Transzygomatic – Subtemporal Approach for Middle Meningeal to P2 Segment of The Posterior Cerebral Artery Bypass: An Anatomical and Technical Study

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Abstract
Objectives: To investigate the use of a bypass between the middle meningeal artery (MMA) and P2 segment of the posterior cerebral artery (PCA) as an alternative to an external carotid artery (ECA–to–PCA) anastomosis.

Study Design: We conducted an anatomical study at a university hospital.

Subjects and Methods: Five adult cadaveric heads (10 sides) were used. After a temporal craniotomy and zygomatic arch osteotomy were performed, the dura of the floor of the middle cranial fossa was separated and elevated. The MMA was dissected away from the temporal lobe and exposed. The foramen spinosum was opened. Intradurally, the carotid and sylvian cisterns were opened. After the temporal lobe was retracted, the interpeduncular and ambient cisterns were opened, and the P2 segment of the PCA was exposed. The MMA trunk was transected just before the bifurcation of its anterior and posterior branches where the MMA trunk and the foramen spinosum was anastomosed end to side with the P2 segment of the PCA.

Results: The mean caliber of the MMA trunk before its bifurcation was 2.1 ± 0.25 mm, and the mean caliber of the P2 was 2.2 ± 0.2 mm. The mean length of the MMA trunk was 39.5 ± 4.8 mm. The mean length of the P2 segment of the PCA was 32 ± 4.1 mm (range, 28 to 36 mm). The mean length of the MMA trunk was 39.5 ± 4.4 mm (range, 35 to 44 mm). In all cadavers we were able to create a tension-free anastomosis between the MMA and P2.

Conclusion
The zygomatic bone is removed and preserved for subsequent reattachment. The dura of the floor of the middle cranial fossa is then separated under the surgical microscope. The MMA can be identified by tracing the vessels from the dural surface medially then the MMA was dissected away from the dura until to the foramen spinosum was reached extradurally. Medially, the temporalis muscle is elevated from the bone of the zygomatic arch, including the zygomatico-maxillary suture, including the lateral rim of the orbit. Posteriorly, the osteotomy was lateral to the condylar fossa.

Discussion
Vertebrobasilar insufficiency is one of the most common causes of central vertigo or dizziness. Several techniques are available for a posterior circulation bypass. (1-4, 7,16) The diameters of the donor (OA and STA) and recipient (PICA, AICA or SCA) arteries are less than 2 mm, which unite the arteries to provide sufficient blood flow. Procedures have of the proximal PCA as the recipient and the ECA or VA as the donor vessels in the bypass are reported to be more protective. (1-4)

The use of the middle meningeal artery as a donor site for bypass surgery was described previously in detail. The middle meningeal artery – middle cerebral artery bypass has been performed especially when the superficial temporal artery was not useful as a donor site. (1-4)

We performed a preclinical study to determine whether the diameter and length of the MMA are suitable for the anastomosis between the MMA and P2 segment of PCA and to determine the feasibility whether this surgery. In the present study, we found that a short length of MMA about 35 mm was suitable to create a bypass between the MMA and P2 segment.

The calibers of the MMA and P2 were well matched. Furthermore, the mean caliber of these arteries was more than 2 mm so the bypass is likely to provide sufficient blood flow. But such an anastomosis is performed, preoperative angiography would help to assess the diameter of the MMA and PCA to wound that they were large enough to serve as a suitable bypass.

Subtemporal transzygomatic approach was found to be suitable for such a bypass procedure.

The MMA to P2 segment of PCA bypass have several advantages; 1. It provides sufficient blood flow because the mean diameter of the MMA is more than 2 mm (7). If it may have a high patency rate because it is a single arterial-to-arterial bypass. Artery-to-artery anastomoses have been reported to have patency rates of more than 90%. (14,15) 3. Such a bypass is more simple to perform than an ECA–to–P2 bypass. No second incision or anastomosis in the cervical region is needed. Finally is an ECA to P2 segment of PCA bypass, the graft bends where it enters the cranial surface of the primary STA (through the petrous bone) and provides a final bypass to the MCA terminus. For this reason, the authors suggest keeping the STA in the dural layer for posterior circulation surgery when STA is not used in other bypasses.

The disadvantage of an MMA to P2 bypass is that the anastomosis is performed at a considerable depth, unlike a superficial STA to MCA (middle cerebral artery) bypass. To prevent cerebrospinal fluid leakage, the dura over the hole can be sealed with fibrin glue.

Conclusion
When an arterial – arterial bypass and an sufficient blood flow are needed, an MMA – to – P2 segment of PCA bypass may be a good alternative to – to – ECA – to – PCA bypass using long grafts.