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LETTER TO THE EDITOR

Magnesium may be an effective therapy for Alzheimer's disease

Dao-Yun Lei, Jie Sun

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Abstract

Magnesium deficiency in serum or the brain of Alzheimer's disease (AD) patients has been shown to be associated with AD. Current research suggests that supplementing or restoring magnesium may be a novel approach to AD treatment. However, the physiological properties of magnesium make such treatment difficult. It is undeniable that magnesium may be an effective therapy for AD.

Key Words: Alzheimer's disease; Magnesium; Therapy; Deficiency

Core Tip: Magnesium deficiency in serum or the brain of Alzheimer's disease (AD) patients has been shown to be associated with AD. However, the physiological properties of magnesium make such treatment difficult. Undeniably, magnesium may be an effective therapy for AD.

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TO THE EDITOR

Alzheimer's disease (AD) is the most common dementia characterized by the decline of cognitive function in the elderly. The accumulation of β-amyloid plaques and the existence of neurofibrillary tangles are the pathological bases for the dysfunction of various signaling pathways in the nervous system[1]. Since the pathogenic mechanism of AD is still not clear, its treatment approaches are unlikely to be meaningfully effective. Several approved drugs ameliorate some of the symptoms of AD, but no

current interventions can modify the underlying disease mechanisms[2,3]. We read the interesting article by Xiong *et al*[4], which was published in *World Journal of Psychiatry*. Their study found that magnesium L-threonate alleviated neuronal apoptosis by inhibiting oxidative stress, especially in the hippocampus. Although the research work revealed a potential scheme for the treatment of AD, we still believe that some views deserve further consideration and look forward to receiving the reply from the authors.

Admittedly, magnesium is one of the most abundant cations in the intracellular environment after potassium. Mg^{2+} is tightly regulated and kept at basal levels by normal Mg^{2+} intake, absorption, and metabolism under physiological conditions. Total magnesium levels in the hippocampus of AD patients decreased by 18% compared with that of normal subjects[5]. Although the presence of magnesium deficiency in patients with AD is notable, its severity may be underestimated. The concentration of serum Mg^{2+} in healthy people ranges from 0.70 mM to 1.05 mM[6]. Mg^{2+} deficiency is generally determined by measuring the total serum Mg^{2+} concentration, but it cannot accurately reflect the concentration of magnesium in the human body. Most Mg^{2+} is stored in bone, muscle, and soft tissue, and the proportion of serum Mg^{2+} is very low. Even if the human body is in a serious state of Mg^{2+} depletion, serum magnesium may also be in the normal range. Although the magnesium concentration in AD patients is reduced, the degree of deficiency cannot be accurately evaluated. It is not only difficult to evaluate magnesium deficiency, but also a reasonable supplement of magnesium. Slutsky *et al* found that following long-term magnesium supplementation, Mg^{2+} concentration in cerebrospinal fluid only increases by 15%[7]. On one hand, systemic magnesium is closely regulated by renal function. On the other hand, the blood-brain barrier separates the brain from the daily fluctuations of blood magnesium. Hippocampal synapses are very sensitive to small changes in extracellular Mg^{2+} concentration (increasing the concentration of magnesium by 15% can increase the synaptic density by 50%)[8]. Encouragingly, compared with other Mg^{2+} compounds (such as magnesium chloride, magnesium citrate, and magnesium gluconate), dietary intake of magnesium L-threonate could significantly increase Mg^{2+} levels in the brain[4]. Therefore, restoring brain magnesium may be a potential way to treat cognitive impairment in patients with AD.

Conclusion

In summary, magnesium may be a novel therapeutic strategy for AD-induced cognitive impairment. However, numerous clinical studies are still needed to confirm the clinical application of magnesium.

FOOTNOTES

Author contributions: Lei DY and Sun J contributed to the conception of the research; Lei DY and Sun J wrote the letter and contributed to the revision of the letter; all authors approved the final manuscript for submission.

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