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Intracranial and Extracranial Vertebrobasilar Artery Stenosis Patient Profile in Dr. Moewardi General Hospital

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ABSTRACT

Introduction: Vertebrobasilar artery stenosis can be extracranial or intracranial, and accounts for up to 20% of posterior circulation ischemic strokes. The gold standard for diagnosing is Digital Subtraction Angiography (DSA), an invasive diagnostic method by injecting a contrast agent into the blood vessels leading to the brain through a catheter. This study aims to determine the profile of patients with intracranial and extracranial vertebrobasilar artery stenosis who underwent DSA procedures.
Methods: This descriptive research was conducted in RSUD Dr. Moewardi in patients who underwent DSA procedures for the period January 2020 to March 2022 and found vertebrobasilar artery stenosis. The study samples were grouped based on the location of the stenosis; intracranial and extracranial. The data collected included age, gender, symptoms, risk factors, degree of stenosis, and angiographic findings.
Results: Of 42 subjects, 33 (78.6%) patients were male. There are 23 (54.8%) patients with intracranial vertebrobasilar stenosis and 19 (45.2%) patients in extracranial. The main symptoms included hemiparesis, vertigo, hemiesthesia, loss of consiciousness, aphasia, dysartria, and dysphagia. The risk factors were 36 (85.7%) patients with hypertension, 18 (42.9%) patients with diabetes mellitus, 18 (42.9%) patients with a history of smoking, and 13 (31%) patients with hyperlipidemia. A total of 8 patients underwent stenting/angioplasty.
Conclusion: The prevalence of vertebrobasilar artery stenosis increases with age, most commonly occurring at the age of 50-59 years..The most common risk factor for vertebrobasilar artery stenosis is hypertension. Management recommendations include a combination of antiplatelet and endovascular therapy.

Keywords: vertebrobasilar artery stenosis; Digital Subtraction Angiography (DSA)

INTRODUCTION

Vertebrobasilar artery represent approximately 20% posterior circulation strokes. Patient with vertebral artery stenosis has 50% more risk of recurrence. This number is in line with the risk of carotid artery stenosis. Unfortunately, there is still lack of study about vertebrobasilar artery stroke[1, 2].

The Joint Study of Extracranial Arterial Occlusion showed frequency of stenosis and occlusion in 4,748 patients undergo angiography after transient ischemic attack (TIA) and stroke. Based on that study, most common posterior segment extracranial circulation lesion occurs in proximal vertebral artery that accounts for 22,4% stenosis (right side) and 28% (left side)[3].

Another study stated that intracranial segment of vertebrobasilar artery are closely linked to infarct in posterior and inferior cerebellum and lateral medulla. Distal part of intracranial vertebral artery are most commonly affected by stroke, but basilar artery involvement is uncommon[4].

Invasive diagnostic method with digital subtraction angiography (DSA) is still a gold standard diagnostic procedure for vertebrobasilar artery stenosis. This procedure done by injection of contrast material through catheter into pre-cerebral vein, allowing some advantages compared to other diagnostic modalities[5].In this research, we aim to evaluate intracranial and extracranial vertebrobasilar artery stenosis patients undergo DSA procedure.

METHOD

This descriptive study was done in Dr. Moewardi General Hospital during January 1st 2020 till March 30th 2022. Digital subtraction angiography (DSA) was done by neurointervention consultant neurologist. Research sample grouped based on stenosis location into two group, intracranial and extracranial vertebrobasilar artery stenosis. Patient data including age, sex, chief complain, risk factor, stenosis degree and angiography findings collected through electronic medical record. Stenosis degree grouped into mild, moderate, severe and crisis.

Inclusion criteria including all patients undergo DSA procedure in Dr. Moewardi General Hospital during January 1st 2020 till March 30th 2022 with vertebrobasilar artery stenosis findings. Data analyzed using SPSS program. This research already granted ethical clearance from Dr. Moewardi General Hospital Ethical Committee with registration number 367 / III / HREC / 2022.

RESULT

Table 1. Patients characteristic

Chracteristic	N = 42	%
Vertebrobasilar Artery Stenosis Location		
Intracranial	23	54,8%
Extracranial	19	45,2%
Sex		
Male	33	78,6%
Female	9	21,4%
Stenosis Degree		
Mild	10	23,8%
Moderate	7	16,7%
Severe	17	40,5%
Crisis	8	19%
Chief Complain		
Hemiparesis	27	64,2%
Vertigo	16	38,1%
Hemianesthesia	8	19%
Decreased Consciousness	1	2,4%
Aphasia	2	4,7%
Dysarthria	9	21,4%
Dysphagia	1	2,4%
Risk Factor		
Hypertension	36	85,7%
Diabetes Mellitus	18	42,9%
Hyperlipidemia	13	31%
Smoking	18	42,9%

Total of 42 patients, 23 patients (54,8%) with intracranial vertebrobasilar artery stenosis and 19 patients (45,2%) with extracranial vertebrobasial artery stenosis. Based on sex, 33 patients (78,6%) were male and 9 patients (21,4%) were female.

There were 10 patients (23,8%) with mild stenosis, 7 patients (16,7%) with moderate stenosis, 17 patients (40,5%) patients with severe stenosis and (19%) and crisis stenosis.

Based on presenting chief complaint, 27 patients (64,2%) complained hemiparesis, 16 patients (38,1%) complained vertigo, 16 patients (38,1%) complained vertigo, 8 patients (19%) complained hemianesthesia, 2 patients (4,7%) came with aphasia, 9 patients (21,4%) came with dysarthria, and each one patient (2,4%) complained dysphagia and came with decreased consciousness. Results are grouped in table 1.

Median age of patients in this research were 59,5 years old with youngest patient were 38 years old and oldest patient recorder were 81 years old. Stenosis location based on patients age can be seen in figure 1.

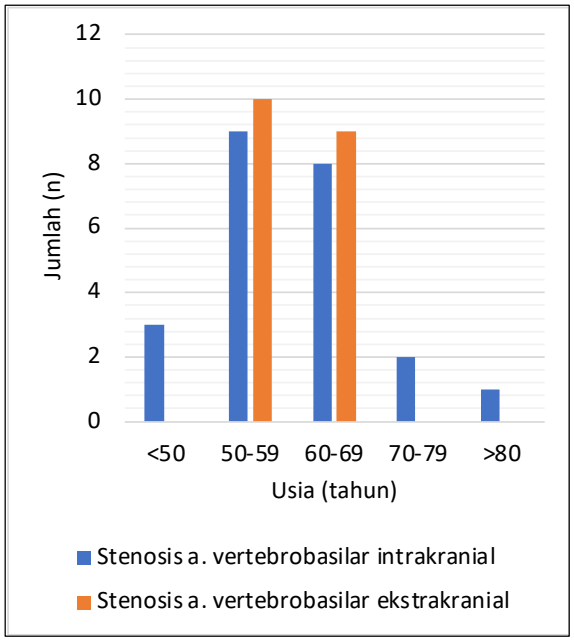

Figure 1. Vertebrobasilar artery stenosisi prevalence based on petients age

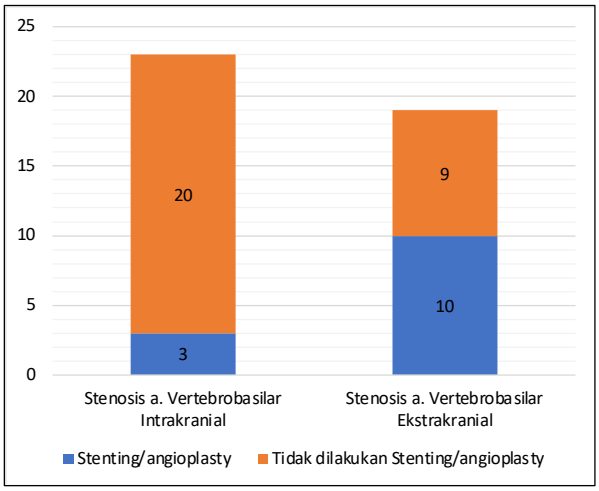

Figure 2. Patients characteristic based on stenting/angioplasty procedure.

Table 2 shown intracranial and extracranial vertebrobasilar artery stenosis patients based on degree of stenosis, chief complain and risk factor.

In this research, total of 13 patients undergo stenting/angioplasty procedure, 10 of them (23,8%) with extracranial vertebrobasilar artery stenosis and 3 (7,1%) with intracranial vertebrobasilar artery stenosis. There were 29 patients (69,1) did not undergo either stenting or angioplasty as seen in Figure 2.

Table 2. Intracranial and extracranial vertebrobasilar artery stenosis patient characteristic based on stenosis degree, chief complain and risk factor

Characteristic	Vertebrobasilar Artery Stenosis Location	
	Intracranial	Extracranial
Stenosis Degree		
Mild	9 (21.4%)	1 (2.4%)
Moderate	3 (7.1%)	4 (9.5%)
Severe	8 (19 %)	9 (21.4%)
Crisis	3 (7.1%)	5 (11.9%)
Chief Complain		
Hemiparese	10 (23.8%)	17 (40.5%)
Vertigo	9 (21.4%)	7 (16.7%)
Hemianesthesia	3 (7.1%)	5 (11.9%)
Decreased Consciousness	0 (0%)	1 (2.4%)
Aphasia	1 (2.4%)	1 (2.4%)
Dysarthria	5 (11.9%)	4 (9.5%)
Dyshphagia	0 (0%)	1 (2.4%)
Hypertension		
Yes	18 (42.9%)	18 (42.9%)
No	5 (11.9%)	1 (2.4%)
Diabetes Mellitus		
Yes	9 (21.4%)	9 (21.4%)
No	14 (33.3%)	10 (23.8%)
Hyperlipidemia		
Yes	10 (23.8%)	3 (7.1%)
No	13 (31%)	16 (38.1%)
Smoking		
Yes	8 (19%)	10 (23.8%)
No	15 (35.7%)	9 (21.4%)

DISCUSSION

Vertebrobasilar artery stenosis was one of the most common risk factor of recurrent stroke with increasing prevalence as ageing. Some studies show only few case occurring below 39 years old of age. Total of 42 patients were included in this study with male dominance (78,6%), youngest age were 38 years old, oldest age were 81 years old and median age of 59,5 years old.

Anatomically, vertebrobasilar artery stenosis distinguished into extracranial and intracranial segment. Extracranial vertebral artery consists of three parts, from aorta arc and subclavian artery into duramater border in vertebral artery V4 segment. Intracranial segments start from vertebral artery going through intracranial space by magnum foramen. Left and right intracranial vertebral artery joined and end as basilar artery. In intracranial segment, basilar artery will branch into dura, upper part of spinal medulla, oblongata medulla and cerebellum[1,6].

Population based data for extracranial vertebral artery from *Stroke Registry New England Medical Center Posterior Circulation* (NEMC-PCR) shown in 407 patients, most common extracranial vertebral artery stenosis location was in first segment of vertebral artery and for intracranial part, most common affected segment was distal third segment or commonly called as vertebrobasilar junction[7].

This results in line with our research that found 23 patients (54,8%) with intracranial vertebrobasilar artery stenosis and 19 patients (45,2%) with extracranial artery stenosis. Most common

segment in extracranial vertebrobasilar artery stenosis was osteal segment. While most common segment in intracranial vertebrobasilar artery stenosis was also on vertebrobasilar junction.

Some earlier studies shown that classic risk factor contributed to vertebrobasilar artery stenosis were smoking, diabetes mellitus and hyperlipidemia. Most common risk factors found during this study were hypertension (85,7%), diabetes mellitus (42,9%), smoking history (42,9%) and hyperlipidemia (31%).

As reported in NEMC-PCT, hypertension was the most common risk factor followed by diabetes mellitus, smoking history and hyperlipidemia. Hypertension and smoking more common in extracranial vertebrobasilar artery stenosis. While diabetes and hyperlipidemia more common in intracranial artery stenosis. The difference may be contributed by difference anatomy characteristic of intracranial and extracranial part of artery[1,7,8].

Vertebral artery had 3-5 mm diameter, relatively smaller than subclavian artery. This difference in anatomy explains different dynamics between carotid and vertebrobasilar artery with different tendency of atherosclerotic plaque formed. Apart from that, it is known that vertebral artery wall had some apparent transformation when entering cranial space. In intracranial vertebral artery segment, tunica adventitia become thinner as decrease of elastic material in tunica adventitia and media[7,8].

Based on *Warfarin Aspirin Symptomatic Intracranial Disease* (WASID) research, patient with intracranial vertebrobasilar artery stenosis had significantly higher risk developing recurrent stroke, approximately 22% in 13,8 months follow up. Most common risk factor noted were systolic blood pressure more than 140 mmHg and mean cholesterol level less than 200 mg/dL[9].

Another study also shown that stenosis was strong independent predictor for recurrent stroke. Apparent risk factor seen in the first two weeks. This explained that posterior circulation stroke, especially caused by vertebrobasilar artery stenosis, linked to high recurrency risk. Apart from prevention, early detection and treatment were also important[10].

Systematic, meta-analysis review done by Amarenco et al shown that statin use can decrease risk of stroke. Statin were HMG-CoA reductase inhibitors aim to decrease low-density lipoprotein (LDL) component in circulation. More than that, statin also had a role in altering atherosclerotic plug formation. Statin also a neuroprotectant, increasing blood circulation in ischemic part of brain and penumbra region in high dose. One of the mechanisms is through increase in endothelium-derived nitric oxide synthase (eNOS). Statin can lower blood pressure 2-5 mmHg, when 2 mmHg decrease in systolic blood pressure can decrease stroke chance by 15%. Inflammation marker in inflammation atherosclerosis, plaque stabilization and decrease in tunica intima also seen in several studies linked to statin consumption[11,15].

Most common chief complain was hemiparesis. Another complain were vertigo, hemianesthesia, decreased consciousness, aphasia, dysarthria and dysphagia.

Vertebrobasilar system giving branch to brainstem area, cerebellum, occipital lobe, inferior temporal lobe, and most of thalamus. Several stenosis complain including vertigo, dizziness, dysarthria, paresis, diplopia, gait disturbances, headache, memory disturbances, nausea and vomiting, decreased consciousness, split second vision loss, dysmetria, ataxia, nystagmus, sensory disturbances, vision field loss and Horner syndrome. Extracranial vertebral artery stenosis often asymptomatic, this is due to compensation by the contralateral part. Symptomatic stenosis was called when ischemia such as sensory deficit, motor deficit, and or cortical dysfunction was found[1,6].

Several neuroimaging modality can be used to detect vertebrobasilar artery stenosis *Digital Substraction Angiography* (cerebral DSA) was gold-standard diagnostic procedure for artery stenosis. It also can be used to measure stenosis degree that could not possibly be done with other diagnostic method[1].

Management of vertebral artery stenosis consist of pharmacological and non-pharmacological approach. Patient with symptomatic artery stenosis can be treated with high intensity statin therapy

(atorvastatin 20-80 mg or rosuvastatin 10-40 mg). High dose statin (80 mg) more effective in prevention of stroke. Patient also need to be screened for risk factor. SAMMPRIS recommend pharmacological management with combination of aspirin and clopidogrel for 90 days in patient with intracranial artery stenosis[1,12,15].

In this research, total of 13 patients undergo stenting/angioplasty procedure, with 3 patients had intracranial vertebrobasilar artery stenosis and 10 patients with extracranial vertebrobasilar artery stenosis.

A retrospective study in China compared management with stenting shown superior results of stenting in terms of better neurological function recovery and lower disability rate. Based on that, stenting management is preferred recommendation in patient with symptomatic vertebrobasilar artery stenosis. In terms of higher risk of stroke recurrence in vertebrobasilar artery stenosis, more advanced management for better curative and preventive strategies need to be evaluated[13,14].

CONCLUSION

Most common risk factor in vertebrobasilar artery stenosis were hypertension followed by diabetes mellitus, smoking history and hyperlipidemia. High recurrence rates in vertebrobasilar artery stenosis become one of important consideration in stenosis management from controlling preventable risk factor, pharmacological management by antiplatelet combination and high dose statin, also stenting/angioplasty choice in management.

CONFLICT OF INTEREST

The authors reported no competing interests.

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