Intra intracranial bypass surgery

Bypass surgery for brain aneurysms is evolving from extracranial-intracranial (EC-IC) to intracranial-intracranial (IC-IC) bypasses that reanastomose parent arteries, revascularize efferent branches with in situ donor arteries or reimplantation, and reconstruct bifurcated anatomy with grafts that are entirely intracranial.

Intracranial-to-intracranial (IC-IC) bypasses are alternatives to traditional Extra intracranial bypass surgery (EC-IC) bypasses to reanastomose parent arteries, reimplant efferent branches, revascularize branches with in situ donor arteries, and reconstruct bifurcations with interposition grafts that are entirely intracranial. These bypasses represent an evolution in bypass surgery from using scalp arteries and remote donor sites toward a more local and reconstructive approach. IC-IC bypass can be utilized preferentially when revascularization is needed in the management of complex aneurysms.

IC-IC bypasses compare favorably to EC-IC bypasses in terms of aneurysm obliteration rates, bypass patency rates, and neurological outcomes. IC-IC bypasses can be more technically challenging to perform, but they do not require harvest of extracranial donor arteries, spare patients a neck incision, shorten interposition grafts, are protected inside the cranium, use caliber-matched donor and recipient arteries, and are not associated with ischemic complications during temporary arterial occlusions. IC-IC bypass can replace conventional EC-IC bypass with more anatomic reconstructions for selected aneurysms involving the middle cerebral artery, posteroinferior cerebellar artery, anterior cerebral artery, and basilar apex [1)].

Case series

2015

During a 17-year period in which 129 Posterior inferior cerebellar artery aneurysms (PICA) in 125 patients were treated microsurgically, 35 IC-IC bypasses were performed as part of PICA aneurysm management, including in situ p3-p3 PICA-PICA bypass in 11 patients (31%), PICA reimplantation in 9 patients (26%), reanastomosis in 14 patients (40%), and 1 V3 VA-to-PICA bypass with an interposition graft (3%). All aneurysms were completely or nearly completely obliterated, 94% of bypasses were patent, 77% of patients were improved or unchanged after treatment, and good outcomes (modified Rankin Scale ≤ 2) were observed in 76% of patients. Two patients died expectantly. Ischemic complications were limited to 2 patients in whom the bypasses occluded, and permanent lower cranial nerve morbidity was limited to 3 patients and did not compromise independent function in any of the patients.

PICA aneurysms receive the application of IC-IC bypass better than any other aneurysm, with nearly one-quarter of all PICA aneurysms treated microsurgically at our center requiring bypass without a single EC-IC bypass. The selection of PICA bypass is almost algorithmic: trapped aneurysms at the PICA origin or p1 segment are revascularized with a PICA-PICA bypass, with PICA reimplantation as an alternative; trapped p2 segment aneurysms are reanastomosed, bypassed in situ, or reimplanted; distal p3 segment aneurysms are reanastomosed or revascularized with a PICA-PICA bypass; and aneurysms of the p4 segment that are too distal for PICA-PICA bypass are reanastomosed. Interposition grafts are reserved for when these 3 primary options are unsuitable. A constructive approach that preserves the PICA with direct clipping or replaces flow with a bypass when sacrificed should remain an alternative to deconstructive PICA occlusion and endovascular coiling when

complete aneurysm occlusion is unlikely [2].

2014

Ten patients had aneurysms that were treated with ACA bypass as part of their surgical intervention. Four patients presented with subarachnoid hemorrhage and 3 patients with mass effect symptoms from giant aneurysms; 1 patient with bacterial endocarditis had a mycotic aneurysm, and 1 patient's meningioma resection was complicated by an iatrogenic pseudoaneurysm. One patient had his aneurysm discovered incidentally. There were 2 precommunicating aneurysms (A1 segment of the ACA), 5 communicating aneurysms (ACoA), and 3 postcommunicating (A2-A3 segments of the ACA). In situ bypasses were used in 4 patients (A3-A3 bypass), interposition bypasses in 4 patients, reimplantation in 1 patient (pericallosal artery-to-callosomarginal artery), and reanastomosis in 1 patient (pericallosal artery). Complete aneurysm obliteration was demonstrated in 8 patients, and bypass patency was demonstrated in 8 patients. One bypass thrombosed, but 4 years later. There were no operative deaths, and permanent neurological morbidity was observed in 2 patients. At last follow-up, 8 patients (80%) were improved or unchanged. In a review of the 29 relevant reports, the A3-A3 in situ bypass was used most commonly, extracranial (EC)-IC interpositional bypasses were the second most common, and reanastomosis and reimplantation were used the least.

Anterior cerebral artery aneurysms requiring bypass are rare and can be revascularized in a variety of ways. Anterior cerebral artery aneurysms, more than any other aneurysms, require a thorough survey of patient-specific anatomy and microsurgical options before deciding on an individualized management strategy. The authors' experience demonstrates a preference for IC-IC reconstruction, but EC-IC bypasses are reported frequently in the literature. The authors conclude that ACA bypass with indirect aneurysm occlusion is a good alternative to direct clip reconstruction for complex ACA aneurysms [3].

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