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ORIGINAL ARTICLE

A morphological study of the posterior communicating artery

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This study aims to identify and yield a better understanding of the origin of the posterior communicating artery, its perforating branches and the relations in the vicinity of that artery. In 30 brains filled with a mixture of latex through the internal carotid and basilar arteries the posterior communicating artery originated from the posterior aspect of the C4 part of the internal carotid artery in 20 hemispheres (66.6%) and from its postero-lateral part in 8 hemispheres (26.6%). In 2 hemispheres (6.6%), however, it originated from the anterior aspect of the internal carotid artery. In 8 hemispheres (26.6%) a foetal type of posterior communicating artery was observed. It was 11.94 mm (8.03–15.07 mm) in length from the origin of the PCoA to the point of union with the posterior cerebral artery. The PCoA gave 5, 8 perforating branches (4–9). The distance of the origin of these branches from the origin of the PCoA was 3.30 mm (0.06–9.05) and the area occupied by the origins of the perforating branches was 4.53 mm (0.01–9.07). The perforating branches of the posterior communicating artery were generally dense in the initial 2/3 of the artery. Consequently, the posterior third of the posterior communicating artery seems to be a safer area during surgical operations. As the perforating branches are dense in the initial 2/3 of the artery, this region is at highest risk of damage during operations.

Key words: posterior communicating artery, morphology, origin, relations

INTRODUCTION

It is important to know the morphology of the posterior communicating artery (PCoA) because of the surgery applied to vascular lesions in this region [9]. In the Yaæargil series 17.1% of intracranial aneurisms are generally located near the origin of the PCoA. In addition, as suprasellar neoplasms contain the branches of the PCoA, the anatomy of the Circle of Willis must be known [10, 11]. The intracerebral course and the areas supplied by its branches are already well known but the origin and extracerebral course of the artery may vary greatly. The aim of this study is to examine the extracerebral course of the PCoA together with its neurovascular relations and the safe area of the perforating branches, as these supply vital structures of the brain.

MATERIAL AND METHOD

In the present study 30 posterior communicating arteries were used obtained from 15 fresh adult cadaver brains. The brains were evaluated without regard to sex. After removal of the brains the internal carotid and basilar arteries were filled bilaterally with latex coloured by Indian ink. The origin, course and the relations with the adjacent structures of the PCoA were then evaluated under Opmi 1 dissection microscopy (X40).

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RESULTS

The posterior communicating artery was surrounded by an arachnoid membrane in all specimens. The posterior communicating artery arose from the posterior aspect of the C4 part of the internal carotid artery in 20 cases (66.6%) and from the posterolateral aspect in 8 cases (26.6%). In 2 cases (6.6%) it originated from the anterior aspect of the internal carotid artery. The origin of this artery was located on the super-medial side of the origin of the anterior choroidal artery (Fig. 1). During its course PCoA twisted from anterior to posterior and on reaching the interpeduncular cistern it united with the posterior cerebral artery at its anterior surface. During its course to the interpeduncular cistern it passed the lateral part of the optic chiasm and the inferior part of the optic tract. The length of PCoA from its origin to the point of union with the posterior cerebral artery was 11.94 mm (8.03–5.07 mm). The mean diameter of the artery was 1.42 mm (1–2.9). The calibre of the artery was thin in some cases and thick in the others (Fig. 2). It was 2 mm or thicker in 8 of the hemispheres (26.6%) and these cases can be defined as foetal in type. The artery coursed on the superior and lateral parts of the oculomotor nerve in those types. Normally PCoA courses on the medial side of the oculomotor nerve. The posterior communicating artery gave 5, 8 perforating branches (4–9). The distance of the origin of these branches from the origin of PCoA was 3.30 mm (0.06–9.05) and the area occupied by the origins of the perforating branches was 4.53 mm (0.01–9.07) (Fig. 2). The branches of the artery supplied the optic chiasm, optic tract, mamillary bodies, hypothalamus and
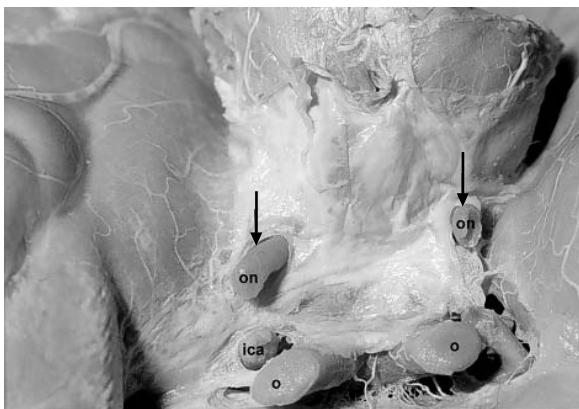
Figure 1. The oculomotor nerve and the internal carotid artery in the interpeduncular cistern; on — oculomotor nerve, ica — internal carotid artery, o — optic nerve, arrows; opening from where the oculomotor nerve arose from the arachnoid membrane.
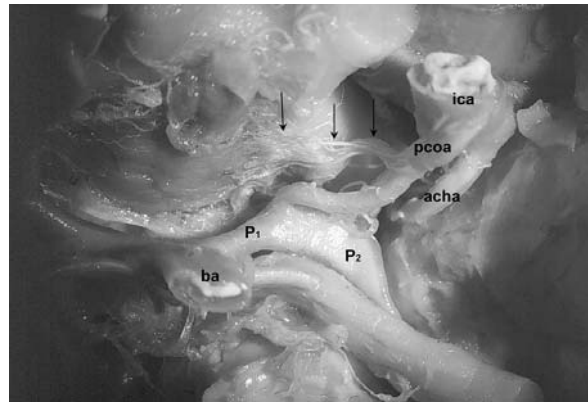
Figure 2. The inferior view of the hemisphere; ica — internal carotid artery, pcoa — posterior communicating artery, acha — anterior choroidal artery, P_1 — P_1 segment of the posterior cerebral artery, P_2 — P_2 segment of the posterior cerebral artery, ba — basilar artery, arrows. The area of the perforating branches of the posterior communicating artery is dense.

paramedian perforating substance. One of the perforating branches supplying blood to the paramedian perforating substance (premamillary artery) was thicker than the others. This branch reached to the cerebral peduncles and to the mamillary bodies.

DISCUSSION

Key and Retzius [6] in 1875 first described the arachnoid membrane surrounding PCoA. In his studies Yaşargil stressed that this membrane was similar to the arachnoid membrane of the oculomotor nerve and that the membrane of the artery was only a continuation of the lateral part of the interpeduncular cistern [14]. In our cases this membrane surrounded the artery, its branches and the oculomotor nerve, the nerve passing through an opening formed by this membrane. The relation between the nerve and the artery is also very important. This nerve is used as the reference point for PCoA by neurosurgeons [13] because during operations it can easily be used to find PCoA. In the present study, if the artery was a foetal type, it was located on the superior and lateral side of the nerve. This can be explained by the embryological development of the artery. When the development of the basilar artery is completed, it begins to supply blood to the posterior part of the brain. Thus PCoA develops properly and acquires its adult form. If this development does not take place, hypoplasia occurs at P1 segment of the posterior cerebral artery and an ipsilateral PCoA develops. This is known as the foetal type or configuration [3, 7, 8, 14]. It has been noted in other studies as well as the present one that the calibre of PCoA shows great

variation. This can be explained by its embryological development and not by the calibre and branching of the artery [1, 2, 7, 10, 13, 14].

During the course of PCoA the perforating branches, which are 2 to 13 in number, arose at a definite place [7]. As Yaşargil [14] mentioned in his report, these branches gain significance if PCoA is not double. Gabrovsky [4] mentioned that the posterior third of PCoA is the area where the risk of perforating branch damage is the least during intra-operative division.

According to certain authors the location of the perforating branches is very important during the pterional approaches to basilar bifurcation aneurysms and aneurysms of the PCoA [5, 12]. In the present study the perforating branches were dense in the initial 2/3 of the artery.

To sum up, the calibre of PCoA presents great variation and the probability of its being foetal in type and unilateral is higher. The location of the perforating branches is significant for surgeons during operations on the aneurysms, as they supply important structures of the brain. Awareness of these facts may be of help to surgeons during operations.

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