

**VARIATIONS IN CIRCLE OF WILLIS AND THEIR CLINICAL IMPLICATIONS: A
COMPREHENSIVE ANATOMICAL STUDY*****¹Dr. Dhara V. Patel (MD Rachana Sharira), ²Dr. Archana A. Patel (MD Rachana Sharira)**¹Assistant Professor, Department of Rachana Sharira, S.S. Agrawal Institute of Ayurveda, Navsari, Gujarat-396445.²Associate Professor, Department of Rachana Sharir, S.S Agrawal Institute of Ayurveda, Navsari, Gujarat-396445.***Corresponding Author: Dr. Dhara V. Patel**Assistant Professor, Department of Rachana Sharira, S.S. Agrawal institute of Ayurveda, Navsari, Gujarat-396445. DOI: <https://doi.org/10.5281/zenodo.19909100>**How to cite this Article:** *¹Dr. Dhara V. Patel* (MD Rachana Sharira), ²Dr. Archana A. Patel (MD Rachana Sharira) (2026). Variations In Circle Of Willis And Their Clinical Implications: A Comprehensive Anatomical Study. World Journal of Pharmaceutical and Medical Research, 12(5), 192–195.

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ABSTRACT

Background: The Circle of Willis (CoW) is a crucial arterial anastomotic network at the base of the brain that ensures collateral circulation. However, anatomical variations are common and may influence cerebrovascular diseases. **Objective:** To study anatomical variations of the Circle of Willis and evaluate their clinical implications. **Methods:** A descriptive study using cadaveric specimens and radiological imaging was conducted. Variations were classified based on completeness and arterial anomalies. **Results:** A complete Circle of Willis was observed in fewer cases, while most showed variations such as hypoplasia and aplasia. **Conclusion:** Variations are common and clinically significant in cerebrovascular disorders.

KEYWORDS: Circle of Willis, Anatomical variation, Stroke, Aneurysm.**INTRODUCTION**

The Circle of Willis is a polygonal arterial network located at the base of the brain, forming an anastomosis between the internal carotid and vertebrobasilar systems.^[1&2] It consists of anterior cerebral arteries, anterior communicating artery, posterior cerebral arteries, posterior communicating arteries, and internal carotid arteries.

A complete and symmetrical Circle of Willis provides an effective collateral pathway during arterial occlusion. However, studies show that the classical configuration is present in less than 50% of individuals.^[3&5] Variations such as hypoplasia, aplasia, duplication, and asymmetry are frequently observed.^[4-6-14]

These variations play a significant role in cerebrovascular conditions such as ischemic stroke and aneurysm formation.^[8&9] Hence, understanding these anatomical differences is crucial for clinicians and neurosurgeons.

MATERIALS AND METHODS**Study Design**

A descriptive cross-sectional anatomical study.

Study Setting

Department of Anatomy and Radiology.

Study Material

- 30 formalin-fixed adult cadaveric brains specimens
- 50 cerebral angiographic images (CT/MR angiography)

Inclusion Criteria

- Intact brain specimens without gross pathology
- High-quality angiographic images

Exclusion Criteria

- Damaged specimens
- Incomplete imaging data

Methodology

- Careful dissection of the base of the brain to expose the Circle of Willis
- Documentation of arterial patterns

- Classification of variations:
 - Complete vs incomplete circle
 - Hypoplasia (arterial diameter <1 mm)
 - Aplasia (absence of vessel)
 - Asymmetry, Duplication and fenestration

Statistical Analysis

Data were analyzed using descriptive statistics (percentage, frequency). Association between variations and clinical conditions was evaluated.

AIMS AND OBJECTIVES

To study anatomical variations of the Circle of Willis and evaluate their clinical implications.

RESULTS

A complete Circle of Willis was observed in 38% of cases, while 62% showed incomplete configurations.

The most common variations observed were:

- Hypoplasia of posterior communicating artery: 30%
- Absence of anterior communicating artery: 12%
- Asymmetry of anterior cerebral arteries: 20%

The present results are comparable to those reported in previous anatomical and radiological studies.^[4&11&12]

Radiological imaging detected variations more frequently than cadaveric studies, supporting earlier research findings.^[5]

Tables

Table 1: Frequency of Variations.

Variation Type	Frequency (%)
Complete Circle	38%
Hypoplastic vessels	30%
Aplastic segments	18%
Asymmetry	20%

DISCUSSION

The present study demonstrates that anatomical variations of the Circle of Willis are more common than the classical pattern, which aligns with previous studies.^[4-5-13]

Hypoplasia of the posterior communicating artery was the most frequent variation. This may significantly reduce collateral circulation during vascular occlusion, increasing the risk of ischemic stroke.^[8]

Incomplete circles are associated with:

- Reduced compensatory blood flow
- Increased susceptibility to cerebral ischemia
- Higher incidence of aneurysm formation^[9&10]

The fetal-type posterior cerebral artery variant may alter cerebral hemodynamics and predispose individuals to vascular disorders.^[7]

Radiological techniques such as MR angiography provide accurate, non-invasive evaluation of these variations.^[5&10]

CONCLUSION

Variations in the Circle of Willis are highly prevalent and clinically important. These variations influence cerebral hemodynamics and are strongly associated with cerebrovascular diseases. Awareness of these variations is essential for accurate diagnosis, surgical planning, and management of neurological conditions.^[8&9]

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Conflict of Interest

None declared.

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