Endoscopic Transorbital Access for Internal Maxillary Artery–Based Bypass to Deep Intracranial Targets: An Anatomical Study

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Introduction:

The endoscopic transorbital approach (ETOA) has emerged as a minimally invasive route to the skull base, yet its role in revascularization is undefined. The internal maxillary artery (IMA) represents a favorable donor for high-flow extracranial-to-intracranial bypass, though its deep location limits use. We assessed the feasibility of ETOA-assisted IMA revascularization to intracranial targets.

Results:

End-to-side IMA–STA–MCA and IMA–STA–ICA bypasses were feasible in all specimens (8/8), with most rated good quality. Direct DPTA–ATA bypasses were feasible in 6/8 and IMA–ATA in 3/8, with failures due to vessel mismatch or inadequate length. The combined corridor allowed safe exposure of extracranial and intracranial vessels with minimal brain retraction.

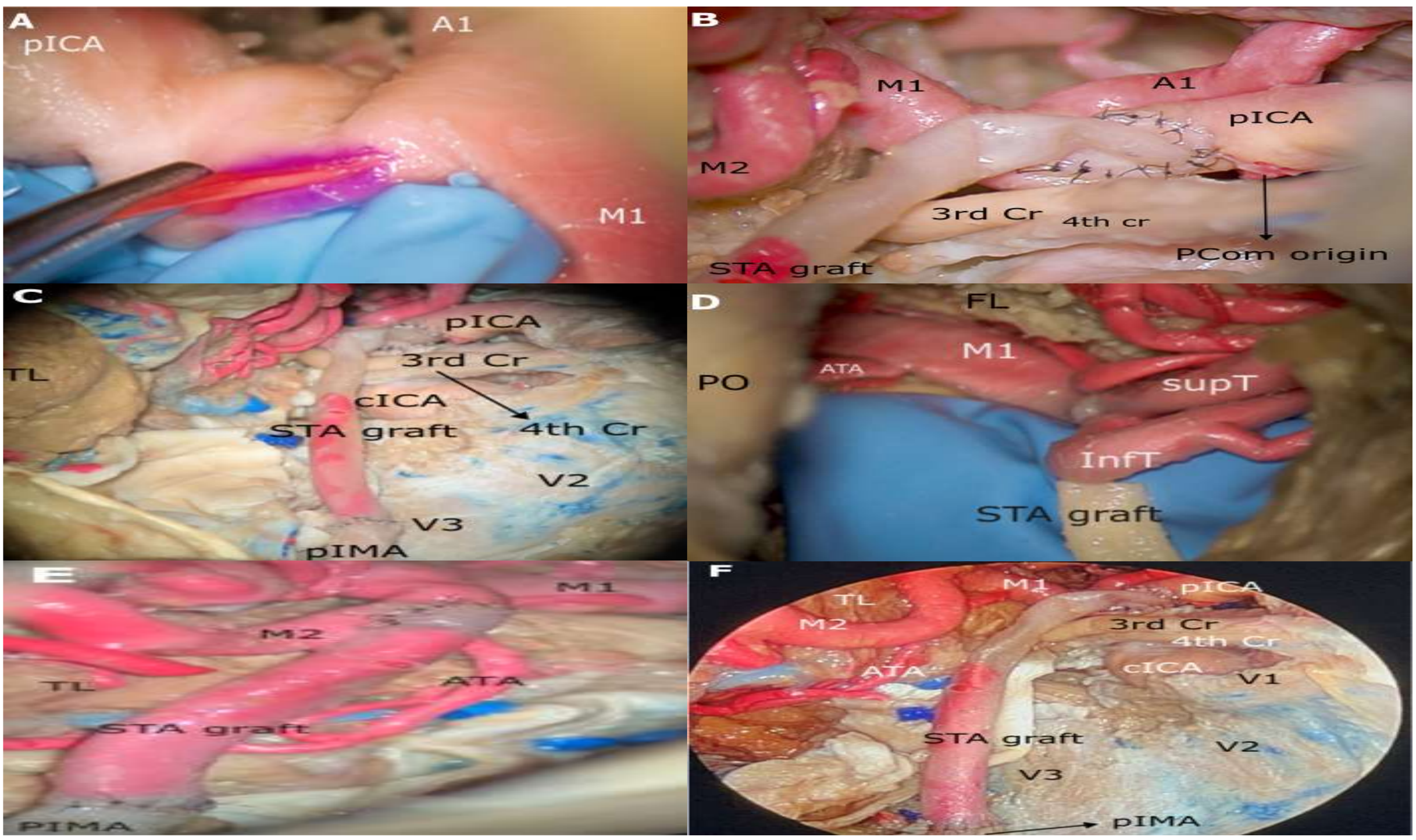

Figure 1. End-to-side microvascular anastomosis using the fish-mouth technique, beginning with arteriotomy and latex removal at the bypass site.
A: Microscopic view of end-to-side bypass between the paraclinoid ICA (pICA) and proximal internal maxillary artery (pIMA) using the STA graft.
B–C: Preparation and bypass between the M2 segment and pIMA using the STA graft.
D–E: Endoscopic view of pICA–pIMA end-to-side bypass.
F: Anatomy: A1 – anterior cerebral artery (1st segment), M1 – middle cerebral artery (1st segment), 3rd/4th Cr – cranial nerves, PCom – posterior communicating artery, TL – temporal lobe, FL – frontal lobe, PO – periorbita, cICA – cavernous ICA, V1–V3 – trigeminal nerve branches.

Method:

Four cadaveric heads (eight sides) underwent endoscopic-assisted transorbital exposure of the IMA and microscopic anastomosis. Donor–recipient bypasses tested included IMA or deep posterior temporal artery (DPTA) to anterior temporal artery (ATA), and IMA-to-M2 or paraclinoid ICA via a superficial temporal artery (STA) graft. Feasibility and bypass quality were systematically assessed.

Conclusion:

Endoscopic-assisted transorbital exposure of the IMA enables deep bypass procedures previously considered highly challenging. This combined endoscopic–microscopic approach may broaden revascularization strategies for giant aneurysms, skull base tumors, and complex ischemic disease, warranting further clinical translation.

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