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A Study to Assess the Relationship between Anomalies of the Circle of Willis and the Risk of Stroke Among Clients Admitted at Selected Hospitals in Indore.

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Introduction

It is estimated that 15–20% of all ischemic strokes are caused by extracranial atherosclerotic disease 1. In patients who have atherosclerosis of the carotid artery, the risk of having a stroke is affected not only by the presence of collateral circulation, but also by the various demographic aspects of the patients 2. Patients who have asymptomatic and symptomatic internal carotid artery stenosis have respective incidences of stroke that range from 1% to 5% to 9% and 10%, respectively.

The function that collateral circulation plays in providing protection is contingent on a variety of circumstances, including anatomical variances, the pressure of the systemic artery system, age, and the rate of advancement of the occlusive condition. The circle of Willis is the most important component of collateral circulation, and it is one of the first things that may be used to restore perfusion in the body in the event that a major artery becomes blocked. When patients have occlusive carotid artery disease, the subtypes of stroke that they experience may be determined by the anatomic characteristics of their collateral circulation. In a prior study, researchers found that the circle of Willis was responsible for up to fifty percent of the structural variations seen in patients' cerebral collateral.

When a patient has symptomatic carotid artery stenosis, the decreased blood flow that is caused by a stenotic carotid artery is compensated for by the increased blood flow that is caused by the collateral system. Because it can maintain blood flow from the contralateral carotid and basilar artery to the

location of the stenotic carotid artery, the circle of Willis is an important collateral channel that should not be ignored. An incomplete circle of Willis was associated with an increased risk of both transient ischemic attack and ischemic stroke in a study that looked at individuals with symptomatic carotid artery disease4. This was found in a study of patients. However, the findings of several other investigations suggested that the prevalence of discontinuity in the circle of Willis in patients with symptomatic carotid disease produced contradicting results. These additional studies were carried out by different researchers. The predominance of missing or hypoplastic segments was related with an elevated risk of stroke, according to early autopsy investigations. This was compared to the risk of stroke in normal people. On the other hand, patients who had a transient ischemic attack or an ischemic stroke as a result of carotid disease did not vary in any way, according to the findings of previous non-invasive imaging studies.

The purpose of the current study was to evaluate the abnormalities in the circle of Willis using CT angiography in patients with symptomatic and asymptomatic carotid artery disease, with the intention of determining whether or not these anomalies are associated with ischemic stroke.

Methodology

Between the months of February 2019 and February 2020, researchers at Index Medical College in Indore carried out a retrospective study of patients who had appeared to our outpatient stroke clinic at Index Medical College with carotid artery disease. The research project received approval from the hospital's ethics committee, and it enrolled a total of 200 patients with multi-detector CT angiography evidence of illness in only one of their carotid arteries. The severity of the narrowing of the carotid artery was evaluated in accordance with the standards established by the North American Symptomatic Carotid Endarterectomy Trial. Patients who had an intracranial aneurysm, vascular malformations, or dissection, as well as those who had a stenosis of more than fifty percent in the contralateral carotid artery to the symptomatic carotid artery as measured by CT angiography, were not allowed to participate in the study.

Recordings were made of the patients' ages and genders, as well as their risk factors for stroke, the degree of carotid artery stenosis, whether or not the patients were experiencing symptoms, and the results of the circle of Willis test.

Patients who presented with the symptoms of a transient ischemic attack or an ischemic stroke in the vascular area of the internal carotid artery, as well as monocular blindness, were considered to be symptomatic patients for the purposes of this study. Patients who followed up at the outpatient stroke clinic without demonstrating the signs of major artery disease were considered to be asymptomatic for the purposes of this definition.

The patients' anterior communicating artery (AcomA), right and left precommunicating arteries (ACA A1 segment), posterior communicating artery (PcomA), and precommunicating posterior cerebral artery were all tested for the circle of Willis (PCA P1 segment). Hypoplastic arteries, also known as arteries that could not be visible by CT angiography, were considered to be aberrant and hence classified as such.

It was determined that a complete circle of Willis existed when the following arteries were present: A1 segment of asymptomatic ACA, Acom A, P1 segment of symptomatic PCA, and symptomatic PcomA. Conversely, it was determined that a circle of Willis anomaly existed when none of these arteries were present.

RESULTS

There were a total of 200 patients who took part in this study over the course of the research period. Of those patients, 66% were males and 34% were females. The population that was being studied had a mean age of 60.1 with a standard deviation of 8.2 years. Of these patients, 29.7% did not show an aberration in the circle of Willis, whereas 69.4% demonstrated an anomaly in their test results. The condition that occurred most frequently among groups was hypertension, followed by coronary artery disease, diabetes mellitus, smoking, hyperlipidemia, a prior stroke, and peripheral artery disease. When comparing individuals with and without a circle of Willis anomaly, there was a statistically

significant difference in the prevalence of hypertension (p = 0.032) and hyperlipidemia (p = 0.01) among the patients. The percentage of patients who had symptoms associated with carotid artery disease was 46.13 percent, while 54.22 percent of patients did not experience any symptoms. It was found that individuals who had asymptomatic carotid artery disease were more likely to have an abnormality in the circle of the Willis than those who had symptomatic carotid artery disease. It was shown that there was no statistically significant difference in the overall incidence of abnormality in the circle of Willis between patients who had symptomatic and asymptomatic carotid artery disease (p = 0.54). In addition, there was no statistically significant difference between patients who had symptomatic and asymptomatic carotid artery disease in accordance with the segments of the circle of Willis (Acoma p = 0.98, IpcomA p = 0.400, IACA A1 p = 0.355, IPCA P1 p = 0.266, KACA A1 p = 0.178, KPCA P1 p = 0.438, and KPcomA p = There was a statistically significant difference between the degree of stenosis and the presence of symptomatic carotid artery disease (p less than 0.001) in this study. In patients with symptomatic and asymptomatic carotid artery stenosis, the median degree of carotid artery stenosis was 60-89% (the 25th percentile was 60-89% and the 75th percentile was preocclusive for the symptomatic group, and the 25th percentile was 55-67% and the 75th percentile was 69-91% for the asymptomatic carotid artery stenosis group). 38% of patients with symptomatic carotid artery disease had preocclusive and/or occlusive carotid artery stenosis, but only 11% of patients with asymptomatic carotid artery disease did.

Conclusion

In conclusion, we were able to identify a distinction between the patient population of symptomatic and asymptomatic internal carotid artery blockage in terms of a circle of the Willis abnormality. This distinction was based on the presence or absence of symptoms. Therefore, future prospective studies could be able to contribute to a better understanding of the role that collateral circulation plays in patients who have carotid artery disease.

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