Direct Revascularization procedure

Direct revascularization (STA-MCA bypass) involves use of a branch of a scalp artery (STA) for direct anastomosis (connection) to a branch of the brain artery (MCA) on the outer surface of the brain. This procedure benefits patients by providing an immediate improvement in blood supply to the brain. It's also known as an extracranial to intracranial bypass graft (EC-IC bypass). By virtue of doing the STA-MCA bypass and laying the STA directly on the brain surface, indirect revascularization is achieved as well. Through enlargement of the STA and increased indirect revascularization, blood flow is expected to continue improving over a period of several months.

Cerebral hyperperfusion syndrome (CHS) is a common complication after direct bypass surgery in patients with Moyamoya disease (MMD). Since preventive measures may be inadequate, Yang et al. assessed whether the blood flow difference between the superficial temporal artery (STA) and recipient vessels (△BF) and the direct perfusion range (DPR) are related to CHS.

They measured blood flow in the STA and recipient blood vessels before bypass surgery by transit-time probe to calculate △BF. Perfusion changes around the anastomosis before and after bypass were analyzed with FLOW 800 to obtain DPR. Multiple factors, such as △BF, DPR, and postoperative CHS, were analyzed using binary logistic regression.

Results: Forty-one patients with MMD who underwent direct bypass surgery were included in the study. Postoperative CHS symptoms occurred in 13/41 patients. △BF and DPR significantly differed between the CHS and non-CHS groups. The optimal receiver operating characteristic (ROC) curve cut-off value was 31.4 ml/min for ΔBF, and the area under the ROC curve (AUC) was 0.695 (sensitivity 0.846, specificity 0.500). The optimal cut-off value was 3.5 cm for DPR, and the AUC was 0.702 (sensitivity 0.615, specificity 0.750).

Postoperative CHS is caused by multiple factors. △BF is a risk factor for CHS while DPR is a protective factor against CHS [1)].

A double anastomosis using a single superficial temporal artery (STA) donor branch for both a proximal side-to-side (S2S) and a distal end-to-side anastomosis is a novel direct bypass technique for use in selected patients necessitating flow augmentation.

To describe the single-vessel double anastomosis (SVDA) technique, including its indications, advantages, and limitations, in addition to reporting our cases series of patients who underwent a SVDA bypass surgery.

Patients undergoing a SVDA bypass at a single institution between January 2010 and February 2016 were retrospectively reviewed. Intraoperative flow data was collected, including STA cut-flow, bypass flows, and cut flow index (CFI). Bypass patency was assessed by cerebral angiography and quantitative magnetic resonance angiography with noninvasive optimal vessel analysis. Adverse events occurring during the hospital stay and clinical status at last follow up was recorded.

Seven patients underwent SVDA bypass. Mean follow-up was 14.5 mo. Initial CFI for the S2S bypasses averaged 0.56 ± 0.25 and CFI after the SVDA averaged 1.15 ± 0.24. There was a statistically

significant average difference in CFI before and after the SVDA bypass ($p < .013$). Thirteen bypasses (93%) were patent postoperatively, and remained patent at last follow up. Four patients experienced various postoperative complications. None of the patients had a new stroke since hospital discharge.

SVDA is a novel technique that can be advantageous for selected cases of extracranial-to-intracranial bypass. Expertise in bypass procedures is a necessary prerequisite. Graft patency rates and complications appear comparable to other bypass techniques [2].

1)
Yang D, Zhang X, Tan C, Han Z, Su Y, Duan R, Shi G, Shao J, Cao P, He S, Wang R. Intraoperative transit-time ultrasonography combined with FLOW800 predicts the occurrence of cerebral hyperperfusion syndrome after direct revascularization of Moyamoya disease: a preliminary study. Acta Neurochir (Wien). 2020 Oct 2. doi: 10.1007/s00701-020-04599-w. Epub ahead of print. PMID: 33006072.
2)
Arnone GD, Hage ZA, Charbel FT. Single Vessel Double Anastomosis for Flow Augmentation - A Novel Technique for Direct Extracranial to Intracranial Bypass Surgery. Oper Neurosurg (Hagerstown). 2019 Jan 23. doi: 10.1093/ons/opy396. [Epub ahead of print] PubMed PMID: 30690506.