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Intraoperative Cortical-MCA Pressure Monitoring in EC-IC Bypass

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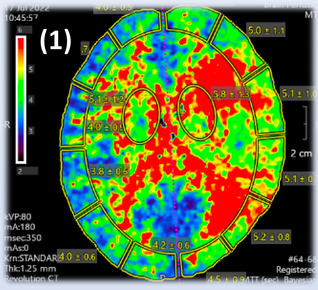
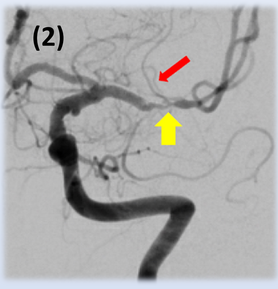
Introduction

- STA-MCA bypass is a bypass technique for cerebral steno-occlusive disease failing medical and endovascular therapy by providing flow augmentation to the penumbra.
- Hyper- and hypoperfusion syndromes are potential complications after bypass surgery due to the acute change in cerebrovascular hemodynamics.
- Intraoperative cortical-MCA pressure monitoring may provide insight in assessing the adequacy of flow augmentation and predicting the risk of hyper- or hypoperfusion injury.

Illustrative Case

- A 58 year-old man presented with acute onset of aphasia with spontaneous recovery. DSA showed critical left M1 stenosis with a perforator arising from the stenotic segment. CT perfusion showed a large penumbra over the left MCA territory.
- He had recurrent aphasia whenever systolic blood pressure dropped below 130mmHg and required a high dose of inotrope in Neurosurgical High Dependency Unit.
- Double barrel left STA-M4 bypass was performed. Postoperatively, there was a complete resolution of aphasia.

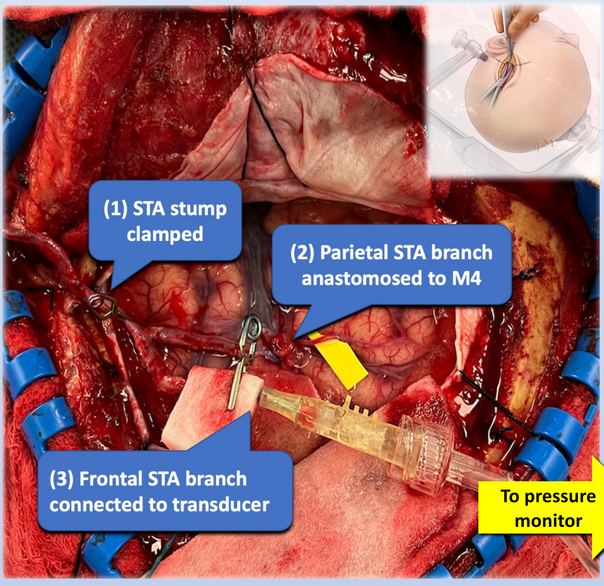




(1) CTA showed significant penumbra over left MCA territory with prolonged Mean Transit Time.

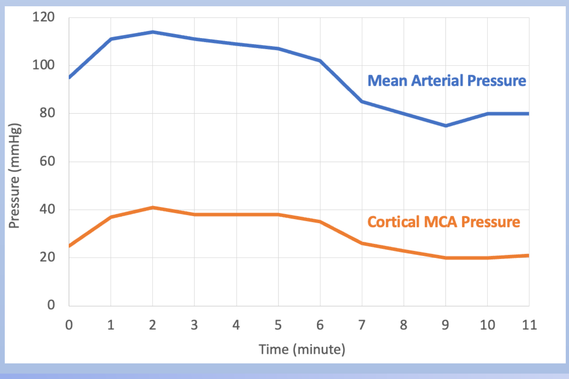
(2) DSA showed left distal M1 stenosis (yellow arrow) with a perforator arising from the stenotic segment (red arrow).

Intraoperative Cortical MCA Pressure Monitoring



- Frontal and parietal branches of STA were skeletonized for anastomosis.
- The parietal branch was first anastomosed to M4.
- A 22-gauge angiocath connecting to an A-line transducer was inserted to the un-anastomosed frontal STA branch, with the STA main trunk remained clamped.
- MAP was elevated from 80mmHg to 110mmHg for hemostasis challenge. Afterwards, vasopressor was stopped to allow a gradual return of MAP to baseline.
- During this period of MAP fluctuations, the corresponding cortical MCA pressure was recorded in a one-minute interval over 10 minutes.
- The pressure recorded over the frontal branch reflected the cortical MCA pressure.

Relationship between Cortical MCA Pressure and Mean Arterial Pressure



A model for real-time monitoring of intra-operative cortical MCA pressure

Cortical MCA pressure changed in concordance with MAP

Clinical Implications

- The degree of cortical MCA pressure fluctuating with MAP changes can be used for predicting the risk of hyper- or hypoperfusion injury.
- To improve our model in future practice, monitoring of cerebral autoregulation pressure can be achieved with intra-operative measurement of cortical MCA flow by flowmeter and calculation of pressure reactivity index (PRx). The proof of the loss of cerebral autoregulation would be an explanation to our patient's pressure-dependent neurological symptoms.

Reference

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