

Middle Meningeal Artery to Middle Cerebral Artery Bypass Using a Mini-Pterional Craniotomy – A Cadaveric Surgical Simulation Study

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Introduction

The middle cerebral artery (MCA) is the most common recipient for cerebral revascularization, with indications ranging from Moya-Moya disease to complex aneurysms requiring complete trapping. There are several native donors available including the superficial temporal artery, external carotid artery, maxillary artery, etc. There is also limited evidence regarding the utilization of middle meningeal artery (MMA) as a donor. MMA is an underutilized and uniquely qualified donor vessel for bypass. In cases of an atrophic/damaged STAs, the MMA would be an ideal donor as it lies in the same surgical field and can be readily harvested from the dural flap. This study aimed to assess the feasibility of MMA-MCA (M4 and M2 territory) bypass via a mini-pterional approach.

Results

The MMA-M4 and MMA-M2 bypasses were completed in all the specimens. The mean caliber of MMA was 1.6 (SD=0.2) mm, parietal M4 was 1.4 (SD=0.1) mm and that of M2 was 2.2 (SD=0.2) mm. The required donor artery length from foramen spinosum for an MMA-M4 bypass was 81.3 (SD=10.1) mm and for MMA-M2 bypass was 77.1 (SD=12.2) mm.

Completed MMA-MCA Bypass



MMA: Middle Meningeal Artery M2: Second segment of middle cerebral artery M4: Fourth segment of middle cerebral artery

Conclusions

This study establishes the technical feasibility and merits of the MMA-MCA bypass. As a donor, MMA harbors the advantages of an intracranial vessel in terms of cranial protection from external trauma, without compromising cerebral circulation. The other advantages of this novel bypass were feasibility with a mini-pterional approach, good caliber match, no fixed brain retraction and relative technical ease.

Learning Objectives

1.Understand the potential role of MMA as a donor for revascularization of the MCA territory

2.Discuss the potential advantages of using the MMA as donor vessel for MMA-MCA bypass

Methods

A mini-pterional craniotomy was performed in twelve cadaveric specimens, ensuring preservation of the anterior MMA trunk along the sphenoid wing. The MMA was harvested from the dura and the M4 vessels (frontal, temporal and parietal) were exposed. After splitting the sylvian fissure, the M2 trunks were exposed. Two end-toside anastomoses were performed: MMA-parietal M4 and MMA-M2. Measurements of the donor and recipient vessel calibers and the total bypass length were recorded.