Research Article

Study of variations in posterior communicating artery in human brain

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Abstract

Introduction: Brain is normally supplied by two internal carotid arteries and two vertebral arteries which unite to form the circle of Willis. The danger of intracranial vascular lesion has increased, so a thorough knowledge of arterial circulation of brain is essential. There are variations in the length, diameter and branches of vessels forming the circle of Willis. Posterior communicating arteries are important arteries connecting the carotid and vertebral systems. **Materials and Methods:** One hundred and four brain specimens were studied. The major blood vessels forming the circle of willis were traced by dissection. Their length, origin, branching pattern and anastomosis were studied, painted and photographed. **Results:** It was observed that the variations in arteries forming circle of Willis was 54%. Maximum variations were observed in the communicating arteries (29%), of these the variations were more (15%) in the posterior communicating arteries. **Conclusion:** A gross anatomical study of arteries forming the circle of willis was conducted. The origin course and branching pattern of major arteries forming the circle was studied and tabulated. Maximum numbers of variations were observed in the posterior communicating artery.

Key words: Internal carotid arteries, variations in posterior communicating artery, brain

Introduction

The danger of intracranial vascular lesion has increased, so a thorough knowledge of arterial circulation of brain is essential. We human beings are thought to be alike in general anatomical construction yet there are variations in the length, diameter and branches of vessels forming the circle of Willis. Posterior communicating arteries are important arteries connecting the carotid and vertebral systems. They play an important role in equalizing the pressure of blood on both sides of the circle thus preventing cerebrovascular accidents. According to study of Fields et al [1] there was duplication of right posterior communicating artery. Crowell and Morawetz [2] stated that the posterior communicating artery took origin from internal carotid artery. Anubha Saha et al [11] in their study with 60 Brain specimens, found that in 38.2% cases posterior communicating artery was absent and in 23.3% cases hypoplastic. We used 104 human brain specimens to study the variations in the circle of Willis. These specimens were studied in the dissection hall of medical colleges. The vessels were traced painted and photographed. Their length and variations were noted. Variations observed in the circle were 54%. It was maximum for the posterior communicating artery (15%).

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Materials and Methods

The brain specimens were obtained from the cadavers in the dissection hall of Govt. Medical College Kottayam and P.K. Das Institute of Medical Sciences Palakkad. Only brain specimens with intact Circle of Willis were taken for this study.

Brain specimens with incomplete and torn circle of Willis were not included in the study. The study was conducted in 104 brain specimens with intact circle of Willis.

The major blood vessels forming the circle of Willis were traced by dissection. Their length, origin, branching pattern and anastomosis were studied, painted and photographed.

Observations

Maximum numbers of variations were observed in the communicating arteries ie 29%, of which more variations were seen in the posterior communicating artery (15%) than in the anterior communicating artery which was 14%.

The posterior communicating artery measured a greatest length of 1.8cms and a smallest of 0.5cms. The right posterior communicating artery was found to be absent in one case and the left in one case. It was thin and short in two cases on the right side and in one case on the left side.

It was enlarged and thickened on the right side in one case and on the left side in three cases. (fig 1) it was thin and elongated on both sides in two cases (fig 2). It was observed to be single on both sides in all specimens except in one case where it was double on the right side.(fig 3)

The posterior cerebral artery was observed to be thin and short in ten cases where the posterior communicating artery and the distal segment of posterior cerebral artery were of the same thickness. It appeared as if the posterior cerebral artery took origin from internal carotid artery directly known as proximal cerebral artery with a primitive posterior communicating artery (fig 4).

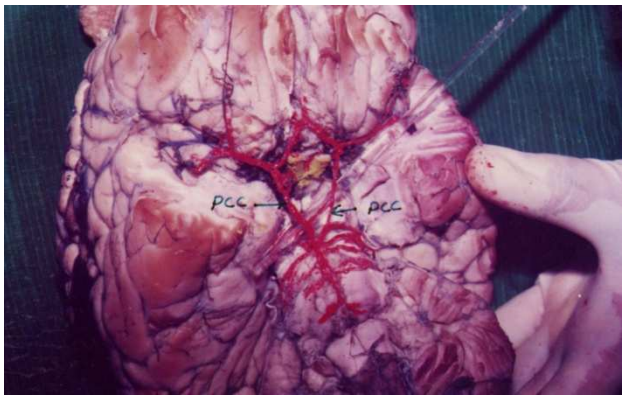

Fig 1: A thick posterior communicating artery on the right side (P.C.C)

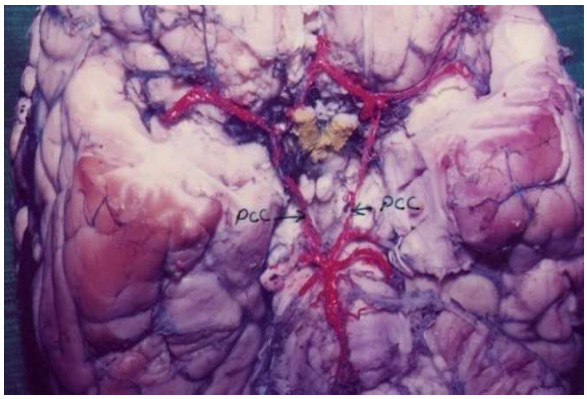

Fig 2: Posterior communicating artery (P.C.C) thin and elongated bilaterally

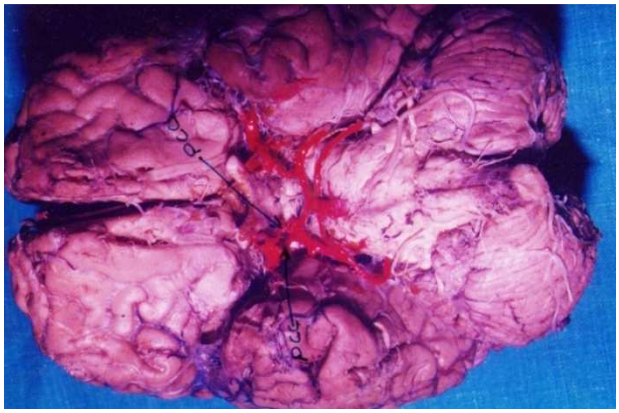

Fig 3: Double posterior communicating artery (P.C.C)on the right side

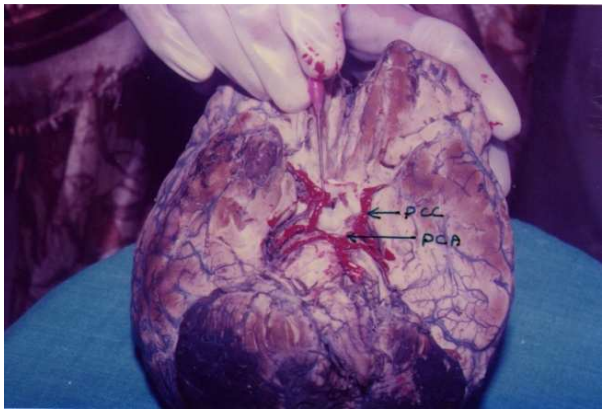

Fig 4: The posterior cerebral artery (PCA) thin and posterior communicating artery (PCC) arising from the internal carotid artery (ICA)

Variations Observed

Artery	Variations observed in	No. of cases
Anterior cerebral		8
Middle cerebral	Nil	Nil
Posterior Cerebral		13
Anterior Communicating		15
Posterior Communicating	Absence Thin and short Duplication Enlarged and thickened Thin and long Abnormal origin from middle cerebral artery	2 3 1 4 4 2 Total = 16

Discussion

Duplication of right posterior communicating artery was seen in one case which is in accordance with the study of Fields et al [1]. In 10 cases the initial segment of posterior cerebral artery was hypoplastic. It was absent in 3 cases.

Crowell and Morawetz stated that the posterior communicating artery took origin from internal carotid artery and is frequently larger on one side which was seen in this study. Except in two cases it took origin from middle cerebral artery [2].

Lewis described the long arteries or medullary arteries from the anterior and posterior cerebral arteries pass in to a depth of three or four centimeters without inter communicating [3].

In 7 cases, it was noted that the posterior cerebral artery appeared to arise from internal carotid artery rather than basilar artery, which is in accordance with Padget [4].

Abbie described that the posterior choroidal artery vary in number and arrangement [5].

Abbie has also described the posterior cerebral artery, a branch of basilar artery but morphologically a continuation of internal carotid artery, which is in accordance with this study [6].

The Circle of Willis and its variations have been extensively studied and was found to have about 60% variations Fawcett and Blachford which was only 54% in this study [7].

Kaplan postulated that medial striate artery (Recurrent artery of Heubner's) is said to anastomose with the

lenticulostriate arteries and the surface branches of anterior and middle cerebral arteries [8].

Mc Cullough reported two cases in which the left cerebral artery ended intracranically without joining the basilar [9].

Lang and Hann have conducted arteriograms and radioisotope flow studies on 58 patients and gave an excellent demonstration of the collateral pathways [10].

Anubha Saha, Bovindala Bhagyalakshmi et al in their study with 60 Brain specimens, found 38.3% having normal posterior communicating artery. In 38.2% cases it was found to be absent and in 23.3% cases hypoplastic. In the present study variations in posterior communicating artery was found to be only 15% [11].

Application: These days there are an increasing number of cerebrovascular accidents and a grave morbidity associated with it. The awareness of these variations is of importance to the neurosurgeons.

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