

VERTIGO AND DIZZINESS IN ANTERIOR CIRCULATION CEREBROVASCULAR DISEASE : SYSTEMATIC REVIEW

Agnes Annurul Maulidia^{1*}, Anni Rota Rimbun Silitonga²

¹Faculty of Medicine, Bandung Islamic University, Indonesia

²Cibabat General Hospital, Indonesia

***Corresponding Author:**
maulidiaagnes@gmail.com

Abstract

Introduction: Recurrent spontaneous vertigo/dizziness episodes may manifest as fleeting occurrences. It is uncommon for vascular vertigo to cause an isolated positional vestibular condition, also known as recurrent positional vertigo or disorientation. The anteriormost boundary of the structure is the solitary anterior communicating artery (ACom), which connects the ring to the bilateral anterior cerebral arteries (ACA).

The aim: This article explore about vertigo and dizziness in anterior circulation cerebrovascular disease.

Methods: By comparing itself to the standards set by the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. So, the experts were able to make sure that the study was as up-to-date as it was possible to be. For this search approach, publications that came out between 2013 and 2023 were taken into account. Several different online reference sources, like Pubmed and SagePub, were used to do this. It was decided not to take into account review pieces, works that had already been published, or works that were only half done.

Result: In the PubMed database, the results of our search brought up 12 articles, whereas the results of our search on SagePub brought up 6 articles. The results of the search conducted for the last year of 2013 yielded a total 7 articles for PubMed and 2 articles for SagePub. In the end, we compiled a total of five papers, 4 of which came from PubMed and one of which came from SagePub. We included three research that met the criteria.

Conclusion: Previous research has linked the findings of vertigo with disturbances in the cerebral arteries, especially when accompanied by complaints of hearing loss, balance disturbances, and limb weakness.

Keyword: Anterior Circulation Cerebrovascular Disease; Dizziness; Vertigo

INTRODUCTION

Vertigo is a sensation in which a person feels the environment rotates relative to oneself (objective vertigo) or vice versa (subjective vertigo). Vertigo is described as a sensation of spinning in or around the patient, and is often of vestibular origin.¹ Peripheral vertigo is vertigo caused by abnormalities in the labyrinth and N. Vestibularis. Vertigo is a symptom that is often found with a prevalence of 7%. Several studies have attempted to investigate the epidemiology of balance disorders including vertigo and nonvestibular dizziness.²

Dizziness is the most frequent complaint expressed by patients, which is equal to 20-30% of the general population. Of the four types of dizziness, vertigo is the most common, which is around 54%. In one study, vertigo was found to be more common in women than men (2:1), about 88% of patients had recurrent episodes. One of the most typical signs of a stroke affecting the posterior circulation is a feeling of vertigo or dizziness. Its onset is often sudden, and it can either last for a long time (more than 24 hours, acute protracted vertigo/dizziness) or only last for a short time (less than 24 hours, transitory vertigo/dizziness).³⁻⁵

Episodes of recurrent spontaneous vertigo/dizziness may manifest as transient occurrences. The occurrence of an isolated positional vestibular condition, often known as recurrent positional vertigo or dizziness, resulting from vascular vertigo, is infrequent. Vertigo or vertigo observed in cerebrovascular illnesses is typically accompanied by concurrent neurological symptoms and indications.^{5,6} As a result, there is now a general agreement among experts that strokes affecting the brainstem or cerebellum might manifest as discrete symptoms of vertigo, dizziness, or imbalance. Transient vertigo or dizziness is a frequently observed symptom of vertebrobasilar ischemia and may sometimes occur in isolation.^{4,6,7}

The circle of Willis is a network of blood arteries that forms a ring around the brain and connects the anterior and posterior circulations. The ring is connected to the bilateral anterior cerebral arteries (ACA) via a single anterior communicating artery (ACom), which serves as the anteriormost boundary of the structure. The ACAs run posterolaterally until they reach their lateral-most junction to the ICA, which travels cephalically through the neck and into the brain. After that, the ACAs continue forward into the brain.^{8,9}

Labyrinthine artery ischemia generally causes vertigo and one-sided hearing loss on the same side as the stroke. This is called the AICA stroke syndrome. Large strokes cause weakness and unsteadiness on the same side of the face. It is the second most common type of stroke in the brainstem, after PICA. It happens about 10% of the time as PICA. Most of the time, hearing loss is caused by AICA area strokes, which are brainstem strokes. This is because the main artery that brings blood to the inner ear, the internal auditory artery (IAA), usually starts in the AICA. Even though the more common PICA area strokes can cause dizziness, they rarely cause hearing loss.³

This article investigates about vertigo and dizziness in anterior circulation cerebrovascular disease.

METHODS

The author of this study verified that it adhered to the standards by adhering to Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines. This is done to ensure that the investigation's findings are accurate. This literature review was conducted to investigate about vertigo and dizziness in anterior circulation cerebrovascular disease. As the primary purpose of this paper, the relevance of the identified challenges will be emphasized throughout.

To participate in the investigation, researchers had to meet the following requirements: 1) The paper must be written in English and investigate about vertigo and dizziness in anterior circulation cerebrovascular disease. For the manuscript to be considered for publication, it must satisfy both of these requirements. 2) A number of the articles examined were published after 2010, but prior to the time period deemed pertinent by this systematic review. Editorials, submissions without a DOI, previously published review articles, and entries essentially identical to previously published journal articles are not permitted.

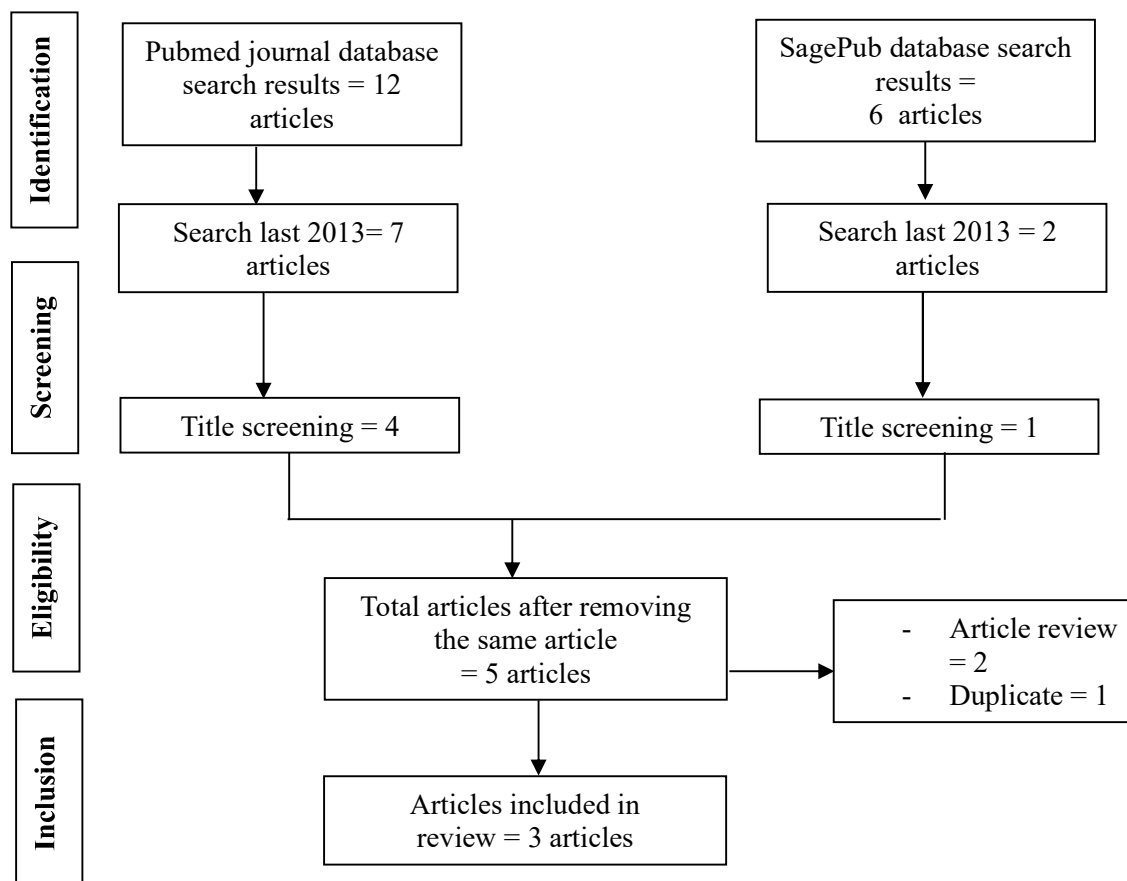


Figure 1. Article search flowchart

We used “vertigo”; “dizziness”; and “anterior circulation cerebrovascular disease” as keywords. The search for studies to be included in the systematic review was carried out from August, 17th 2023 using the PubMed and SagePub databases by inputting the words: (“*vertigo*”[MeSH Terms] OR “*vertigo*”[All Fields] OR “*vertigos*”[All Fields] OR “*vertigoes*”[All Fields]) AND (“*dizziness*”[MeSH Terms] OR “*dizziness*”[All Fields] OR “*dizzy*”[All Fields] OR “*vertigo*”[MeSH Terms] OR “*vertigo*”[All Fields]) AND (“*anterior*”[All Fields] OR “*anteriores*”[All Fields] OR “*anteriorization*”[All Fields] OR “*anteriorized*”[All Fields] OR “*anteriors*”[All Fields]) AND (“*cerebrovascular circulation*”[MeSH Terms] OR “*cerebrovascular*”[All Fields] AND “*circulation*”[All Fields]) OR “*cerebrovascular circulation*”[All Fields] OR “*circulation*”[All Fields] AND “*cerebrovascular*”[All Fields]) OR “*circulation cerebrovascular*”[All Fields] AND (“*disease*”[MeSH Terms] OR “*disease*”[All Fields] OR “*diseases*”[All Fields] OR “*disease s*”[All Fields] OR “*diseased*”[All Fields]) used in searching the literature.

The authors examined the abstract and title of each study to determine whether or not it met the inclusion criteria. The authors then determined which previous studies would serve as sources for the article and chose those studies. This conclusion was reached after analyzing numerous studies that all appeared to indicate the same trend. All submissions must be written in English and must be previously unpublished. For the systematic review, only publications meeting all inclusion criteria were considered.

This narrows the search results to only those that are pertinent to your search. We disregard the findings of any study that does not meet our criteria. The research findings will then be analyzed in depth. The research conducted for this study revealed the following information: names, authors, publication dates, location, study activities, and parameters. Each author conducted independent research on the research included in the publication's title and abstract prior to deciding which publications to investigate further.

The next stage is to evaluate all of the articles that meet the review's inclusion criteria. Then, based on the findings, we will choose which articles to include in the review. This criterion is used to select documents for further analysis. To facilitate the selection of papers for evaluation as much as feasible. This section discusses the prior studies conducted and the aspects of those studies that made their inclusion in the review appropriate.

RESULT

In the PubMed database, the results of our search brought up 12 articles, whereas the results of our search on SagePub brought up 6 articles. The results of the search conducted for the last year of 2013 yielded a total 7 articles for PubMed

and 2 articles for SagePub. In the end, we compiled a total of five papers, 6 of which came from PubMed and one of which came from SagePub. We included three research that met the criteria.

Sankalia, et al (2021)¹⁰ showed HINTS battery was found to be more accurate than the first MRI of the brain done in the first 24 hours (97.1% vs. 82.9%). The first MRI of the brain and the HINTS battery both had a 100% specificity, while the HINTS battery only had an 80% specificity. 33 of the 35 people who had a stroke had normal h-HIT. Two anterior inferior cerebellar artery (AICA) infarcts had abnormal h-HIT. All of the people who had VN had abnormal h-HIT, but all of the people who had VM had normal h-HIT. Everyone who had a positive skew departure was told they had a stroke. All of the people with VN and VM did not have skew deviation.

Final diagnoses for people with unidirectional nystagmus were very different (P = 0.001) from each other. All of the people with VN had nystagmus in only one way. Six people who had a stroke and one person with VM also had nystagmus that moved in only one way. Stroke happened to a significantly higher number of people with nystagmus that changed direction (P = 0.001). Out of the 35 stroke patients, 19 (54.3%) had nystagmus that changed direction. One person with nystagmus that changed direction was found to have VM. No one with VN was found to have nystagmus that changed direction.¹⁰

Table 1. The literature include in this study

Author	Origin	Method	Sample Size	Result
Sankalia, 2021 ¹⁰	India	Cross sectional study	Seventy-five patients	The sensitivity of the HINTS battery in identifying stroke during the first 24 hours in patients with acute-onset first episode of spontaneous vertigo was found to be higher compared to the initial MRI of the brain.
Zuo, 2018 ¹¹	China	Retrospective cohort study	87 adult patients with HSE	Acute isolated vertigo or dizziness was diagnosed as acute cerebral infarction in 16.8% of patients who presented with these symptoms. Both an elevated neuron-specific enolase level in the serum and anomalies in the vertebral artery were the most reliable indications of an acute cerebral infarction.
Brevern, 2014 ¹²	Germany	Case report	One patient	Patients who experience an acute vestibular syndrome as a result of a cortical stroke commonly exhibit impairment in the temporoparietal junction.

Zuo, et al (2018)¹¹ showed out of the total sample size of 46 individuals diagnosed with acute cerebral infarction, seven patients exhibited progression of the condition, leading to a National Institutes of Health Stroke Scale (NIHSS) score of 1 or higher within a 24-hour period. The mean duration from emergency department (ED) arrival to the onset of worsening was 5 hours. A total of 10 patients exhibited acute infarction in two or more areas. The study observed that 42 individuals exhibited lesions in the posterior circulation, affecting various regions such as the cerebellum (n = 25), thalamus (n = 9), occipital lobe (n = 8), and brainstem (n = 7). A total of four patients presented with infarctions in the anterior circulation zone, specifically affecting the frontal lobe, corpus callosum, and centrum semiovale.

Vertigo is an infrequent manifestation of acute brain lesions. In Brevern case study, they discuss the clinical findings of a 51-year-old individual who exhibited symptoms of an acute vestibular syndrome. These symptoms included spontaneous vertigo and nystagmus, as well as lateropulsion and nausea. The underlying cause of these symptoms was determined to be a middle cerebral artery infarction. The normal head impulse test unveiled the primary etiology of the acute vestibular condition. This paper presents a thorough examination of the existing literature pertaining to individuals who have experienced hemispheric stroke and subsequently developed acute vertigo.¹²

DISCUSSION

Differentiating between strokes in patients with acute dizziness/vertigo is a significant challenge, particularly in cases when there are no apparent accompanying symptoms or indicators of central nervous system involvement. Despite the advancements in imaging technology that have occurred over the course of several decades, a notable number of acute strokes may elude detection on imaging, particularly in the acute phase or when the lesions are of a small size. Therefore, it is more likely for mild strokes that result in isolated dizziness or vertigo to be misdiagnosed in the emergency department.³

Despite the existence of many diagnostic criteria for acute vascular vertigo, there is a need for more comprehensive and sophisticated approaches that can effectively address temporary vestibular symptoms resulting from vascular impairment.³

Among the members of Zuo, et al (2018) cohort, a significant majority of acute cerebral infarctions, specifically 91%, were observed in the posterior circulation, with the cerebellum being the most frequently affected region.¹¹ Additionally, our study identified four individuals who exhibited infarction in the anterior circulation. In these instances, it is hypothesized that the lesions impact the multimodal vestibular cortical networks that are responsible for perceptual functions.¹²

These networks include the thalamus, temporoparietal cortex, and the region next to the inferior frontal gyrus. Differences were seen between the cerebral infarction group and the noncerebral infarction group in terms of smoking history, headache, and unsteadiness. There was no observed association between acute cerebral infarction and other vascular risk factors, such as atrial fibrillation. A recent study revealed that individuals diagnosed with vertigo exhibited a statistically significant 3.01-fold increased likelihood of experiencing a stroke compared to the control group. According to Lee et al. (2011)¹³, individuals who exhibited more than three risk indicators experienced a significantly elevated risk for stroke, with a 5.51-fold increase in risk.

The findings pertaining to patients exhibiting vascular risk factors in this article diverged notably from those observed in our investigation, likely attributable to dissimilarities in research priorities and criteria for participant inclusion. In contrast to the anterior circulation, it has been observed that posterior circulation infarction is frequently associated with headache.¹⁴ This headache may manifest as either widespread or confined to the occipital scalp. Lee et al. (2006)¹⁵ discovered in their research that a significant proportion of individuals suffering from vertigo caused by cerebellar infarction had concurrent symptoms of imbalance.

Cerebellar ischemic stroke is a frequently encountered etiology of vascular vertigo. Typically, the presence of additional neurological symptoms or indications is observed in conjunction with a minor infarct in the cerebellum. However, it is possible for vertigo to manifest as the sole presenting symptom without any accompanying localizing symptoms.¹⁶ Around 11% of patients diagnosed with isolated cerebellar infarction exhibited symptoms resembling acute peripheral vestibulopathy. The majority of these patients experienced an infarct in the region supplied by the medial branch of the posterior inferior cerebellar artery (PICA).¹⁷

The utilization of a head impulse test enables the distinction between acute isolated vertigo linked to cerebellar infarction within the posterior inferior cerebellar artery (PICA) zone and less severe conditions affecting the inner ear. Acute hearing loss (AHL) resulting from a vascular etiology is primarily linked to cerebellar infarction within the anterior inferior cerebellar artery (AICA) territory. However, it is worth noting that AHL is seldom observed in cases of cerebellar infarction within the territory of the posterior inferior cerebellar artery (PICA).^{15,18}

Currently, there have been the identification of at least eight subgroups of AICA territorial infarction based on the neurotological manifestations. Among these subgroups, the most prevalent pattern of audiovestibular dysfunction is characterized by the simultaneous loss of auditory and vestibular functioning. Occasionally, the manifestation of acute solitary audiovestibular loss may serve as the early indication of an imminent posterior circulation ischemic stroke, namely within the area of the anterior inferior cerebellar artery (AICA).^{7,18}

The long-term prognosis of audiovestibular impairment resulting from cerebellar infarction is more favorable than previously believed. Roughly 50% of individuals diagnosed with cerebellar infarction in the superior cerebellar artery area (SCA) exhibit genuine vertigo, indicating a higher prevalence of vertigo and nystagmus in SCA territory cerebellar infarctions than previously believed. This article provides a summary of recent research findings pertaining to the clinical characteristics of vertigo and hearing loss associated with cerebellar ischemic stroke syndrome.^{17,18}

CONCLUSION

Previous research has linked the findings of vertigo with disturbances in the cerebral arteries, especially when accompanied by complaints of hearing loss, balance disturbances, and limb weakness.

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