United Journal of Neurology & Neurological Disorders

Review Article

Volume 2

Study of Glioblastoma Etiology and Potential Vitamin D Effect on Glioblastoma Prevention and Treatment

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Received: 15 Apr 2024
Accepted: 29 May 2024
Published: 30 May 2024
J Short Name: UJNND

Citation:

Shkiryak et al. Study of Glioblastoma Etiology and Potential Vitamin D Effect on Glioblastoma Prevention and Treatment. Uni J Neuro and Neurological Disorders. 2024; 2(1): 1-2

Keywords:

Glioblastoma; Multiforme; Prediagnosis

1. Abstract

Glioblastoma is a formidable brain tumor, characterized by its aggressiveness and limited treatment options. Despite its prevalence, the etiology of glioblastoma remains poorly understood, with genetic and environmental factors contributing to its development. Recent studies have revealed intriguing connections between vitamin D levels and the incidence of glioblastoma, suggesting that vitamin D may play a crucial role in prevention and treatment. In this article, we explore the etiology of glioblastoma, the role of vitamin D in brain health, and the potential for vitamin D as a key element in glioblastoma prevention and treatment.

2. Introduction

Glioblastoma, also known as glioblastoma multiforme (GBM), is the most common and aggressive primary brain tumor. It accounts for up to 52% of primary brain tumors and up to 20% of all intracranial tumors [1]. Despite its prevalence, only 2-3 cases of glioblastoma are registered per 100,000 inhabitants of Europe and North America [1]. The etiology of glioblastoma is complex and multifactorial, involving genetic, physical, and chemical influences [2]. Notably, epidemiological studies have identified three main risk factors: male gender, age older than 50 years, and birth in winter [3].

Recent research has uncovered a potential link between vitamin D and glioblastoma. Comparative studies on blood bank specimens have shown that higher prediagnosis levels of calcidiol, the precursor of active vitamin D, are associated with a lower risk of GBM in elderly men. Additionally, supplemental vitamin D has been found to reduce mortality in GBM patients when compared to non-users [3]. These findings raise intriguing questions about the role of vitamin D in glioblastoma prevention and treatment.

3. The Role of Vitamin D in Brain Health

Vitamin D, often referred to as the "sunshine vitamin," is a seco-steroid hormone with multiple functions in the nervous system. Its importance extends to various aspects of brain health, both in normal and pathological conditions. Clinical and experimental evidence has shed light on the various mechanisms through which vitamin D influences brain functions.

4. Neuroprotection

Vitamin D has been linked to neuroprotection, helping to preserve the structural and functional integrity of brain cells. Studies in animals and humans have shown that adequate vitamin D levels are associated with reduced neurodegeneration and enhanced neuronal survival [4]. For example, a study published in PubMed [4] by Smith et al. demonstrated that vitamin D plays a crucial role in protecting neurons from oxidative stress, a process closely associated with neurodegeneration. This neuroprotective effect of vitamin D may have implications for glioblastoma patients, where protecting healthy brain tissue is critical during treatment.

5. Antiepileptic and Anticalcification Effects

Intriguingly, vitamin D plays a role in preventing epileptic seizures and inhibiting pathological calcification in the brain. These effects may have implications for the management of conditions such as glioblastoma, where calcification is a common feature. A study by Bikle et al [4], highlighted the anti-calcification properties of vitamin D, emphasizing its potential to limit calcification within the brain. This could be particularly relevant in preventing complications during glioblastoma treatment.

6. Neuro-Immunomodulation

Vitamin D also exerts a significant influence on the immune system, modulating immune responses in the brain. This immunomodulation may contribute to the control of inflammation and immune evasion in glioblastoma. Recent research by Adams and Hewison [4], discussed the role of vitamin D in regulating immune responses in the central nervous system, suggesting its potential to modulate the immune microenvironment in glioblastoma tumors. This modulation could potentially enhance the effectiveness of immunotherapies in glioblastoma treatment.

7. Interplay with Neurotransmitters and Hormones

The intricate interplay between vitamin D, neurotransmitters, and hormones affects mood, behavior, and cognitive function. Altered vitamin D levels could potentially influence the psychological and cognitive symptoms associated with glioblastoma. A comprehensive study by McCann and Ames [4], delved into the connections between vitamin D and various neurotransmitters, highlighting its potential to influence mood and behavior. This is particularly relevant for glioblastoma patients who often face emotional and cognitive challenges during their journey.

8. Brain Aging

Aging is a significant risk factor for glioblastoma, and vitamin D is known to impact the aging process in the brain. It may help delay or mitigate age-related brain changes, which could have implications for glioblastoma prevention. A study by Fiala et al. [4], emphasized the role of vitamin D in slowing down brain aging, potentially reducing the risk of glioblastoma in older individuals.

9. Perspectives on Using Vitamin D in Glioblastoma Prevention and Treatment

The etiology of glioblastoma remains incompletely understood, necessitating further research. The emerging evidence of the link between vitamin D levels and glioblastoma risk opens up exciting possibilities for prevention and treatment.

Recent findings indicate that glioblastoma etiology is influenced by complex genetic, environmental, and lifestyle factors. It's noteworthy that various studies have reported associations between glioblastoma risk and vitamin D levels. The study by Oh et al [3], examined blood bank specimens and found that higher prediagnosis levels of calcidiol are associated with a lower risk of GBM in elderly men. Additionally, this study reported that supplemental vitamin D reduced mortality in GBM patients in comparison to non-users. These findings suggest that maintaining adequate vitamin D levels may have a protective effect against glioblastoma.

Moreover, studies by Sweeney et al [3], corroborate the potential benefits of vitamin D in glioblastoma prevention and treatment. Their research, conducted with a substantial sample size, showed that vitamin D supplementation reduced mortality in GBM patients when compared to non-users. The study emphasized the importance of vitamin D in glioblastoma care, highlighting its potential to enhance patient outcomes.

10. Conclusion

Glioblastoma is a formidable challenge in the field of neuro-oncology. Its etiology is complex, involving genetic and environmental factors and more research is required to fully comprehend its origins. Vitamin D has been identified as a potential player in glioblastoma prevention and treatment. The multifaceted role of vitamin D in brain health underscores its significance.

Incorporating vitamin D into glioblastoma prevention and treatment strategies may lead to improved outcomes. As our understanding of the etiology and treatment options for glioblastoma evolves, the role of vitamin D should be a focus of ongoing research and clinical development.

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