

**Original Research**

## **Anatomical Variations Of Circle Of Willis And Their Prevalence Using Magnetic Resonance Angiography In A Tertiary Care Center**

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### **ABSTRACT**

**Objective:** The purpose of this study is to determine and evaluate the prevalence and anatomical variants in the circle of Willis (CW) seen in non-contrast three-dimensional MRI brain in a series of 2728 patients who have undergone from August 2019 to August 2021.

### **Materials and methods:**

MRI – PHILIPS ACHIEVA 1.5 T

MRA examination consisted of 3D-TOF-MRA and fast spin-echo T2-weighted axial imaging. Variations in the CW were classified using 3D-TOF-MRA

T2-weighted imaging was done to rule out abnormalities or lesions in the brain.

### **Method of collection of data:**

A descriptive study was undertaken in 2728 patients, Images will be obtained from the PACS database using the search terms – MRI brain/MRA brain.

**Inclusion Criteria:**

All the patients underwent MRI in the Department of Radiodiagnosis at VIMS & RC, Bangalore.

**Exclusion Criteria:**

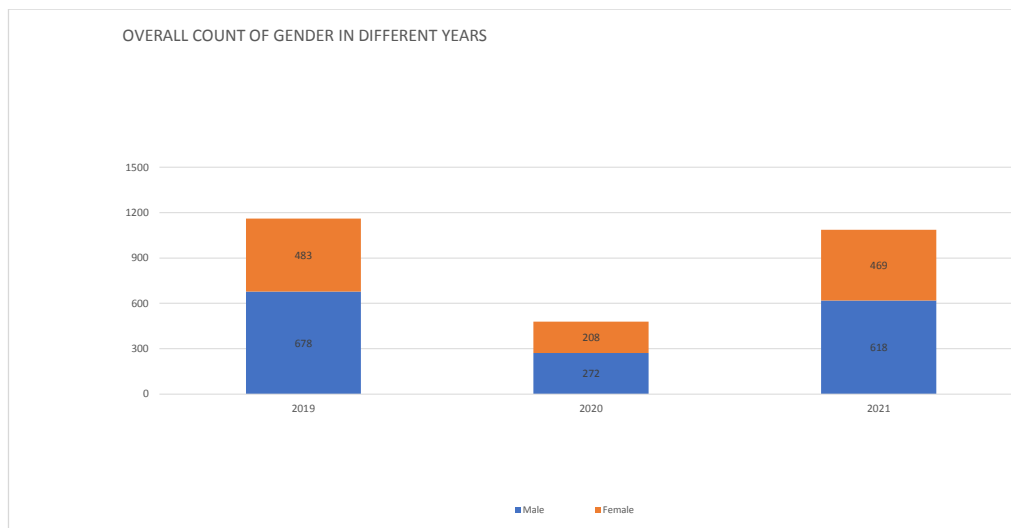
General contradictions for MRI like patients with metallic implants or pacemakers.  
 The patients who have undergone major intracranial surgeries.  
 Patients who were claustrophobic.

**STATISTICAL ANALYSIS:**

Descriptive statistics were reported using numbers and percentages for categorical variables in cases of MRA-proven COW variations. The data conducted will be tabulated and entered in Microsoft Excel spreadsheet 2010 and statistical analyses were conducted using SPSS version 20.0 software. Continuous variables were expressed as Mean.

**RESULTS:**

The study group consisted of around 2728 patients in the three years (2019,2020 and 2021). Out of the total population in 2019, 559 participants were male and 399 were female; in 2020, 272 were male and 208 were female and in 2021, 737 contributed male and 553 contributes female. The above description was illustrated through the graph given below in different years.



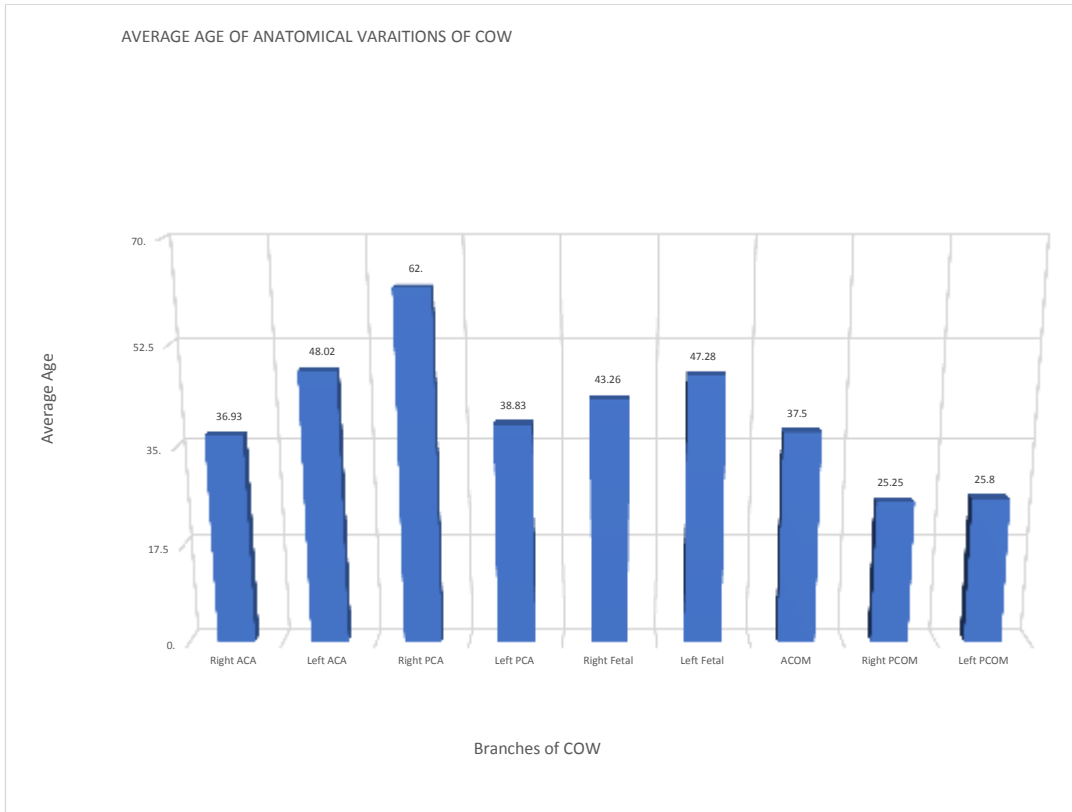
Incidents of morphological types of COW variations and common types of anterior and posterior circulation are documented in the below table for three years.

Year	2019	2020	2021	Total
Hypoplastic Right ACA	10	17	27	54
Hypoplastic Left ACA	10	10	14	34
Hypoplastic Right PCA	3	0	0	3
Hypoplastic Left PCA	3	0	9	12
Right Fetal	6	16	35	57

Left Fetal	5	15	25	45
ACOM	0	2	0	2
Right PCOM	1	3	0	4
Left PCOM	2	3	0	5

The above table shows us the overall count of people affected by the COW variations.

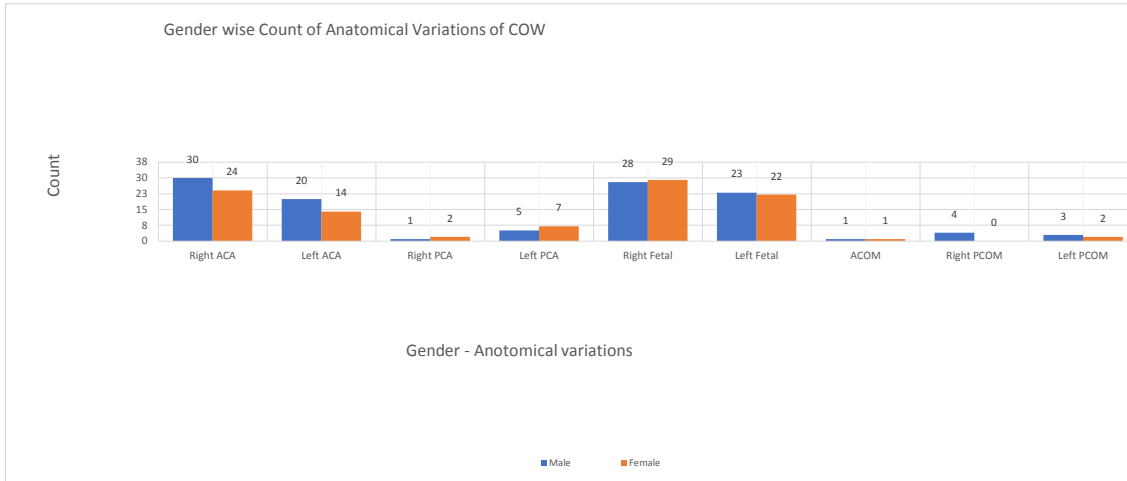
**ANALYSIS BASED ON THE AGE:**



The bar chart shows the average age group of the people affected by the COW variations.

To summarize, Left ACA and Left Fetal are in the average age group of 48 and 47 respectively whereas other variations of Right ACA and Left PCA age group range from 36 years and 38 years respectively. People who are affected through Right Fetal are the average age of 43 years. It seems like at an overall level, mid-age group people affects more likely than other age groups.

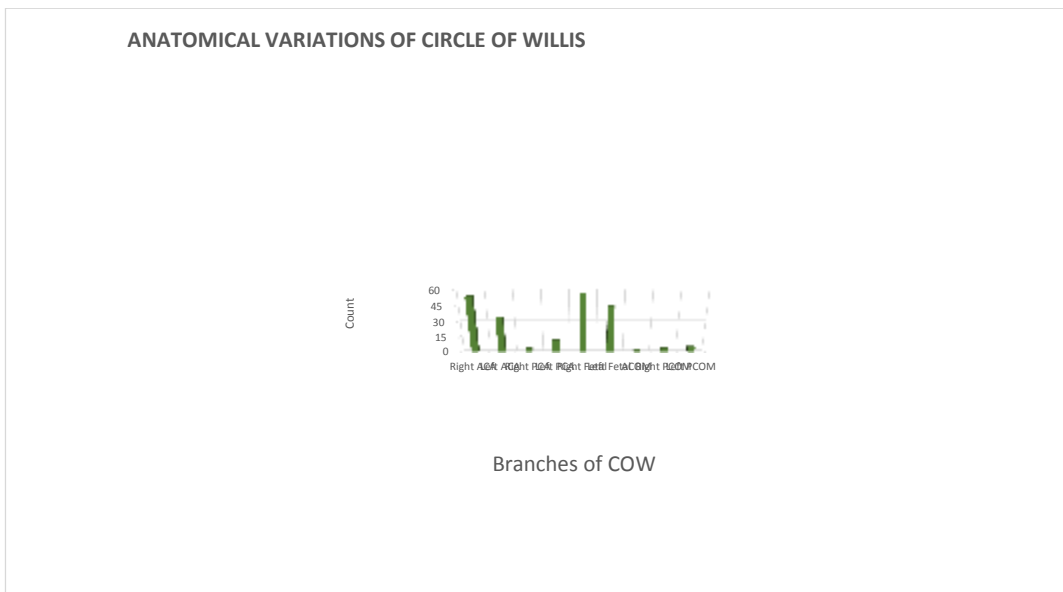
**GENDER WISE ANALYSIS OF COW VARIATIONS:**

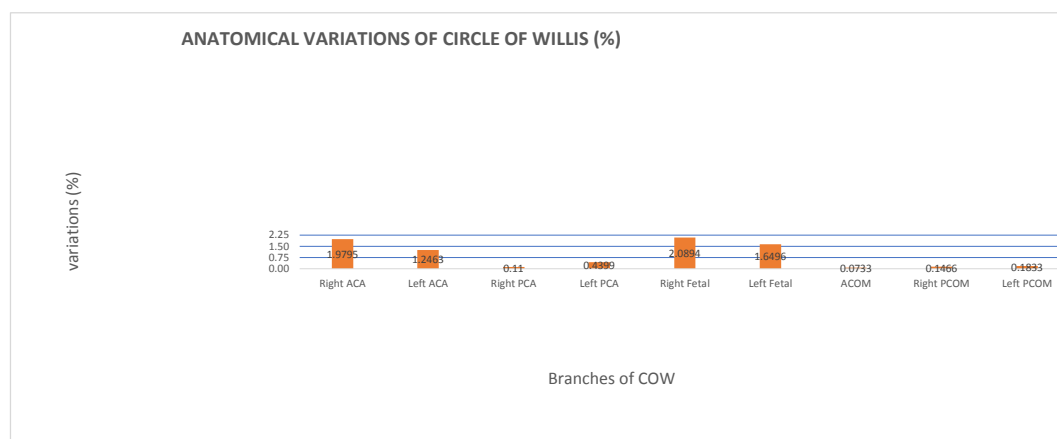


The prevalence of the variants of the anterior and posterior COW for the different age groups of both sexes is taken into consideration. An in-depth analysis has been done on the results of the male and female patients which is illustrated in the above bar chart. It shows how many males and females were affected.

Overall, most of the anatomical variations were seen to be the majority in Males compared to Females. Specifically, most of the males and females were affected through Right ACA more than others. The least among all the anatomical variations can be seen in males and females through ACOM.

Right ACA was found in 30 males and 24 females. After this, most of the population was affected with Left ACA having a count of 20 males and 14 females. The number of males and females affected by Right Fetal PCA and Left Fetal PCA (28 males, 29 females) and (23 males and 22 females) respectively. The count of the people where Left ACA and Right ACA were absent was very low.





The highest Proportions of the variations were present in Right Fetal with 57 members which are about 2.09% of the total population. Right ACA has 54 participants which contribute about 1.98% which is the next highest after Right Fetal. Left ACA and Left Fetal have 34 and 45 members which are very near to each other and also contribute 1.25% to 1.65% respectively in the overall data collected from the patients. Left PCA and Left PCOM show reduced variations with 12 and 5 members which are about 0.44% and 0.18% which is negligible. Right PCOM, Right PCA, and ACOM show a similar percentage proportion of 0.15%, 0.11% and 0.07% respectively.

### CONCLUSION:

To conclude, the configuration of the COW may vary greatly in the general sample size of the overall population. Further research should be conducted on various races and larger populations to confirm the influence of genetic, regional, environmental, and hemodynamic factors or their combination to get accurate results. This would help neurosurgeons and radiologists to avoid any complications in the future.

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