

Morphological Variability of the P1 Segment of the Posterior Cerebral Artery: An Anatomical and Angiographic Study with Clinical Correlations

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ABSTRACT

Purpose: The precommunicating (P1) segment of the posterior cerebral artery (PCA) is a short but clinically important arterial segment whose calibre, length and perforator distribution influence posterior circulation haemodynamics, thalamo-mesencephalic ischaemia and the management of posterior communicating artery (PComA) aneurysms. The aim of this study was to characterize the morphology of the P1 segment in a combined anatomical and angiographic series and to discuss the findings in relation to their clinical implications for radiological interpretation and neurovascular procedures.

Methods: A total of 320 cases were evaluated: 20 formalin-fixed brain specimens (10 plastic-injected), 120 CT angiographies (CTA) and 180 MR angiographies (MRA). P1 length, P1 calibre, right–left symmetry, hypoplasia, agenesis, fenestration, fetal-type PCA configuration, posteromedial perforator pattern and superior cerebellar artery (SCA) origin were recorded. Quantitative morphometric measurements were performed only on the angiographic datasets. Measurements were reviewed independently by two senior radiologists with consensus adjudication. Right–left morphometric comparisons were performed with the Mann–Whitney U test on independent samples, because individual case identifiers were not available to support paired analysis.

Results: Mean P1 length was 7.57 ± 2.24 mm on the right ($n = 255$) and 7.38 ± 2.19 mm on the left ($n = 254$). Mean P1 calibre including hypoplastic segments was 1.87 ± 0.59 mm on the right and 1.86 ± 0.57 mm on the left. P1 hypoplasia (calibre < 1 mm) was observed in 51 cases (15.9 %), P1 agenesis in 6 (1.9 %) and P1 fenestration in 3 (0.9 %). Five posteromedial perforator patterns were described using an exploratory framework proposed in this study, with asymmetric patterns representing 59.4 % of cases and an artery of Percheron pattern in 5 cases (1.6 %). The SCA arose from P1 in 25 cases (7.8 %), including 3 contralateral origins.

Conclusion: P1 length and mean calibre were broadly symmetric between sides, but clinically relevant variants — hypoplasia, agenesis, fenestration, fetal-type PCA, asymmetric perforator patterns, artery of Percheron, and SCA origin from P1 — were frequent enough to support systematic reporting of the P1–PComA complex on CTA and MRA. The proposed perforator scheme is exploratory and requires external clinical–radiological validation.

Keywords: posterior cerebral artery, P1 segment, fetal-type posterior cerebral artery, artery of Percheron, CT angiography, MR angiography