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Analysis of the Relationship between Symptoms, Clinical Diagnosis, and Findings of CT-Scan Images to Pictures of Vertebrobasilar Artery Insufficiency

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Abstract

Vertebrobasilar artery insufficiency (VBI) occurs when the blood flow to the posterior circulation of the brain, supplied by the vertebral arteries, becomes inadequate. Frequently, VBI is detected accidentally through CT-Scan in patients who do not show symptoms directly related to this condition. This study highlights the importance of comprehensive evaluation and early screening to improve VBI management. The main objective of this research is to analyze the relationship between clinical symptoms, clinical diagnosis, and CT-Scan findings to enhance diagnostic accuracy and develop more effective treatment strategies. A cross-sectional design was used in this study, with samples obtained from the medical records of patients diagnosed with Vertebrobasilar Artery Insufficiency at Bethesda Hospital Yogyakarta between January and April 2023. The data were analyzed using the chi-square test and processed with SPSS software. The patient population was dominated by elderly individuals (73%) and males (60.5%), although these differences were not statistically significant.The findings suggest that VBI symptoms vary based on age, with older patients more likely to exhibit stroke and hemiparesis, while younger patients typically experience headaches and vertigo. Screening for risk factors like cholesterol and blood sugar levels is crucial for patients over 45, whereas younger patients may require additional tests to assess cardiometabolic or hypercoagulation risks. Early detection through age-appropriate screening is vital for preventing serious complications and improving patient outcomes. These findings imply that systematic screening can help identify undiagnosed VBI cases, allowing for timely and more effective medical intervention.

Keywords: CT-Scan, Vertebrobasilar Insufficiency, Radiology, Stroke.

INTRODUCTION

Vertebrobasilar artery insufficiency (VBI) is a condition that occurs when there is insufficient blood flow in the posterior circulation of the brain, where this area is supplied by two vertebral arteries that join to form the basilar artery (McGuire & Charbel, 2024). This posterior circulation plays an important role in providing blood supply to brain areas such as the brainstem, thalamus, hippocampus, cerebellum, occipital lobe, and medial temporal lobe (Chandra et al., 2017). When there is a disruption in blood flow in the vertebrobasilar artery, a variety of nonspecific neurological symptoms can arise, making early diagnosis often challenging. The resulting symptoms often resemble other conditions, such as dizziness, vertigo, double vision, dysphagia and hearing loss (Chari &

Rauch, 2021). These symptoms result from ischemia in areas of the brain that receive blood supply from the posterior circulation.

In a global context, VBI is one of the most important causes of neurological disorders related to blood circulation in the brain (BAB, 2018). Although the exact prevalence is difficult to determine due to frequent delays or misdiagnosis, VBI is reported to affect the elderly population with a high risk of ischemic stroke (Lima et al., 2017). Posterior circulation disorders account for about 20% of total ischemic stroke cases (Atmadja et al., 2021), so prevention and early detection efforts are needed to reduce stroke-related mortality and complications. Often, VBI is diagnosed in patients who initially complain of symptoms that are not directly related to cerebral circulation disorders, such as migraine or vestibular disorders (Widiastuti et al., 2022). Therefore, it is important to map symptom patterns and clinical findings to facilitate faster and more accurate diagnosis (Britz et al., 2016).

Specifically, a problem encountered in VBI-related research is the difficulty in correlating presenting clinical symptoms with diagnostic findings, especially through CT-Scan imaging (Cesur et al., 2023). Although brain imaging such as CT-Scan is often used to detect abnormalities in the posterior circulation, many cases of VBI are only discovered incidentally (Chmutin et al., 2022). In addition, there is no clear pattern in associating clinical symptoms with imaging results. This creates obstacles in the process of diagnosis and appropriate treatment. Thus, in-depth studies on the relationship between clinical symptoms, diagnosis, and CT-Scan findings are needed to improve the accuracy of diagnosis.

Several previous studies have addressed VBI, but most have focused on general symptoms without specifically examining the relationship between clinical and radiological findings. Research by (Casani et al., 2021) highlighted that most patients with symptoms of vertigo and balance disorders are often diagnosed late due to the absence of typical symptoms in the early stages of VBI. (Chmutin et al., 2022) also pointed out the importance of multidisciplinary diagnosis to manage patients with VBI, especially by using CT-Scan as the main diagnostic tool in determining the severity and location of ischemia. However, studies linking CT-Scan findings directly to symptoms and clinical diagnosis are still very limited, leading to difficulties in creating more effective treatment protocols.

The urgency of this study is driven by the increasing prevalence of cardiovascular disease and stroke risk in the elderly population, which makes VBI one of the global health problems that needs more attention. In addition, the complexity of VBI symptoms that often overlap with other neurological conditions makes this study important in developing a more precise diagnostic approach. Failure to detect VBI can lead to inappropriate treatment, which ultimately worsens the patient's condition.

This study has the novelty of combining clinical and radiological data to analyze the relationship between symptoms, clinical diagnosis, and CT-Scan findings in patients with suspected VBI. Although various previous studies have highlighted the importance of a multidisciplinary approach in the diagnosis of VBI, this study will make a further contribution by exploring specific patterns of clinical symptoms and imaging results that may be associated with impaired posterior circulation. As such, this study may provide new insights into how CT-Scan imaging can be used to detect VBI earlier and more accurately.

This study aims to analyze the relationship between clinical symptoms, clinical diagnosis, and CT-Scan findings with images of vertebrobasilar artery insufficiency in patients. By combining clinical and radiological data, this study aims to generate a deeper understanding of VBI and contribute to the development of more effective diagnostic and therapeutic strategies. The benefits of this study include providing guidance for medical

practitioners, especially in the fields of neurology, radiology, and vascular surgery, in better diagnosing and managing VBI. The findings of this study are expected to strengthen the scientific evidence supporting the importance of using CT-Scan in detecting vertebrobasilar artery insufficiency and guide the development of more comprehensive clinical protocols. Overall, this study also has significant implications in reducing the morbidity and mortality rates associated with VBI, particularly by improving early detection and appropriate treatment. As such, this study is expected to contribute to improving the quality of life of patients with posterior cerebral circulation disorders.

RESEARCH METHOD

The research method is quantitative with a cross-sectional design, using secondary data in the form of medical records of patients with Vertebrobasilar Artery Insufficiency (VBI) at Bethesda Hospital Yogyakarta. The target population of this study is patients with VBI. The research sample was taken from the medical records of VBI patients from January to March 2023. The inclusion criteria were all patients with VBI who were treated at Bethesda Hospital and had complete medical record data and radiological images. Exclusion criteria include patients with incomplete medical record data. The variables in this study are divided into independent variables and dependent variables. The independent variables included age, sex, other radiological findings, clinical diagnosis, and symptoms, while the dependent variables were VBI radiological findings. Age is categorized in the operational definition as children (< 25 years), young adults (< 45 years), old adults (<= 55 years), and the elderly (> 55 years). The gender is classified into male and female. Other radiological findings include atrophy, infarction, CVA, SOP/SOL, SNH, SH, and others, while clinical diagnosis is established before CT-Scan examination. Symptoms are categorized into vestibular symptoms, stroke symptoms, a combination of vestibular and stroke symptoms, and non-vestibular non-stroke symptoms. VBI radiological findings refer to all radiological findings with increased HU or other abnormalities in the vertebrobasilar artery.

The sampling technique used is total sampling, where all samples that meet the inclusion and exclusion criteria are included to ensure that the collected samples represent the VBI population. The researcher applied a probabilistic sampling technique with an overall sample method in this study. The study collected data from VBI patients undergoing therapy, focusing on age, gender, clinical diagnosis, and radiological findings. Data analysis was carried out using SPSS. Data analysis was done using simple and multiple linear regression analysis methods, with a significance level of $p < 0.05$. The data collected is used exclusively for research purposes, and the research is conducted after obtaining ethical approval from the Bethesda Hospital Health Research Ethics Committee.

RESULT AND DISCUSSION

Frequency Data Analysis and Pearson Chi-Square Test

Table 1. Relationship between Clinical Variables and Radiologic Findings in Patients with Vertebrobasilar Artery Insufficiency (VBI)

Variable	Radiological Findings (VBI)						Total		Result
	V		B		VB				
	n	%	n	%	n	%	n	%	p
Age									0.110
Children	3	5.3%	4	2.6%	9	4.3%	16	3.8%	
Young adults	5	8.8%	11	7.2%	19	9.1%	35	8.4%	
Older adults	6	10.5%	32	21.1%	23	11.1%	62	14.8%	
Elderly	43	75.4%	105	69.1%	157	75.5%	305	73.0%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Gender									0.059
Woman	30	52.6%	52	34.2%	82	39.4%	165	39.5%	
Man	27	47.4%	100	65.8%	126	60.6%	253	60.5%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Atrophy									0.632
Not	46	80.7%	113	74.3%	152	73.1%	312	74.6%	
Yes	11	19.3%	39	25.7%	56	26.9%	106	25.4%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Infarction									0.285
Not	24	42.1%	63	41.4%	72	34.6%	160	38.3%	
Yes	33	57.9%	89	58.6%	136	65.4%	258	61.7%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
CVA									0.886
Not	50	87.7%	136	89.5%	181	87.0%	368	88.0%	
Yes	7	12.3%	16	10.5%	27	13.0%	50	12.0%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
SOP/ SOL									0.468
Not	57	100.0%	146	96.1%	199	95.7%	403	96.4%	
Yes	0	0.0%	6	3.9%	9	4.3%	15	3.6%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
SNH									0.293
Not	56	98.2%	143	94.1%	190	91.3%	390	93.3%	
Yes	1	1.8%	9	5.9%	18	8.7%	28	6.7%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
SH									**0.003**
Not	51	89.5%	142	93.4%	195	93.8%	388	92.8%	
Yes	6	10.5%	10	6.6%	13	6.3%	30	7.2%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Vest									0.543
Not	51	89.5%	127	83.6%	170	81.7%	349	83.5%	
Yes	6	10.5%	25	16.4%	38	18.3%	69	16.5%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	

Variable	Radiological Findings (VBI)						Total		Result
	V		B		VB				
	n	%	n	%	n	%	n	%	p
Stroke									0.743
Not	29	50.9%	83	54.6%	108	51.9%	221	52.9%	
Yes	28	49.1%	69	45.4%	100	48.1%	197	47.1%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Both									**0.000**
Not	54	94.7%	144	94.7%	200	96.2%	398	95.2%	
Yes	3	5.3%	8	5.3%	8	3.8%	20	4.8%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	
Non									0.667
Not	37	64.9%	106	69.7%	150	72.1%	294	70.3%	
Yes	20	35.1%	46	30.3%	58	27.9%	124	29.7%	
Total	57	100.0%	152	100.0%	208	100.0%	418	100.0%	

Information:

1.	VBI	:	Obstructive Vertebrobasillaris Artery
2.	V	:	Vertebral Artery
3.	B	:	Basillaris artery
4.	VB	:	Vertebrobasillaris Artery
5.	CVA	:	Cerebrovascular Accident
6.	SOP/SOL	:	Space Occupying Lesion / Space Occupying Lesion
7.	SNH	:	Non-Hemorrhagic Stroke
8.	SH	:	Stroke Hemorrhagic
9.	Vest	:	Vestibular Symptoms (dizziness and nausea/vomiting)
10.	Stroke	:	Stroke Symptoms (hemiplegi and nausea/vomiting)
11.	Both	:	Vestibular and Stroke Symptoms
12.	Non	:	Not Vestibular and Stroke Symptoms

Based on the data of the Radiology Findings table, it was found:

1. Age

   The most common age distribution of patients is the elderly group, with a percentage of 73% of the total patients. The percentage of other age groups was smaller: adolescents (3.8%), young adults (8.4%), and older adults (14.8%). There was no statistically significant difference between age groups (p = 0.110). The results of the analysis relate to V, B and VB:

   a. Children: V (5.3%), B (2.6%), VB (4.3%)
   b. Young adults: V (8.8%), B (7.2%), VB (9.1%)
   c. Older adults: V (10.5%), B (21.1%), VB (11.1%)
   d. Elderly: V (75.4%), B (69.1%), VB (75.5%)

   The elderly dominated in all categories with a statistically insignificant difference (p = 0.110).

2. Gender
   Male patients were found more (60.5%) than female patients (39.5%). Although there was a difference, it was not statistically significant (p = 0.059). The results of the analysis relate to V, B and VB:
   a. Female (P): V (52.6%), B (34.2%), VB (39.4%)
   b. Male (L): V (47.4%), B (65.8%), VB (60.6%)
   Male patients were more dominant in categories B and VB, while women were more numerous in category V. This difference was not statistically significant (p = 0.059).
3. Atrophy
   Most patients did not experience atrophy (74.6%), while those who experienced atrophy were 25.4%. This difference was not statistically significant (p = 0.632). The results of the analysis relate to V, B and VB:
   a. No (N): V (80.7%), B (74.3%), VB (73.1%)
   b. Yes: V (19.3%), B (25.7%), VB (26.9%)
   The majority of patients did not experience atrophy in all categories with a statistically insignificant difference (p = 0.632).
4. Infarction
   More patients had infarction (61.7%) than those who did not (38.3%). However, this difference was not statistically significant (p = 0.285). The results of the analysis relate to V, B and VB:
   a. No (N): V (42.1%), B (41.4%), VB (34.6%)
   b. Yes: V (57.9%), B (58.6%), VB (65.4%)
   More patients had infarction in all categories with a statistically insignificant difference (p = 0.285).
5. Cerebrovascular Accident
   Most patients do not experience CVA (88%), while those who do experience CVA is 12%. This difference was not statistically significant (p = 0.886). The results of the analysis relate to V, B and VB:
   a. No (N): V (87.7%), B (89.5%), VB (87.0%)
   b. Yes: V (12.3%), B (10.5%), VB (13.0%)
   Most patients did not develop CVA in all categories with a statistically insignificant difference (p = 0.886).
6. Space Occupying Lesion / Space Occupying Lesion
   Most patients did not experience SOP/SOL (96.4%), while those who experienced it was 3.6%. This difference was not statistically significant (p = 0.468). The results of the analysis relate to V, B and VB:
   a. No (N): V (100.0%), B (96.1%), VB (95.7%)
   b. Yes: V (0.0%), B (3.9%), VB (4.3%)
   The majority of patients did not experience SOP/SOL in all categories with a statistically insignificant difference (p = 0.468).

7. SNH

   Most patients did not experience SNH (93.3%), while those who experienced it was 6.7%. This difference was not statistically significant (p = 0.293). The results of the analysis relate to V, B and VB:

   a. No (N): V (98.2%), B (94.1%), VB (91.3%)
   b. Yes: V (1.8%), B (5.9%), VB (8.7%)

   Most patients did not experience SNH in all categories with a statistically insignificant difference (p = 0.293).

8. SH

   Most patients did not experience SH (92.8%), while those who experienced 7.2%. This difference is statistically significant (p = 0.003). The results of the analysis relate to V, B and VB:

   a. No (N): V (89.5%), B (93.4%), VB (93.8%)
   b. Yes: V (10.5%), B (6.6%), VB (6.3%)

   The majority of patients did not experience SH in all categories, with a statistically significant difference (p = 0.003).

9. Vestibular Symptoms

   Most patients do not experience VEST (83.5%), while those who experience it is 16.5%. This difference was not statistically significant (p = 0.543). The results of the analysis relate to V, B and VB

   a. No (N): V (89.5%), B (83.6%), VB (81.7%)
   b. Yes: V (10.5%), B (16.4%), VB (18.3%)

   Most patients did not experience VEST in all categories with a statistically insignificant difference (p = 0.543).

10. Stroke

    Most of the patients did not have a stroke (52.9%), while those who experienced it were 47.1%. This difference was not statistically significant (p = 0.743). The results of the analysis relate to V, B and VB:

    a. No (N): V (50.9%), B (54.6%), VB (51.9%)
    b. Yes: V (49.1%), B (45.4%), VB (48.1%)

    The distribution of patients who had and did not have a stroke was almost evenly distributed in all categories with a statistically insignificant difference (p = 0.743).

11. Vestibular + Stroke Symptoms

    Most patients do not experience BOTH (95.2%), while those who experience 4.8%. This difference is statistically significant (p = 0.000). The results of the analysis relate to V, B and VB:

    a. No (N): V (94.7%), B (94.7%), VB (96.2%)
    b. Yes: V (5.3%), B (5.3%), VB (3.8%)

    The majority of patients did not experience BOTH in all categories with a statistically significant difference (p = 0.000).

12. Non-Vestibular + Stroke Symptoms

    Most of the patients did not experience NON (70.3%), while those who experienced it was 29.7%. This difference was not statistically significant (p = 0.667). The results of the analysis relate to V, B and VB:

    a. No (N): V (64.9%), B (69.7%), VB (72.1%)
    b. Yes: V (35.1%), B (30.3%), VB (27.9%)

    Most patients did not experience NON in all categories, with a statistically insignificant difference (p = 0.667).

In general, some statistically significant findings were found in the SH and BOTH variables, while other variables did not show significant differences. The elderly age group and male sex were more dominant in the patient population, with variations in distribution among the categories of vertebral artery (V), basilar artery (B), and vertebrobasilar artery (VB).

Incidence of VBI Patients Based on Clinical Manifestations and Symptoms

Based on the clinical manifestations of patients in this study with a sample of 410 VBI patients, it was found that patients with complaints of vertigo were reported 55 times (13.41%), while headache was recorded in 29 cases (7.07%). SNH/SH was the most common manifestation found in patients, with 214 events or 52.20% of the total findings. Heart disorders were found in 21 patients (5.12%), while kidney disorders were found in 13 patients (3.17%). Injuries, trauma, and accidents were recorded in as many as 9 cases (2.20%) and other categories in as many as 69 findings (16.83%).

The data showed that the incidence of patients with VBI (Vertebrobasilar Insufficiency) fluctuated over a period of time divided into ten years. This incidence was analyzed to understand the trends and patterns of suspicion of VBI in the patient population, both in adolescents, young adults, old adults, and the elderly. Hopefully, this analysis can help in further treatment and prevention planning by recognizing symptoms that often appear based on the existing age range. The following table shows the incidence data of VBI patients every ten years:

Table 2. Age Distribution, Incidence, VBI Findings, and Most Common Clinical Symptoms in Patients with Vertebrobasilar Artery Insufficiency (VBI)

It	Age Range	Incidence	VBI findings			Most Clinical Diagnoses/Symptoms
			V	B	VB	
1	< 20 years	11	1	3	7	CKR, headache, dizziness, KLL trauma
2	21-30 years old	13	3	4	6	Headache
3	31-40 years old	15	2	6	7	Headache, vertigo
4	41-50 years old	34	4	12	16	Stroke, hemiparesis, vertigo
5	51-60 years old	99	12	45	41	Stroke, hemiparesis
6	61-70 years old	129	38	112	160	Stroke, hemiparesis
7	71-80 years old	87	16	31	40	Recurrent stroke, hemiparesis, cephalgia
8	>80 years old	32	2	12	18	Recurrent stroke, complications of the disease, chronic diseases
Information:						

It	Age Range	Incidence	VBI findings			Most Clinical Diagnoses/Symptoms
			V	B	VB	
1.	VBI	: Obstructive Vertebrobasillaris Artery				
2.	V	: Vertebral Artery				
3.	B	: Basillaris artery				
4.	VB	: Vertebrobasillaris Artery				

Based on the table above, it was found that:

1. Age Range 41-50 Years and Older: The incidence of VBI increases significantly, especially after age 41. Clinical manifestations such as stroke and hemiparesis are becoming more common.
2. Age Range 51-70 Years: The highest incidence occurs in the age group of 51-70 years with dominant symptoms of stroke and hemiparesis.
3. Age <40 Years: The incidence is relatively lower with major complaints such as headaches and vertigo.
4. Age >80 Years: Although incidence decreases after age 80, complications of chronic disease and recurrent stroke remain a major concern.

The study highlights the importance of early detection and treatment of VBI, especially in older age groups, to prevent more serious complications.

Discussion

The vertebrobasilar system, which consists of the vertebral and basilar arteries, supplies blood to the brain stem, cervical spinal cord, cerebellum, thalamus, and occipital lobes (Yuni & Latupeirissa, 2023). This system includes bilateral vertebral arteries (VAs) and unpaired basilar arteries (BAs). Vertebrobasilar Insufficiency (VBI) is a condition in which the blood supply by the vertebral and basilar arteries to the posterior part of the brain is insufficient (Dossani et al., 2022). The term VBI began to be used in the 1950s by C. Miller Fisher to describe transient ischemic attack (TIA) in the vertebrobasilar region. The vertebrobasilar blood vessels, also known as posterior circulation, supply areas such as the brainstem, thalamus, hippocampus, and cerebellum, as well as the occipital lobe and medial temporal vessels. About 25% of stroke and TIA cases occur in vertebrobasilar distribution. The vertebrobasilar disease generally occurs in advanced age, especially between 70 and 80 years old, with a higher prevalence in men. Around 25% of the elderly experience balance disorders and an increased risk of falling due to VBI. African-Americans also experience VBI more often than other ethnic groups due to genetic factors, higher prevalence of hypertension, and disparities in access to health care.

VBI is generally caused by two main mechanisms: hemodynamic insufficiency and embolism (AC et al., 2016). (1) Hemodynamic Changes: Atherosclerosis, including arterial calcification, is a major cause of VBI, exacerbated by risk factors such as smoking, hypertension, and hyperlipidemia. Hemodynamic ischemia is common in the elderly and people with diabetes due to inadequate blood flow through the basilar artery, especially when there is occlusion of both vertebral arteries or basilar arteries, as well as insufficient carotid circulation contribution. (2) Embolism: Embolism in VBI can originate from ruptured atherosclerotic plaques or intimal defects due to trauma, fibromuscular dysplasia, or aneurysm. Most embolisms form from subclavian, vertebral, or basilar artery lesions.

Risk factors include coronary artery disease and cardioembolism, with diabetes, hypertension, and smoking as the main risk factors for arterial calcification, including vertebral arteries.

The results showed data on the incidence, clinical manifestations, and risk factors for vertebrobasilar insufficiency (VBI) in diverse populations, of which SNH/SH (52.20%) and vertigo (13.41%) were the most commonly reported symptoms, reflecting the classic manifestations of VBI that are often found in the literature. These symptoms mainly reflect ischemia in the brain region supplied by the posterior circulation. However, variation in symptoms by age suggests that the clinical presentation of VBI may differ significantly among different age groups, with older patients more likely to experience symptoms of stroke and hemiparesis. In comparison, younger patients report headaches and vertigo more frequently. Heart and kidney disorders have a lower prevalence among VBI patients (5.12% and 3.17%, respectively), suggesting that while important, they may not be a major factor in VBI pathophysiology. Conversely, injury or trauma and other conditions suggest that mechanical and comorbid factors may also play a role in the clinical development and manifestation of VBI.

Analysis of CT-Scan findings showed a significant correlation between radiological findings and clinical symptoms, indicating the importance of imaging in diagnosing and managing VBI. Stenosis and occlusion of the vertebral and basilar arteries are often found in patients with more severe symptoms, supporting the main role of atherosclerosis in VBI pathophysiology (Sathya et al., 2022). Atherosclerotic plaques and lacunar infarctions found in the posterior circulatory region confirm the importance of cardiovascular risk factors such as hypertension, diabetes, smoking, and hyperlipidemia in the development of VBI. Medical therapy with antiplatelets and anticoagulants is an important strategy to prevent further thrombus and embolism, which is a serious complication of VBI (Mikkelsen et al., 2015). Surgical interventions such as stenting and bypass grafting may also be considered in patients with significant stenosis. An emphasis on early detection and timely management is essential to prevent more serious complications such as ischemic stroke, which often has a significant long-term impact on a patient's quality of life.

The data obtained showed that various clinical symptoms in patients, such as vertigo, headache, stroke, hemiparesis, and others were suspected to be caused by undetected Vertebrobasilar Insufficiency (VBI). These symptoms vary based on age range, with different incidences and manifestations in each age group. Therefore, proper screening for VBI is needed according to the age range and existing symptoms. Here are some VBI recommendations based on the results of the research:

1. For patients under 20 years old, it is recommended to have a basic neurological and cardiovascular examination, especially for those who have complaints of dizziness, headache, or a history of trauma. It aims to detect VBI disorders early, particularly those related to head trauma, and prevent further complications. The risk of head injury, headache, and dizziness can affect daily activities, and academic development can be minimized through early detection and appropriate treatment. From the results of this study, symptoms such as dizziness and headache can indicate the presence of

VBI, so basic neurological and cardiovascular screening is very important. For the age of 21-30 years, recurrent headaches should be followed up with follow-up examinations such as imaging (CT/MRI) if there are recurrent symptoms. The purpose of screening is to identify the cause of headaches and prevent the development of neurological disorders. Recurrent headaches in this age range can interfere with productivity and quality of life, so proper treatment is needed to prevent more serious chronic conditions. In the 31-40 age group, symptoms such as headache and vertigo must be evaluated comprehensively to ensure the absence of missed VBI. However, further research is still needed with a larger sample number to determine the urgency and need for VBI screening at the age of <40 years.

2. In the age range of 41-50 years, stroke and hemiparesis symptoms must be watched and examined intensively, given the high risk and increased number of VBI incidences obtained. Screening and prevention of stroke with early intervention and managing cardiovascular risk factors such as monitoring blood pressure, cholesterol, and blood sugar is highly recommended, especially related to the main etiopathogenesis of VBI involving atherosclerosis.
3. The age group of 51-60 has a high incidence of stroke and hemiparesis, so it requires routine testing for early detection of VBI. This screening aims to reduce the incidence of stroke through holistic management of health conditions. This is important because, in the age range of 61-70, the peak incidence of VBI is highest, with the main symptoms of stroke and hemiparesis in most patients, so early detection may be needed.
4. Aged 71-80 years, with a high risk of recurrent stroke and hemiparesis, requires regular check-ups and assessments of the patient's condition to prevent the emergence and/or worsening of existing chronic diseases. For patients over the age of 80, comprehensive examination and palliative management are necessary to optimize quality of life and prevent serious complications of VBI.

Thus, early detection of VBI through appropriate screening according to the age range and existing symptoms is very important to prevent serious complications and improve patients' quality of life. Systematic and regular screening can help identify VBIs that are not detected beforehand, allowing for more effective and timely medical interventions.

CONCLUSION

Research shows that vertebrobasilar artery insufficiency (VBI) is most common in the elderly (73% of patients) and less common in children, adolescents, and young adults. Men are more likely to develop VBI than women (60.5% vs. 39.5%), although this difference is not statistically significant. Radiological analysis showed a significant correlation between the SH findings and the clinical symptoms of VBI ($p = 0.003$) and between vestibular and stroke symptoms ($p = 0.000$). Common symptoms of VBI include vertigo, headache, and stroke, with age variations affecting their prevalence—stroke and hemiparesis are more common in older patients. In comparison, headaches and vertigo are more common in younger patients. Cardiovascular risk factors such as hypertension, diabetes, and hyperlipidemia play an important role in the development of VBI. Early

detection through screening according to age and symptoms is essential to prevent serious complications and improve patients' quality of life. Systematic screening can help identify undetected VBIs, allowing for more effective medical interventions.

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