Extracranial-intracranial bypass

- CT Perfusion for Predicting Ischemic Stroke in Patients With Symptomatic Carotid or Middle Cerebral Artery Occlusion: A Post Hoc Analysis of the CMOSS Study
- Extracranial-Intracranial Bypass with Reconstruction Clip Surgery Following Failed Flow Diverter Therapy for a Giant Internal Carotid Aneurysm: A Case Report
- Pseudoaneurysm development in extracranial-intracranial bypass surgery: Diagnostic challenges and surgical solutions
- Virtual cut flow, an innovative noninvasive 4D ASL MRI biomarker of EIC bypass patency
- Long-Term Follow-Up of Extracranial-Intracranial Bypass Surgery for Symptomatic Cerebral Artery Occlusion
- Mixed Reality-Assisted Surgical Planning of Flow-Augmentation Extracranial-Intracranial Bypass Surgery: A Technical Note
- Five aneurysms in the posterior circulation associated with moyamoya disease: illustrative case
- Neurovascular Pathology in Intracranial Mucormycosis: Treatment by Cranial Bypass and Literature Review

The Extra intracranial bypass surgery (EIBS) has been proposed by Yasargil and Raymond Madiford Peardon Donaghy in 1967 to bypass an occlusive process in the arteries supplying the brain that is not accessible surgically in another way. Following a rise in the number of procedures performed annually worldwide, a sharp decline followed after The International Cooperative Study of Extracranial Intracranial Arterial Anastomosis.

On the basis of a better understanding of the origin of cerebral ischemic events, more precise indications have been developed targeting to improve hemodynamic insufficiency, by surgically adding an extracranial arterial supply. Furthermore, technical improvements of the procedure allow more deliberate indication for EIBS, e.g. using high-flow bypass while performing an “occlusion-free” anastomosis. [1)].

Given current limitations with existing treatments, cerebral revascularization remains an essential technique for aneurysm surgery [2)].

Indications

Extra-intracranial bypass surgery has regained significant relevance since 2000s.

Extracranial-intracranial bypass for ischemic stroke

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The proposed revival of bypass surgery is due to the progress in individualized, tailored therapeutic strategies as well as patient selection. Furthermore a dramatic improvement in the surgical technique as well as the development of a broad armamentarium of different bypass types, which today allow tailored revascularization strategies for our patients. Finally, the revival of bypass surgery is also explained by significant technical progress.

One of the major developments within the last years is the ELANA technique which allows performance of an anastomosis without the need for temporary clipping, thus dramatically reducing the risk for perioperative ischemia in bypass surgery.

Extra-intracranial bypass surgery has become a central part of a highly specialized, interdisciplinary strategy for the therapy of complex aneurysms and skull base tumors [3)]

Types

Superficial temporal artery to middle cerebral artery bypass for moyamoya disease

Superficial temporal artery to middle cerebral artery bypass

Superficial temporal artery to superior cerebellar artery bypass

Occipital artery to posterior cerebral artery bypass

Occipital artery to posterior inferior cerebellar artery bypass

Complications

Extra intracranial bypass surgery complications.

Case series

The purpose of a retrospective observational study was to investigate the long-term changes in cerebrovascular reactivity (CVR) as a measure of cerebral hemodynamics in patients with Intracranial atherosclerotic stenoocclusive disease (IC-SOD) after they have undergone an Extra intracranial bypass surgery. Twenty-six patients suffering from IC-SOD were selected from the CVR database. Nineteen patients underwent unilateral and 7 underwent bilateral revascularization. CVR measurements were done using Blood oxygen level dependent functional magnetic resonance imaging and precisely controlled CO2 and expressed as ΔBOLD (%)/Δ PETCO2 (mmHg). Trends in CVR over time were compared in both vascularized and non-vascularized hemispheres. Repeated measures analysis of variance with Greenhouse-Geisser correction was used to determine CVR changes within the grey matter MCA for longitudinal assessments. Overall, re-vascularized hemisphere showed a significant increase in CVR at the first follow-up, followed by a slight decrease at the second follow-up that significantly increased compared to the pre-bypass. However, the changes in the postoperative CVR were quite variable across the patients. Similar variability was seen in subsequent follow-ups, with a slight overall decline in the long term CVR as compared with first post-operative CVR.

The study demonstrates that EC-IC bypass has a beneficial long-term effect on cerebral hemodynamics and this effect varies between patients probably due to the variability in the underlying vascular pattern receiving the bypass. Hence, in the postoperative follow-up of patients routine functional imaging to monitor cerebral hemodynamics may be useful as the risk of stroke and cognitive decline remain present with impaired CVR [4)].

2016

Twenty-two patients with flow data were included (median aneurysm size, 22 mm). The intraoperative flow offer (cut flow) of the superficial temporal artery was sufficient in these cases relative to the flow demand in the sacrificed vessel (59 vs 28 mL/min) to warrant its use. Bypass flow averaged 81 mL/min postoperatively (n = 19). Bypass flows were highest in the immediate postoperative period but remained stable between the intermediate and final follow-up (40 vs 52 mL/min; P = .39; n = 8). Mean ipsilateral hemisphere flows were maintained after bypass (299 vs 335 mL/min; P = .42; n = 7), and remained stable over intermediate and long-term follow-up. Ipsilateral hemispheric flows remained similar to contralateral flows at all time points.

Despite a relative reduction in bypass flow over time, hemispheric flows were maintained, indicating that simple native donors can carry sufficient flow for territory demand long term when an intraoperative flow-based algorithm is used for donor selection [5].

Extra intracranial bypass cost

Extra intracranial bypass cost.

1)
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