High flow extracranial to intracranial vascular bypass procedure for giant aneurysms: indications, surgical technique, complications and outcome

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With 5 Figures

Abstract

High flow extracranial–intracranial (hfEC–IC) vascular bypass remains an important surgical technique in selected patients. For example, in those with
giant aneurysms where the natural history of the condition is poor, and direct surgical approaches are recognised as excessively hazardous. hfEC–IC also allows for major carotid vessel occlusion in the treatment of skull base tumours which would otherwise be untreatable. We describe the indications, techniques, complications, and outcomes of this procedure in an era where few neurosurgeons are exposed to high volume vascular neurosurgery, and fewer still are trained to perform hfEC–IC. We emphasise the need for a stereo-typed and meticulous technique, highlighting key points at each stage of the operation, to ensure graft survival and minimal chances of morbidity.

**Keywords:** Giant aneurysm; high flow EC–IC bypass.

**Introduction**

The aim of this chapter is to outline the current indications, techniques, complications and outcomes of high flow extracranial–intracranial (hfEC–IC) bypass for extreme cerebral vascular disease.

hfEC–IC is a procedure that results in the formation of a sizable vascular conduit between the extracranial circulation and the intracranial circulation, allowing the opportunity to sacrifice a major intracranial parent vessel. The method continues to be recognised as technically demanding with significant hazards, all the more pertinent given reduced training opportunities in vascular neurosurgery. Despite these changes in neurosurgical training culture, the technique remains important for assisting the small numbers of individuals who present with extreme pathological challenges.

hfEC–IC has been performed since 1953 when Conley, an Ear Nose and throat surgeon used a Saphenous vein graft (SVG) to bypass the cervical internal carotid artery to aid resection of a tumour [6]. Whilst Yasargil et al. in 1967 reported on surgical techniques of revascularization in dogs, it was Lougheed et al. in 1971 who reported the first a successful “high flow” common carotid artery-to-intracranial carotid SVG bypass for athero-occlusive extracranial carotid disease [18, 38]. However, it was not until 1986 that a sizable clinical series emerged (with surgical technique and outcome) with 77 patients undergoing high flow was reported by Sundt [31]. They reported on successfully applying the technique for SVG bypasses into the M2 segment of the MCA and the P2 segment of the PCA.

The indications for a hfEC–IC can broadly be categorized into those required for carotid sacrifice to aid the complete resection of a neoplastic lesion at the skull base or high cervical region, and those required for cerebrovascular pathologies [28, 37] (see Table 1). The number of patients in which hfEC–IC is indicated remains small (Table 2). Indeed, over a cumulative period of 55 years only 460 hfEC–IC bypasses were reported world wide. Moreover, with improvements in stent technology and use of stereotactic radiosurgery, the potential need for hfEC–IC may decline although there is little evidence of this occurring to date [26].