Suspected Fahr Syndrome in a 5-year-old girl: Case Report

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Abstract: **Background**: Fahr syndrome, a rare condition with a prevalence of less than 1 in 1,000,000, is an inherited neurological disorder characterized by abnormal calcium deposits in brain regions governing motor function. While it predominantly afflicts adult people it can also manifest in children, who may exhibit neurodevelopmental issues, including microcephaly, neonatal seizures, cerebral atrophy, encephalopathy, and typically bilateral cerebral calcifications in the basal ganglia. Brain CT scan is the most sensitive modality in localizing and assessing the extent of calcium deposits. The prognosis is highly variable and unpredictable. **Report**: We present the case of a 5-year-old girl who presented with recurrent seizures, fever, and cough. She had suffered from frequent seizures since the age of 8 months and was diagnosed with epilepsy at 1 year of age. The patient was malnourished, and blood tests indicated decreased calcium levels. A CT scan of the head revealed multiple bilateral calcifications in the basal ganglia and cerebellar hemisphere, along with cerebral atrophy, indicative of Fahr Syndrome. **Conclusion**: Clinical presentation, including microcephaly, seizures, cerebral atrophy, hypotonia, and tremors, alongside radiological findings, strongly suggest Fahr syndrome. Symptomatic treatment includes oral anticonvulsants (valproic acid and levetiracetam) to mitigate seizures have shown gradual improvement.

1 INTRODUCTION

Fahr syndrome is a rare disease with the prevalence up to 1:1.000.000 (Saleem et al., 2013). Fahr syndrome is usually affects people within 40-50 years old (Carecchio et al., 2023). Fahr syndrome is characterized by bilateral calcification in ganglia basalis with progressive neurological disorder that usually includes movement disorder such as Parkinsonian symptoms, athetosis, etc. Otherwise, it may present with features like recurrent seizures, cognitive impairment, and speech delay, as the affected areas of the brain govern various movements, including the basal ganglia, thalamus, dentate nucleus, cerebral cortex, cerebellum, subcortical white matter, and hippocampus (Kundu et al., 2017).

The terms Fahr syndrome or Fahr disease are applicable when there are primary basal ganglia calcifications without a known cause, or when secondary causes of basal ganglia calcifications are identified. There is no definitive cure is available for Fahr disease and management is focused primarily on symptomatic relief (Amisha and Munakomi, 2023).

The diagnostic criteria for Fahr's syndrome have been adapted from Moskowitz et al. 1971, Ellie et al. (1989), and Manyam (2005) [(Kundu et al., 2017), (Benke, 2004), (Rastogi et al., 2011)], and can be outlined as follows:

- Bilateral calcification of the basal ganglia visualized on neuroimaging. Other brain regions may also be observed.
- Progressive neurologic dysfunction, typically featuring a movement disorder and/or neuropsychiatric manifestations. Onset generally occurs in the fourth or fifth decade, but it may also manifest in childhood.
- Absence of biochemical abnormalities and somatic features indicative of mitochondrial

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or metabolic diseases or other systemic disorders.
- Absence of an infectious, toxic, or traumatic cause.
- Family history consistent with autosomal dominant inheritance.

The differential diagnosis of Fahr syndrome are (Amisha and Munakomi, 2023):
- Congenital intellectual disability
- Latent tetany and myopathic changes that can cause brain calcification
- Infectious disease in there is Basal ganglia calcification, discovered in infancy along with ophthalmologic abnormality
- Addison disease
- Calcified angiomas, infections, encephalitis

2 REPORT

A 5-year-old girl presented with developmental delay and recurrent attack of seizure. The type of seizures is generalized tonic clonic, occurred up to ten times a day and lasted for 2-3 minutes. This patient also came with high fever and cough. She had history of microcephaly, recurrent seizures, and developmental delay since the age of 8 months old. She got valproic acid and phenytoin for anticonvulsant, used to seizures since she was 9 months old. Since she was 1 year old, she was diagnosed by epilepsy. The seizures got worse until she was 1 year 6 months old, she got recurrent seizures up to 10 times a day and for each seizure last in about 4 minutes. Since that, she referred to the type A hospital for the continuous examination and observation.

General examination of this patient revealed to be severe pain, with apathetic consciousness, total Glasgow Coma Score (GCS) 9. She has severe microcephaly, but none of abnormality of her eyes, ears, nose, and mouth. On thorax physical examination, we found substernal retractions and wet rhonchi of auscultation. The auscultation of the heart is normal with regularly heart beats. Then, on the abdominal physical examination, we found normal abdominal appearance with bowel sounds positive up to 12 times per minutes. On motor examination, it was found that ROM movement was limited, both hands and right leg were stiff, tremor in right hand and the left leg was in a curled position. On neurological examination, Babinski reflexes were positive on both legs and positive Oppenheim reflexes on the left. Regarding nutritional status, the patient is malnourished.

Table 1: Laboratory findings.

	Normal score	**04/05 /19**	**10/06 /19**	**23/05 /22**	**18/10 /23**
Ca	8,8 – 10,8 mg/dL	8,9	8	8,8	8

Blood chemistry revealed decreased of calcium levels. Which indicate condition of the patient has hypocalcemia.

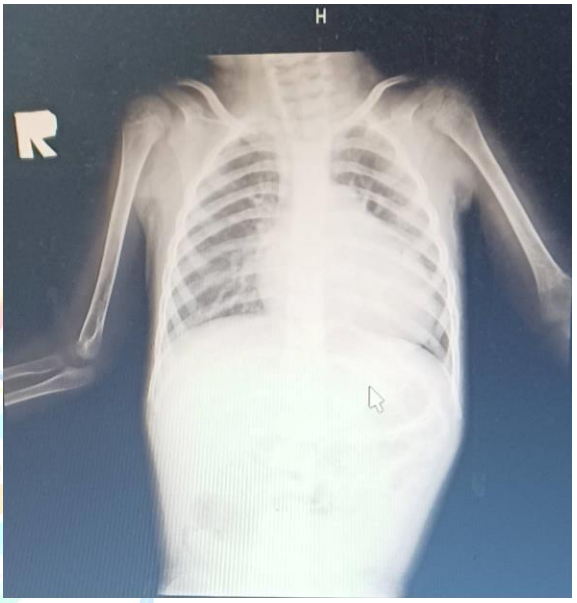

Figure 1: Thorax x-ray.

From the thorax x-ray (Figure 1) of the patient, there is infiltration in the right of paracardial and cardiomegaly with cardiothoracic ratio (CTR) 62%. This x-ray showed of suspected bronchopneumonia appearance. So, from the anamnesis, physical examination, and imaging of the thorax, this patient is diagnosed by bronchopneumonia.

From the CT imaging of the brain (Figure 2), its shows multiple bilateral symmetrical calcifications in basal ganglia and bilateral cerebellar hemispheres and linear calcification in the right frontal cortical sulci. It impresses of Fahr Syndrome, Cerebral Atrophy, and Dandy Walker Variant.

3 DISCUSSIONS

In this case, the patient is a 5-year-old girl. She has microcephaly since she was 8 months old, tremor of her right hand, recurrent seizures with generalized tonic clonic seizures, and developmental delay. Fahr

syndrome affects the areas that control movement on the brain, such as basal ganglia, thalamus, putamen, etc. Therefore, we could find movement disorder on the symptoms, such as tremor and progressive neurological disorder, such as recurrent seizures and developmental delay (Nishiyama et al., 1991). On the other cases and journals, there's no microcephaly found in Fahr syndrome (Kundu et al., 2017)(Saleem et al., 2013). Microcephaly with general tonic clonic seizures could be found in Aicardi-Goutieres syndrome. But, Aicardi-Goutieres syndrome is a congenital disease, so the symptoms could be found since birth of the patient. It affects skin rashes and liver inflammation too that we didn't find in this case (Saleem et al., 2013). In this case, the patient started progressive symptoms since she was 8 months old.

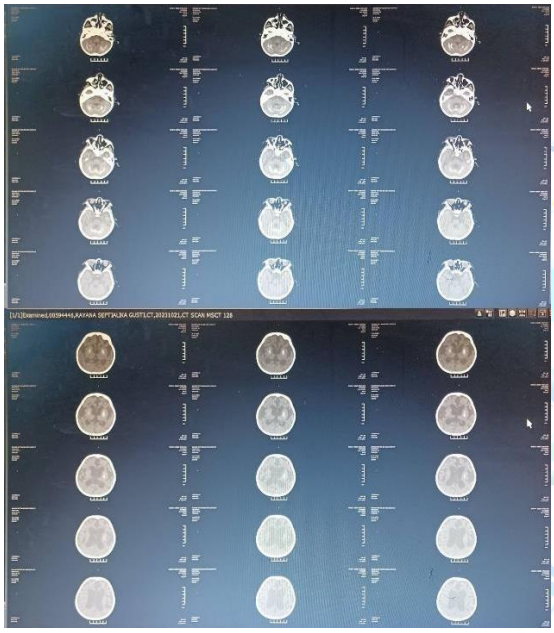

Figure 2: CT imaging of brain.

Fahr syndrome is diagnosed by CT imaging with bilateral calcification of basal ganglia (Manyam et al., 1992). CT imaging of this patient showed multiple bilateral symmetrically calcification in basal ganglia and bilateral cerebelli hemisphere, linier calcification in right sulci cortical of frontalis. Calcification in periventricular region usually found in CMV infection and calcification in intracerebral usually found in toxoplasma infection. Calcification in basal ganglia may found as a consequence of several genetic, infectious, and metabolic conditions (Niwa et al., 2008). In this case, CMV infection and toxoplasma infection could be eliminated based on clinical manifestation of this patient.

One of the etiologies of Fahr syndrome is idiopathic disorder, such as hypoparathyroidism. Hypoparathyroidism is characterized by hyperphosphatemia, hypocalcemia, and decreased of PTH level (Palu et al., 2021). In this case, the patient has hypocalcemia that occurs calcification of basal ganglia. But, there's no examination of phosphate level and PTH level. So, in this patient couldn't diagnosed by hypoparathyroidism.

Treatment of Fahr syndrome is only symptomatic support due to no definitive cure available for the treatment of Fahr syndrome. In this case, the patient was given valproic acid for the recurrent seizures. The patient also diagnosed with bronchopneumonia, so the patient also got antibiotics. Prognosis of Fahr syndrome is unpredictable, variable, and unrelated for the extent of calcification. Prognosis of this patient due to the recurrent seizures symptoms of Fahr syndrome is dubia ad malam. Otherwise, the prognosis of bronchopneumonia diagnosis is dubia ad bonam for quo ad functionam and quo ad vitam, but dubia ad malam for quo ad sanationam.

4 CONCLUSIONS

In this case, the patient is a 5-year-old girl, and according to the past data, it's a very rare case of Fahr syndrome that affects children. The characterized symptoms of Fahr syndrome are progressive neurological disorder and movement disorder due to bilateral calcification of basal ganglia. So, patient either young old girl or boy, with developmental delay, recurrent seizures, and movement disorder such as tremor should be thought about Fahr syndrome for the differential diagnose. The infection may cause calcification in brain too, but the characterized calcification of Fahr syndrome is basal ganglia bilateral calcification. Treatment of Fahr syndrome doesn't have any definitive cure yet, so the focus target of the treatment is symptoms support for improvement of quality of life.

For the future researchers, more studies about the correlation between microcephaly and Fahr syndrome, or the correlation between microcephaly and calcification of basal ganglia still needed.

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