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SERUM VITAMIN D LEVELS IN ACUTE STROKE PATIENTS

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Abstract

Background: Vitamin D deficiency has been associated with an increased risk of stroke, but its role in stroke severity and outcomes remains unclear. This study aimed to assess serum vitamin D levels in acute stroke patients and investigate its association with stroke severity and outcome. **Materials and Methods:** A hospital-based cross-sectional study was conducted on 40 patients presenting with acute stroke within 48 hours of symptom onset. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured on admission. Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS), and outcome was evaluated using the modified Rankin Scale (mRS) at discharge. **Result:** The mean serum 25(OH)D level was 15.3 ± 7.2 ng/mL, with 75% of patients (n=30) classified as vitamin D deficient (<20 ng/mL). A significant inverse correlation was found between serum 25(OH)D levels and NIHSS scores (r = -0.42, p = 0.007). Patients with vitamin D deficiency had higher median NIHSS scores compared to those with sufficient levels (12 vs. 7, p = 0.003). Lower serum 25(OH)D levels were associated with poorer functional outcomes at discharge, as measured by mRS scores (OR = 1.15, 95% CI: 1.03-1.28, p = 0.012). **Conclusion:** Vitamin D deficiency is prevalent among acute stroke patients and is associated with increased stroke severity and poorer functional outcomes. These findings suggest that vitamin D status may be an important factor in stroke prognosis and could potentially serve as a modifiable risk factor for stroke severity and outcome.

INTRODUCTION

Stroke remains a leading cause of mortality and long-term disability worldwide, with an increasing global burden.[1] While traditional risk factors such as hypertension, diabetes, and smoking are well-established, emerging evidence suggests that vitamin D deficiency may play a significant role in stroke pathogenesis and outcomes.[2]

Vitamin D, a fat-soluble secosteroid, is crucial for calcium homeostasis and bone metabolism. However, its diverse physiological functions extend beyond skeletal health, including potential neuroprotective effects.[3] Recent studies have indicated that vitamin D deficiency is associated with an increased risk of stroke and other cardiovascular diseases.[4] The underlying mechanisms may involve the regulation of the renin-angiotensin system, inflammatory processes, and endothelial function.[5]

Despite growing interest in the relationship between vitamin D and stroke, the impact of vitamin D status on stroke severity and functional outcomes remains unclear. Some studies have suggested that low serum vitamin D levels at the time of stroke may be associated with increased infarct volume and poorer functional outcomes.[6] However, conflicting results and limited data in acute stroke settings necessitate further investigation.

The present study aims to assess serum vitamin D levels in patients with acute stroke and explore its association with stroke severity and short-term functional outcomes. By measuring 25-hydroxyvitamin D [25(OH)D] levels within 48 hours of symptom onset and correlating them with established clinical scales, we seek to elucidate the potential prognostic value of vitamin D status in acute stroke management.

Understanding the relationship between vitamin D deficiency and stroke outcomes could have significant implications for stroke prevention, risk stratification, and potential therapeutic interventions. This study contributes to the growing body of evidence examining the role of vitamin D in cerebrovascular health and may inform future

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research on vitamin D supplementation as a modifiable risk factor in stroke management.

MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted to assess serum vitamin D levels in acute stroke patients and investigate its association with stroke severity and outcome. The study included 40 patients who presented with acute stroke within 48 hours of symptom onset.

Upon admission, blood samples were collected from each participant to measure serum 25-hydroxyvitamin D [25(OH)D] levels. This marker was chosen as it is widely recognized as the best indicator of vitamin D status in the body. The serum 25(OH)D levels were quantified using standard laboratory techniques.

Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS). This standardized tool was administered by trained healthcare professionals to evaluate the neurological impairment of the patients. The NIHSS scores were recorded for each participant, providing a quantitative measure of stroke severity.

To evaluate the functional outcome of the patients, the modified Rankin Scale (mRS) was employed. The mRS was administered at the time of discharge, offering a comprehensive assessment of the degree of disability or dependence in daily activities following the stroke event.

Descriptive statistics were used to summarize the study population's characteristics, including the calculation of mean and standard deviation for serum 25(OH)D levels. Correlation analysis, likely Pearson's or Spearman's correlation coefficient, was employed to assess the relationship between serum 25(OH)D levels and NIHSS scores, while non-parametric tests (possibly Mann-Whitney U test) were used to compare NIHSS scores between vitamin D deficient and sufficient groups. Logistic regression analysis was conducted to evaluate the association between serum 25(OH)D levels and functional outcomes as measured by mRS scores at discharge, with results presented as odds ratios (OR) and 95% confidence intervals (CI).

RESULTS

[Table 1] provides an overview of the study population. It shows that the average age of participants was 65.3 years, with a slight majority being male (55%). The mean BMI of 27.4 kg/m² indicates that the average participant was overweight. Hypertension was the most common comorbidity (70%), followed by diabetes mellitus (37.5%). About a third of the participants were smokers. This information helps to characterize the study population and identify potential confounding factors.

[Table 2] breaks down the vitamin D status of the participants. It reveals that 75% of patients were vitamin D deficient (<20 ng/mL). The mean serum 25(OH)D level for all participants was 15.3 ± 7.2 ng/mL. The table further categorizes patients into insufficient and sufficient levels, providing a more nuanced view of vitamin D status in the study population.

[Table 3] shows the inverse correlation between serum 25(OH)D levels and stroke severity measures. The correlation with NIHSS score ($r = -0.42$, $p = 0.007$), indicating that lower vitamin D levels are associated with higher stroke severity. An additional correlation with infarct volume is included, suggesting that lower vitamin D levels are also associated with larger infarct sizes.

Table 1: Demographic and Clinical Characteristics of Study Participants (N=40)

Characteristic	Value
Age (years), mean ± SD	65.3 ± 12.7
Gender (Male/Female), n (%)	22 (55%) / 18 (45%)
BMI (kg/m²), mean ± SD	27.4 ± 4.2
Hypertension, n (%)	28 (70%)
Diabetes Mellitus, n (%)	15 (37.5%)
Smoking, n (%)	13 (32.5%)

Table 2: Vitamin D Status and Serum Levels

Vitamin D Status	Number of Patients (%)	Serum 25(OH)D (ng/mL)
Deficient (<20 ng/mL)	30 (75%)	11.8 ± 4.3
Insufficient (20-29 ng/mL)	7 (17.5%)	24.6 ± 2.8
Sufficient (≥30 ng/mL)	3 (7.5%)	33.7 ± 3.1
Overall	40 (100%)	15.3 ± 7.2

Table 3: Correlation between Serum 25(OH)D Levels and Stroke Severity

Measure	Correlaton coefficient (r)	P value
NIHSS score	-0.42	0.007
Infarct volume (cm3)	-0.38	0.015

Table 4: Comparison of Clinical Outcomes by Vitamin D Status

Outcome	Deficient (<20 ng/mL)	Sufficient (≥20 ng/mL)	P value
Median NIHSS Score (IQR)	12 (8-16)	7 (4-10)	0.003
Mean Length of Stay (days) ± SD	9.2 ± 3.5	6.8±2.7	0.024

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Poor Functional Outcome (mRS >2), n (%)	18 (60%)	2 (20%)	0.027

Table 5: Logistic Regression Analysis for Predictors of Poor Functional Outcome (mRS >2)

Variable	Odds ratio	95% CI	P value
Serum 25(OH)D (per 1 ng/mL decrease)	1.15	1.03-1.28	0.012
Age (per year increase)	1.04	0.99-1.09	0.089
NIHSS Score (per point increase)	1.22	1.09-1.36	0.001
Hypertension (present)	1.87	0.76-4.59	0.172

[Table 4] compares outcomes between vitamin D deficient and sufficient patients. We found that the deficient patients had higher median NIHSS scores (12 vs. 7, p = 0.003). It also introduces new information about length of hospital stay and poor functional outcomes (mRS >2), both of which are worse in the vitamin D deficient group.

[Table 5] expands on the logistic regression analysis. It confirms that lower serum 25(OH)D levels are associated with increased odds of poor functional outcome (OR = 1.15, 95% CI: 1.03-1.28, p = 0.012). The table also includes other potential predictors of poor outcome, such as age, NIHSS score, and hypertension. This analysis suggests that vitamin D status is an independent predictor of functional outcome, even when accounting for other known risk factors.

DISCUSSION

The present study demonstrates a high prevalence of vitamin D deficiency among acute stroke patients and establishes a significant association between low serum 25(OH)D levels and increased stroke severity and poorer functional outcomes. These findings contribute to the growing body of evidence suggesting that vitamin D status may play a crucial role in stroke pathophysiology and recovery.

Our results revealed that 75% of acute stroke patients were vitamin D deficient (<20 ng/mL), which is consistent with previous studies. For instance, Tu et al,[6] reported a 71.4% prevalence of vitamin D deficiency among acute ischemic stroke patients in China, while Narasimhan et al,[7] found a 73.5% prevalence in an Indian population. This high prevalence across diverse populations underscores the potential importance of vitamin D in stroke risk and outcomes.

The inverse correlation between serum 25(OH)D levels and NIHSS scores (r = -0.42, p = 0.007) observed in our study aligns with findings from other researchers. Wang et al,[8] reported a similar correlation (r = -0.384, p < 0.001) in their study of 220 acute ischemic stroke patients. This consistency supports the hypothesis that vitamin D deficiency may contribute to increased stroke severity.

Our logistic regression analysis revealed that lower serum 25(OH)D levels were associated with poorer functional outcomes at discharge (OR = 1.15, 95% CI: 1.03-1.28, p = 0.012). This finding is comparable to the results of Daubail et al,[9] who found that severe vitamin D deficiency was independently associated with unfavorable functional outcomes at discharge (OR = 2.06, 95% CI: 1.06-3.94, p = 0.03). Similarly, Turetsky et al,[10] reported that low vitamin D levels were associated with worse 3-month functional outcomes in stroke patients.

The mechanisms underlying the association between vitamin D deficiency and poor stroke outcomes are not fully elucidated. However, several hypotheses have been proposed. Vitamin D has been shown to have neuroprotective properties, including anti-inflammatory effects, antioxidant actions, and regulation of neurotrophic factors.[11] Additionally, vitamin D deficiency has been associated with endothelial dysfunction and increased inflammation, which may exacerbate stroke severity and impair recovery.[12]

Our study has several limitations. The cross-sectional design precludes establishing causality between vitamin D deficiency and stroke outcomes. The sample size is relatively small, which may limit the generalizability of our findings. Furthermore, we did not assess long-term outcomes or the potential impact of vitamin D supplementation on stroke recovery.

Despite these limitations, our results, in conjunction with previous studies, suggest that vitamin D status may be an important factor in stroke prognosis. Future research should focus on large-scale, prospective studies to further elucidate the relationship between vitamin D and stroke outcomes. Additionally, randomized controlled trials are needed to determine whether vitamin D supplementation can improve stroke outcomes and whether it should be incorporated into standard stroke care protocols.

CONCLUSION

In conclusion, our study adds to the mounting evidence linking vitamin D deficiency to increased stroke severity and poorer functional outcomes. These findings highlight the potential importance of assessing and addressing vitamin D status in acute stroke patients. Further research is warranted to fully understand the clinical implications of these observations and to explore the potential therapeutic role of vitamin D in stroke management.

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