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CASE REPORT

Wilsons Disease: Brain Magnetic Resonance Imaging

ABSTRACT

Wilson's disease (WD) is an autosomal recessive systemic disorder that causes copper accumulation and toxicity in multiple organs. Various neurologic symptoms, such as rigidity, tremor, bradykinesia, dystonia, chorea, dysarthria, and dysphagia, are observed in the central nervous system involvement of WD. Magnetic Resonance Imaging (MRI) usually shows increased T2-weighted signals in the basal ganglia, mesencephalon, and pons. MRI is a valuable, non-invasive imaging technique for the diagnosis and follow-up of central nervous system involvement in life-threatening WD. In this case report, we will present cranial MRI findings of WD with cranial involvement.

Keywords: Hepatolenticular degeneration, Wilson's disease, magnetic resonance imaging

Wilson's disease (WD), or hepatolenticular degeneration, is a rare autosomal recessive disorder that causes copper accumulation in many tissues (brain, liver, cornea) and secondary damage to the affected organ (1, 2). The age of WD onset for most occurs between 5 and 35 years, which may reflect the potential copper storage capacity of the liver (3). Its incidence rate varies from 1/30,000 to 1/10,000; the incidence of WD is higher in some populations due to increased rates of consanguineous marriage (4, 5). Although WD is more common in men than in women, neuropsychiatric symptoms are more common in men, and liver symptoms are more common in women (1, 2). Brain lesions may be present in multiple sites in WD, exhibiting abnormally symmetric signals in the bilateral hemisphere, mostly (6). In this case report, we aim to present a patient with WD who showed brain involvement clinically and with magnetic resonance imaging (MRI) findings.

CASE

A 34-year-old man with known WD was admitted to our hospital with complaints of difficulty in speech, tremor in voluntary movements, and loss of balance. Neurologic examination revealed a cerebellar explosive spelling pattern, a right ataxic gait, and bilateral intrinsic tremor. The non-contrast cranial MRI of the patient showed diffuse T2 signal intensities extending from the midbrain and pons to the middle cerebellar peduncles (Figure 1 A, B, C, D, E, F) and increased T2 signal intensities in the caudate nuclei, putamen, ventricular lateral thalamus, and symmetrical basal ganglia (Figure 2). These findings are similar to the central nervous system involvement findings of WD. It is also accompanied by hydrocephalus in the ventricles (Figure 3, 4).

DISCUSSION

WD is an autosomal recessive disorder in which copper accumulates in different organs as a result of one of several mutations in the ATP7B gene on chromosome 13, which controls the protein transporter responsible for the removal of excess copper, leading to secondary damage to organs (5, 7). Although the ATP7B gene is expressed in the human central nervous system, dysfunction in the brain as a result of mutation does not cause symptoms.

The main route of excretion of copper (95%) is the liver, and in the case of a mutation, copper accumulates first in the liver, then enters the bloodstream and accumulates in other organs. As a result of its accumulation in the central nervous system, it causes neurological and psychiatric symptoms with nerve tissue damage. In this context, the cause of neurological symptoms is primarily extrahepatic copper toxicity (5, 8). For this reason,

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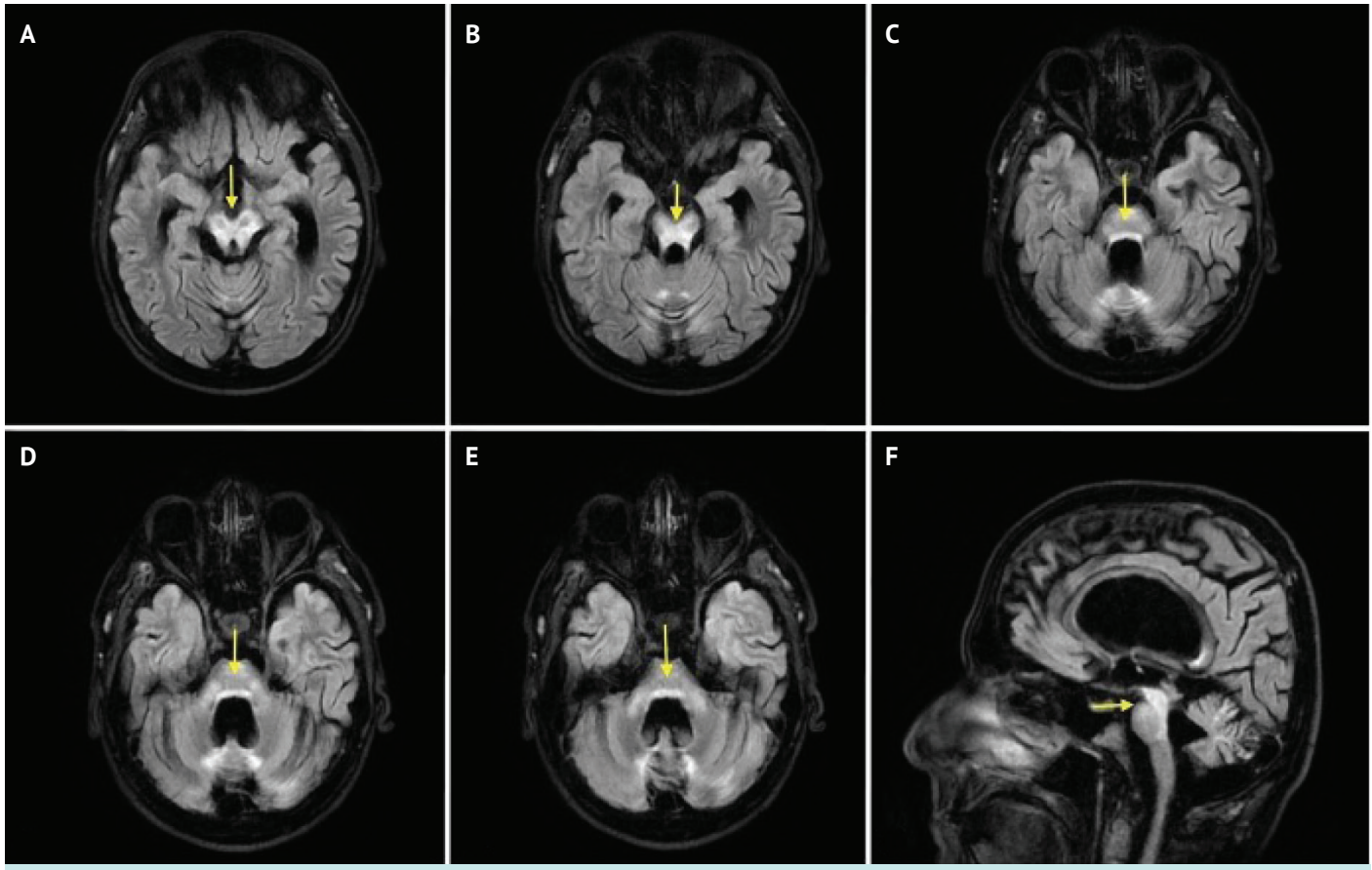

Figure 1. (A, B, C, D, E) Axial and (F) sagittal sections of non-contrast cranial magnetic resonance imaging FLAIR sequences showed diffuse T2 signal intensities extending from the midbrain and pons to the cerebellar peduncles (yellow arrows).

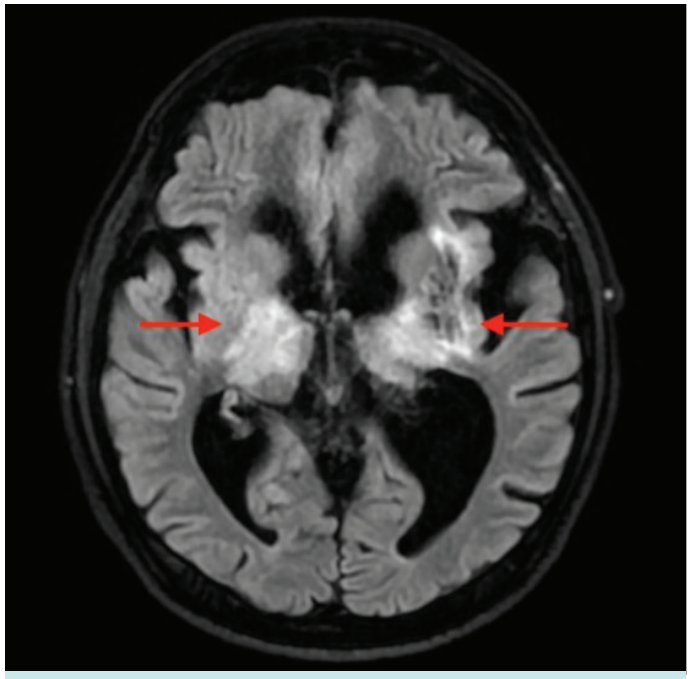

Figure 2. Non-contrast cranial magnetic resonance imaging FLAIR sequence shows T2 signal enhancement in the caudate nuclei, putamen, ventricular lateral thalamus, and symmetrical basal ganglia (red arrows).

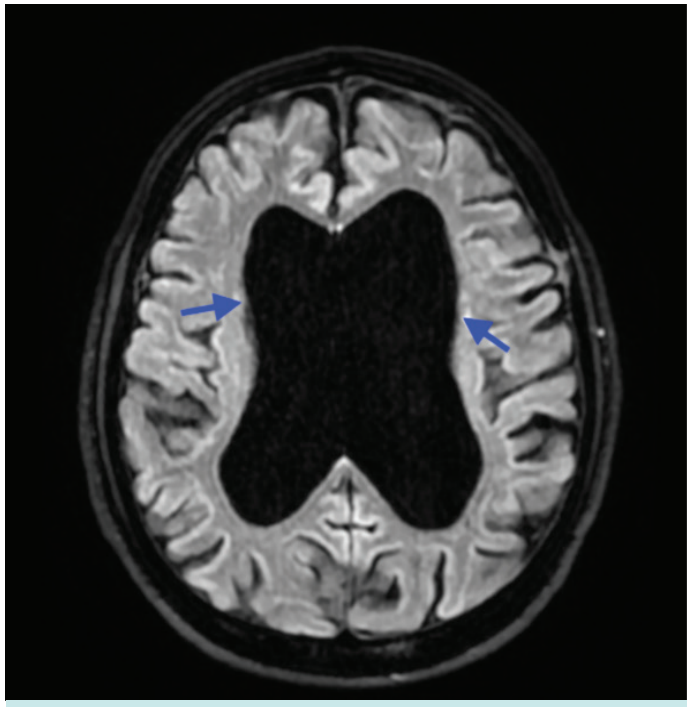

Figure 3. Non-contrast cranial magnetic resonance imaging FLAIR sequence shows hydrocephalus in the lateral ventricles (blue arrows).

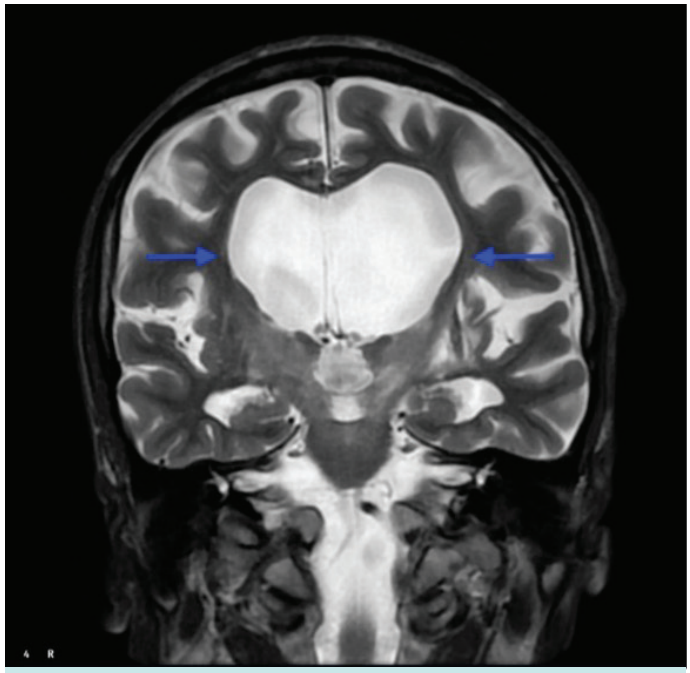

Figure 4. Coronal sections of non-contrast cranial MRI T2-weighted images show hydrocephalus in the lateral ventricles (blue arrows).

the first symptoms of WD are usually hepatic and present with liver dysfunction in the first decade of life, while neuropsychiatric symptoms are seen in untreated cases, poor compliance with treatment, or treatment failure and appear in the third/fourth decade of life (5, 8).

WD presents as a spectrum of neurological symptoms, including rigidity, tremor, bradykinesia, dystonia, chorea, dysarthria, and dysphagia, and a completely monosymptomatic presentation is rare (7, 8).

The most prominent MRI findings in untreated patients are symmetrical hyperintensities in T2-weighted images in the basal ganglia (most commonly the putamen (45-85%), 2nd most frequently the caudate nucleus (30-60%), and the mesencephalic and pontine white matter; however, the T1 signal is generally reduced in the basal ganglia (2, 8). These T2 hyperintense lesions are partially reversible with anti-copper treatment and likely reflect edema and demyelination caused by copper toxicity. Typical T2 hyperintense lesions and hypointensities can also be seen in the basal ganglia on T2-weighted images from early disease stages. These hypointensities can be better demonstrated by T2-weighted or susceptibility-weighted imaging (SWI), and these hypointense lesions were confirmed to be caused by abnormal iron deposition in a postmortem MRI histopathology correlation study (8). It is also accompanied by ventricular dilatation in 73% of cases (9). Hydrocephalus is also present in our case. The lenticular nucleus was found to be the most frequently affected region in WD, and the least affected regions were the hippocampus and cerebellum (2). In the brain stem, involvement is common in the midbrain and pons. In the cerebral cortex, frontal cortex lesions are most common, while parietal and occipital cortex lesions are less commonly affected. Lesions in two or more regions can often be seen in the same patient. Regardless of whether cortical lesions are observed in the white matter, involvement of the frontal, parietal, temporal, and occipital lobes can often be seen, with the former appearing as a diffuse abnormal signal extending from the frontal to the occipital lobe (10). In addition, WD can involve the corpus callosum (11) and conduction pathways, including the corticospinal, red nucleus thalamic, and cerebellopontine pathways (12). Interestingly, some degree of atrophy can be observed in WD patients, mostly in the cerebrum (13).

CONCLUSION

WD is a systemic disease characterized by copper accumulation and may significantly decrease the quality of life with central system involvement and may be life-threatening. Since MRI is a valuable non-invasive imaging technique that helps in the diagnosis and follow-up of central nervous system involvement in WD, it requires a multisystemic approach with the cooperation of clinicians and radiologists in the diagnosis and follow-up of the disease.

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REFERENCES

1. Zhong W, Huang Z, Tang X. A study of brain MRI characteristics and clinical features in 76 cases of Wilson's disease. J Clin Neurosci 2019;59(1):167-74. [CrossRef]
2. Litwin T, Gromadzka G, Czlonkowska A, Gołębiowski M, Poniatowska R. The effect of gender on brain MRI pathology in Wilson's disease. Metab Brain Dis 2013;28(1):69-75. [CrossRef]
3. Czlonkowska A, Rodo M, Gromadzka G. Late onset Wilson's disease: Therapeutic implications. Mov Disord 2008;23(6):896-8. [CrossRef]
4. Ala A, Walker AP, Ashkan K, Dooley JS, Schilsky ML. Wilson's disease. Lancet 2007;369(9559):397-408. [CrossRef]
5. Chaudhry HS, Anilkumar AC. Wilson Disease. Treasure Island: StatPearls Publishing; 2023.
6. Ranjan A, Kalita J, Kumar V, Misra UK. MRI and oxidative stress markers in neurological worsening of Wilson disease following penicillamine. Neurotoxicology 2015;49(1):45-9. [CrossRef]
7. Członkowska A, Litwin T, Chabik G. Wilson disease: Neurologic features. Handb Clin Neurol 2017;142(1):101-19. [CrossRef]
8. Dusek P, Litwin T, Członkowska A. Neurologic impairment in Wilson disease. Ann Transl Med 2019;7(Suppl 2):S64. [CrossRef]
9. Ozkan TB. Wilson's disease in children. J Uludag Univ Fac Med 2005;31(3):163-70.
10. Trocello JM, Woimant F, El Balkhi S, Guichard JP, Poupon J, Chappuis P, et al. Extensive striatal, cortical, and white matter brain MRI abnormalities in Wilson disease. Neurology 2013;81(17):1557. [CrossRef]

11. Trocello JM, Guichard JP, Leyendecker A, Pernon M, Chaine P, El Balkhi S, et al. Corpus callosum abnormalities in Wilson's disease. J Neurol Neurosurg Psychiatry 2011;82(10):1119-21. [CrossRef]
12. Van Wassenaer-van Hall HN, van den Heuvel AG, Jansen GH, Hoogenraad TU, Mali WP. Cranial MR in Wilson disease: Abnormal white matter in extrapyramidal and pyramidal tracts. AJNR Am J Neuroradiol 1995;16(10):2021-7.
13. Singh P, Ahluwalia A, Saggar K, Grewal CS. Wilson's disease: MRI features. J Pediatr Neurosci 2011;6(1):27-8. [CrossRef]