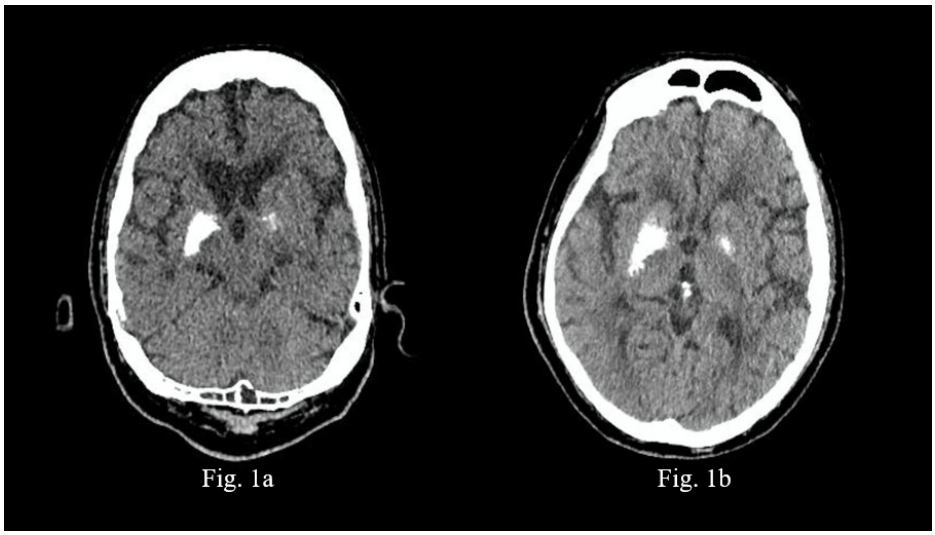

Figure 1. 1a. Non-contrast CT scan of the brain showing calcifications in the basal ganglia, without further comments at the patient's care center. 1b. Non-contrast CT scan of the brain showing confluent calcifications in the basal ganglia, predominantly on the right side, which had already been observed in a previous study.

During hospitalization, studies were conducted to determine the cause of Fahr's disease. Laboratory tests revealed abnormal renal parameters and liver function tests (probably of oncological origin). In addition, serum levels of calcium, magnesium, phosphorus, and parathyroid hormone were within normal limits. Cerebrospinal fluid analysis was also normal, as were the results of VDRL and HIV tests.

On the 9th day, the gastroenterology evaluation was carried out, including endoscopic ultrasound, biopsies, and an unsuccessful endoscopic retrograde cholangiopancreatography (ERCP). Subsequently, an external biliary drain was placed in the interventional radiology department. Medical treatment for cholangitis was continued, with slow but favorable improvement in the infection. On the 22nd day of hospitalization, after consultation, the patient underwent a comprehensive geriatric assessment (CGA), which identified the following problems:

- Baseline status: independent for basic activities of daily living (BADL); moderately dependent for instrumental activities of daily living (IADL); during hospitalization, fully dependent for BADL (Barthel Index: 0 points).
- Mixed delirium (4 'A's Test [4AT]: 4 points).
- Partially edentulous, corrected.
- Acquired deconditioning.
- Impaired mobility (4B).
- Risk of pressure injury.
- Constipation.
- Risk of malnutrition (Mini Nutritional Assessment Short Form - MNA SF: 11 points).
- Frailty (FI-CGA: 0.4).
- Social vulnerability (Gijón's Social-Familial Evaluation Scale: 18 points): single, caregiver for a nephew and a sister with Alzheimer's disease.
- Retirement pension: none.
- Caregiver burden (Zarit Burden Interview: 48 points).

Based on the individual context of each patient, a multidisciplinary care plan was established in addition to internal medicine, including physical medicine and rehabilitation, psychiatry, nutrition, social services, and nursing.

On the 27th day of hospitalization, improvements were observed in cognitive function (4AT: 0 points, Pfeiffer Short Portable Mental Status Questionnaire - SPMSQ: 0 errors) and in BADL (Barthel Index: 45 points). Although the patient was still frail, the same recommendations were maintained. Finally, he was discharged on the 41st day of hospitalization and would continue to receive specialized home medical care for older adults.

DISCUSSION

Fahr's disease is most commonly inherited in an autosomal dominant pattern with incomplete penetrance and is age-related, but it can also be transmitted as an autosomal recessive trait

or occur sporadically. Four involved genes have been identified (SLC20A2, XPR1, PDGFRB, and PDGFB), yet about 46 % of cases have an unknown mutation. Most individuals tend to develop the disease later in adulthood, and in relation to its pathophysiology, the most widely described hypothesis is that abnormal calcium deposition is due to either brain abnormal metabolism or metastatic deposition due to a locally altered blood-brain barrier [10].

Defective iron transport and free radical production cause tissue damage, which initiates calcification around a nidus composed of mucopolysaccharides and related substances. The calcium deposition begins within the vessel wall and perivascular space and slowly extends to affect the entire neuron. Progressive calcification compresses nearby vessels, reducing blood flow and thus continuing the vicious cycle of decreased blood flow, tissue injury, and mineral deposition [10,11].

Its clinical spectrum includes parkinsonism, choreoathetosis, dystonia, pyramidal symptoms, depression, mainly frontotemporal dementia with executive dysfunction, delirium, seizures, speech disorders, and myoclonus, among others, which often bear are similar in other pathologies. Therefore, a thorough physical examination, mental health screening, memory and cognitive assessment, and functional outcome measures (functional independence, dynamic gait index, timed up-and-go test, and Fullerton advanced balance scale) are required, in addition to specific diagnostic criteria (Table 2), and the exclusion of other related causes through complete blood count, metabolic panel, blood and urine heavy metal testing, calcium, phosphorus, magnesium, alkaline phosphatase, calcitonin, vitamin D, parathyroid hormone, cerebrospinal fluid analysis, Ellsworth-Howard test, imaging studies, and molecular genetic testing [11-13].

Table 2. Diagnostic criteria for Fahr's disease [10]

Criteria
1. Progressive neurological dysfunction, with onset at any age.
2. Radiographic evidence of bilateral basal ganglia calcification and some other brain regions.
3. Absence of biochemical abnormalities suggesting endocrinopathies, mitochondrial disorders, or other systemic conditions.
4. Absence of infections, toxins, or trauma.
5. Family history consistent with autosomal dominant inheritance.

This is one of the few hereditary neurological conditions that lead to progressive dystonia, parkinsonism, and neuropsychiatric manifestations.

Imaging findings typically reveal symmetrical and extensive calcifications, as observed in this case. Calcium metabolism disorders may be associated with intracerebral calcification, as seen in hypoparathyroidism, pseudohypoparathyroidism, and hyperparathyroidism. Other causes of intracranial calcifications include oligodendrogliomas, astrocytomas, mitochondrial diseases, infections (Epstein-Barr virus, toxoplasmosis, syphilis), and inflammatory diseases such as vasculitis and systemic lupus erythematosus (SLE), among others [14]. However, Fahr's disease represents a heterogeneous group of disorders that are not associated with any secondary condition, as in this patient. Table 3 provides a comparison of the present case with previously reported cases.

Management focuses on providing symptomatic relief: anticonvulsants, analgesics, anticholinergics for incontinence, selective serotonin reuptake inhibitors, and neuroleptics. The use of carbamazepine, benzodiazepine, and barbiturates may cause greater gait dysfunction. It has been reported that lithium increases the risk of seizures in these patients and that neuroleptics may exacerbate extrapyramidal symptoms [3,15-17]; therefore, caution is advised in this regard.

Concerning geriatric evaluation, it is extremely important to perform a comprehensive assessment, which includes the following:

- Clinical assessment: evaluates acute or chronic pathologies and determines the patient's disease burden. Nutritional status, polypharmacy, and sensory capacity should also be assessed.
- Functional assessment: evaluates the degree of independence and analyzes gait, balance, and physical performance. The need for interventions or assistive devices should be identified.
- Mental assessment: performs a cognitive evaluation to detect cognitive impairment or dementia. Assesses effective aspects, including depression, anxiety, mood or sleep disorders.
- Social assessment: evaluates the relationship between the individual and their environment and identifies social risks. It should be determined whether the patient requires caregiver support or referral to an appropriate level of care.

As this assessment is dynamic, it also helps to preliminarily identify clinically significant changes across different domains. In addition, it contributes in tailoring rehabilitation to the functional needs of older adults prior to discharge, facilitating a smoother transition to community living during the post-hospitalization period.

Table 3. Comparative summary of the patient (case 1) and other cases of Fahr's disease and syndrome

Case	Sex	Age	Diagnosis	Risk Factors	Imaging Findings	Psychotic symptoms	Cognitive impairment	Other psychiatric disorders	Extrapyramidal findings	Other neurological signs	Response to neuroleptics
1	Male	75	Late-onset, primary	Type 2 diabetes mellitus	Bilateral basal ganglia calcifications	Schizophreniform disorder and delusional disorder	Mild	Depression	None	-	-
2	Male	73	Late-onset, primary	Cerebrovascular disease?	Striopallidodentate calcifications	Severe: well-structured, with paranoid delusions of theft and conspiracy, associated with intense emotional involvement	Serious, progressive: memory, language, orientation, calculation, attention (MMSE: 19/30; MODA: 88/100)	Apathy	Bradykinesia, followed by secondary hypertonia, dyskinesias, tremor, and gait disturbances.	-	Poor
3	Male	37	Early-onset secondary	Head trauma	Striopallidal calcifications	Serious: poorly structured paranoid delusions of transformation and bodily grandiosity, auditory hallucinations, and aggressiveness.	Mild: language, comprehension, abstract reasoning, visuomotor ability. (WAIS: below the lower limit)	Flattening of affectivity	Facial and limb dyskinesias	Amimia, vacant expression	Poor
4	Male	54	Late-onset, primary	-	Striopallidal calcifications with mild cerebellar atrophy	Absent	Mild: memory	Mixed anxiety-depressive syndrome	None	-	-
5	Female	48	Early-onset, secondary	Head trauma, hyperparathyroidism	Striopallidal calcifications with mild cerebellar atrophy	Absent	Mild: attention, memory, logical reasoning, language, visuospatial abilities.	Mixed anxiety-depressive syndrome	None	Persistent glabellar reflex	-
6	Female	63	Late-onset, primary	-	Striopallidodentate calcifications with frontal leukoaraiosis and left pontocerebellar meningioma	Absent	Cognitive testing evaluated sustained and divided attention, memory, and executive functions Very mild: sustained and divided attention.	Decreased self-care in health	None	-	-
7	Female	73	Late-onset, secondary	Hyperparathyroidism	Striopallidal calcifications (worsened during follow-up with the development of moderate atrophy), leukoaraiosis, and a left parietal cortical infarction)	Progressive: visual hallucinations followed by aggressiveness and paranoid delusions.	Progressive: memory, orientation. (MMSE initial: 24.7/30, followed by progressive worsening).	Major depression	Early, progressive (worsening of upper limb tremor followed by gait disturbances)	Palmomental reflex	Partial
8	Female	82	Late-onset, secondary	Hyperparathyroidism. History of CVD?	Striopallidodentate calcifications with diffuse atrophy	Progressive: visual and auditory hallucinations followed by aggressiveness	Progressive, severe: memory, orientation, attention (MMSE 19.5/30)	Depression	Early (diffuse hypertonia present at rest and during intentional movement, gait disturbances)	Persistent glabellar reflex, bilateral Babinski reflex	Good

Legend: MMSE, Mini-Mental State Examination; MODA, Milan Overall Dementia Assessment; WAIS, Wechsler Adult Intelligence Scale; CVD, cerebrovascular disease

Frailty is another important aspect, as it increases vulnerability and adverse outcomes. Hospitalized frail older adults require a broad range of services encompassing multiple dimensions, including those within the physical component. However, measures such as mechanical restraints should only be reserved for exceptional circumstances, although their use remain common in our healthcare system [19].

Regarding social vulnerability in this population, it has been observed that, regardless of frailty status, this condition is associated with prolonged hospitalization and the need for long-term care after discharge, which contribute to higher healthcare costs. Even more serious are the findings from some studies indicating that the care provided to older patients is inappropriate and unfair, emphasizing the need to address negative attitudes toward older adult care, inadequate

environments, lack of resources, lack of knowledge and skills, and a specialized model of healthcare delivery that fail to consider the age of the patient [20,21].

In conclusion, Fahr's disease requires a thorough clinical examination, accompanied by laboratory, imaging, and genetic tests. In addition, a geriatric approach is essential to provide holistic, person-centered care, rather than focusing solely on the underlying pathology. It is also important to share geriatric interventions with other professionals to ensure high-quality care for older adult patients in our society.

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