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The Necessity of Vertebral Artery Doppler/USG Examination in Vertigo Patients

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ABSTRACT

Introduction: Vertigo, characterized by a sensation of spinning or movement, presents as a common complaint in primary care, emergency departments, neurology, psychiatry, and otolaryngology clinics. Its diverse etiologies, including inner ear disorders and neurological conditions, pose diagnostic challenges. The diagnostic process typically involves a comprehensive neurological examination, but additional tests like vertebral artery Doppler examination may be necessary, particularly when vascular causes are suspected. However, the necessity of this examination remains unclear. In this retrospective study, we aimed to evaluate the necessity of vertebral artery Doppler/USG examination in patients presenting with vertigo.

Methods: A cohort of 1021 patients attending a neurology outpatient clinic with complaints of dizziness/vertigo underwent comprehensive evaluation, including vertebral artery ultrasound/Doppler examination.

Results: The study revealed that the majority of patients (about 90%) exhibited no evidence of significant vertebral artery atherosclerosis. However, hemodynamically significant vertebral artery pathology was observed in 5.1% of patients, predominantly among older male individuals with cardiovascular risk factors. Additionally, anatomical variations in vertebral artery anatomy were noted, highlighting the importance of considering vascular factors in vertigo evaluation.

Conclusion: These findings underscore the importance of tailored diagnostic approaches and comprehensive assessment in patients with vertigo, emphasizing the role of vertebral artery Doppler examination, particularly in specific patient subgroups. Over 60-year-old patients with vertigo are likely to have hemodynamically important vertebral artery atherosclerotic lesions and clinicians should keep this information in mind during daily practice. Understanding the necessity of this adjunctive diagnostic tool can aid in timely diagnosis and management, potentially reducing healthcare costs and optimizing patient outcomes. However, this examination may not be necessary in 90% of vertigo patients.

Keywords: Dizziness, Doppler USG, elder patients, vertebral artery, vertigo

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INTRODUCTION

Vertigo is a common complaint encountered in clinical practice, often presenting diagnostic challenges due to their diverse etiologies. It is characterized by a sensation of spinning or movement, often described as feeling like the person or their surroundings are spinning or tilting when they are not (1,2). Vertigo is a common presenting complaint in primary care and emergency departments. It can be caused by inner ear problems, such as benign paroxysmal positional vertigo (BPPV), vestibular neuritis, Meniere's disease, or labyrinthitis. Dizziness is a broader term that refers to a range of sensations, including lightheadedness, feeling faint, unsteadiness, or a general sense of imbalance (1,2). It can have various causes, including inner ear problems, dehydration, low blood pressure, medication side effects, anxiety, or neurological conditions (3–6). In neurological practice, complaints of dizziness, vertigo, and imbalance are commonly encountered, often presenting diagnostic challenges (7). These symptoms can arise from various underlying neurological, vestibular, or systemic conditions, making accurate diagnosis and appropriate treatment crucial but sometimes difficult to achieve promptly.

Highlights

- **VA Doppler examination is needed particularly in specific patient subgroups.**
- **Vertigo patients over 60 often have significant VA atherosclerotic lesions**
- **Vertebral artery Doppler examination is in the normal range in 90% of vertigo patients.**

The diagnostic process for dizziness and vertigo typically involves a comprehensive neurological examination, including assessment of cranial nerve function, gait and balance evaluation, and vestibular function testing (3). However, in cases where the etiology remains

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unclear, additional tests may be necessary, such as imaging studies (e.g., brain MRI), vestibular function tests (e.g., videonystagmography), and vascular assessments (e.g., vertebral artery Doppler examination). These tests may delay the confirmation of diagnosis and initiation of appropriate treatment. This delay not only prolongs patient discomfort and disability but also leads to significant economic implications, including loss of workload and increased healthcare costs (4). The use of vertebral artery Doppler examination in patients with vertigo serves as a valuable adjunctive tool in the diagnostic process, particularly in cases where vascular insufficiency or abnormalities are suspected (8–11). By evaluating blood flow in the vertebral arteries, this non-invasive test can provide insights into potential vascular causes of vertigo, such as vertebrobasilar atherosclerosis or vertebral artery dissection (12). Incorporating such vascular assessments into the diagnostic algorithm can help streamline the evaluation process, improve diagnostic accuracy, and facilitate the timely initiation of appropriate treatments tailored to the underlying etiology. Therefore, the aim of this study is to find out the necessity of vertebral artery Doppler examination in patients with vertigo.

METHODS

1021 patients who applied to the neurology outpatient clinic of Numune Training and Research Hospital between April 2013 and May 2014 with complaints of dizziness/vertigo were included in this study. This retrospective study was approved by the Ethical Committee of our hospital (TABED 1-24-155). The patient's medical history was investigated from their medical files retrospectively.

Vertebral artery ultrasound/Doppler examinations were performed by an experienced neurosonology specialist. A high-resolution (Toshiba Xario Model SSA-660A, Japan) ultrasonography device and a 7.5 MHz linear probe were used for the measurements in the study. After making depth and gain adjustments, vertebral artery ultrasonography and Doppler examination were adjusted. The segments of vertebral arteries including V2 (in every patient), V1 (in most patients), and V0 (in detectable patients) were visualized.

The data were given as mean ± SD and were put into analysis on the IBM Statistical Package for Social Sciences (SPSS) version 23.0 package program for statistical analyses. For all the tests, values under the p-value of 0.05 were accepted as statistically significant. Statistical numeric data were rounded off to have a single digit after the decimal point. Descriptive statistics, chi-square test, and for group comparisons independent sample tests were used for the evaluation of the data.

RESULTS

The study analyzed a cohort of patients with a mean age of 59.4 years, ranging from 18 to 91 years old. Among the patients, the majority consisted of 647 individuals (63.3%) who were female. The chi-square test analysis showed a statistically significant difference between the ratios of males and females ($p<0.05$).

Regarding the vertebral artery evaluations, the examination of the right vertebral artery in 30 patients and the left vertebral artery in 38 patients couldn't be completed for unspecified reasons. However, in the remaining patients, the right vertebral artery of 932 individuals and the left vertebral artery of 922 individuals were assessed for atherosclerosis, which involves the narrowing of arteries due to plaque buildup. Remarkably, these assessments revealed that the vast majority of patients, 932 (about 91.0%) for the right vertebral artery and 922 (90.1%) for the left vertebral artery, had no evidence of atherosclerotic lesions, indicating that their vertebral arteries were free from significant stenosis (narrowing) ($p<0.05$).

Hemodynamically significant vertebral artery pathology was observed in only 52 of 1021 (5.1%) patients complaining of vertigo. The atherosclerotic lesion was detected only in the right vertebral artery in 15 of them, only in the left vertebral artery in 13 patients, and in both the right and left vertebral arteries in 24 patients. The mean age of these 52 patients was 72.2±10.9 which was significantly higher than the average of the cohort of this study. Interestingly, the female/male ratio of these patients was also different from the original cohort of the study. Among 1021 patients, female vertigo patients were 63.3%, and in the atherosclerotic lesion group 59.6% of patients were male ($p<0.05$).

Furthermore, when anatomical variations were examined, particularly regarding the entry point into the bony canal, notable findings were observed. In 49 cases involving the right vertebral artery, and 51 cases involving the left vertebral artery, entry from the upper segment of the bony canal was noted. Additionally, varying degrees of tortuosity, which refers to twists or bends in the course of the artery, along with other rare anatomical variations, were identified in some of the ultrasound examinations.

Overall, these findings provide valuable insights into the prevalence of atherosclerosis and anatomical variations in the vertebral arteries among patients presenting with complaints of dizziness, shedding light on potential contributing factors to their symptoms and guiding further diagnostic and therapeutic interventions.

DISCUSSION

The findings of the study regarding the prevalence of atherosclerosis and anatomical variations in the vertebral arteries among patients with complaints of vertigo align with existing literature in several key aspects. First of all, this study revealed that a significant proportion of patients, approximately 90%, had no evidence of atherosclerotic lesions in their vertebral arteries. This finding is consistent with previous research indicating that atherosclerosis of the vertebral arteries is not as common as in other arterial territories, such as the carotid arteries (13). However, atherosclerosis remains an important consideration in the evaluation of patients with vertigo, particularly in older populations or those with risk factors such as hypertension, diabetes, or smoking. Thus, in this study, the rate of significant vertebral artery atherosclerotic lesions in elder male patients was higher. This data is in accordance with the literature indicating the higher incidence of atherosclerosis in older male people (14).

The data showing the anatomical variations in the vertebral arteries, such as entry from the upper segment of the bony canal and tortuosity, corroborates with existing knowledge regarding the variability in vertebral artery anatomy (11). Anatomical variations can have clinical significance, as they may predispose individuals to hemodynamic changes or complicate vascular interventions. Understanding these variations is essential for the accurate interpretation of imaging studies and for planning appropriate treatment strategies.

The study underscores the importance of considering vascular factors, such as atherosclerosis and anatomical variations, in the evaluation of patients with vertigo. Clinicians should maintain a high index of suspicion for vascular pathology, particularly in older individuals or those with cardiovascular risk factors (15,16). Comprehensive assessment, including vascular imaging studies like vertebral artery Doppler examination, can aid in identifying contributing factors to vertigo and guiding appropriate management strategies, which may include lifestyle modifications, pharmacotherapy, or vascular interventions.

Another important point is the interchangeable use of vertigo and dizziness which represent distinct sensations. Dizziness is a broader term that refers to a range of sensations, including lightheadedness, feeling faint, unsteadiness, or a general sense of imbalance (1). It can have various causes, including inner ear problems, dehydration, low blood pressure, medication side effects, anxiety, or neurological conditions (2). At this point, it is very important for a clinician to understand the patient's exact complaint.

In summary, vertebral artery USG-Doppler examination of vertigo/dizziness patients was found to be normal in 90% of the patients in our study. The findings of the study contribute to our understanding of the selective necessity of vertebral artery ultrasound-Doppler examination. This study's results emphasize that this test may be crucial only for older male patients with cardiovascular risk factors and co-morbid chronic diseases. Besides, this study also highlights the importance of detailed anamnesis and neurological examination. In this way, medical costs and time loss can be prevented in outpatient clinics. This study's results may also contribute to the designing of a diagnostic approach algorithm for this common patient group.

Ethics Committee Approval: This retrospective study was approved by the Ethical Committee of Numune Training and Research Hospital (TABED 1-24-155).

Informed Consent: All patients signed the informed consent form.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept- OK; Design- OK; Supervision- OK; Resource- OK; Data Collection and/or Processing- OK; Analysis and/or Interpretation- OK, HK; Literature Search- OK, HK; Writing- OK, HK; Critical Reviews- OK, HK.

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