

Case Report

The Surgical Management of Intraoperative Intracranial Artery Injury in open Skull Base Surgery - A Series of Three Cases

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Abstract:

Background: intracranial surgery is very commonly performed around the world. During these surgeries, intraoperative injury to the major intracranial vessels is a very serious condition. It has to be addressed promptly by either direct repair or vascular bypass. We describe three cases where there was vascular injury during surgery which were managed by direct repair. This implies the necessity of learning microvascular techniques for safely perform the surgery and save the patient from neurological deficits.

Key Words: Emergency; Intraoperative injury, Vascular surgery consultation; Iatrogenic; Unplanned

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Introduction:

During brain tumor neurosurgery, it is important to recognize the possibility of vascular injury, particularly in cases where the lesion is closely associated with the Sylvian fissure and middle cerebral artery (MCA) branches¹. When major intraoperative vascular injury is suspected, it is crucial to identify and repair the injury if possible¹.

As surgical disciplines evolve, the use of a multidisciplinary approach to operative intervention has increased. The contribution to this approach for vascular surgeons is the reconstruction of critical vascular structures or providing vascular control and

repair during a specific operative procedure². Many requests for vascular surgery expertise occur as an unplanned emergency intraoperative consultation².

Vascular surgeons provide useful technical expertise for urgent needs to control hemorrhage. Their familiarity in performing difficult dissections in the vicinity of large and important arteries and veins and in performing reconstructions of major arteries and veins can help in R0 resection³. Nothing can replace performing open surgery, and assisting with anatomic exposure during training is a good educational opportunity⁴. Even during minimally invasive procedures of spine, if vascular intervention is needed then open procedure has to be adopted⁴.

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A technique was reported for managing an intraoperative tear of an aneurysm neck by using cotton as a bolster applied with an aneurysm clip or clips to occlude otherwise irreparable aneurysm neck tears while maintaining patency of the parent artery⁵. Cotton-clipping is especially effective for managing intraoperative rupture of an aneurysm neck and for managing broad-based aneurysms without an adequate reconstructable neck⁶.

In neurosurgery, the complex anatomy of brain and its vasculature and use of specialized instruments limits the expertise of pure vascular surgeons. Therefore the neurosurgeons need to evolve in neurovascular surgeons. This takes patients and practice of these complex procedures. In this article we focus situations where neurovascular expertise was necessary in cases other than intracranial aneurysm, AVM, or intracranial vascular bypass surgery.

Case summary

Case 1:

A twenty years old female was admitted with right sided hemangiopericytoma arising from the right side of the tuberculum sellae. She underwent pterional craniotomy. During dissection of the tumour, a branch of the right MCA, supplying the tumour was avulsed from the right MCA. This resulted in torrential bleeding. There was no 'stem' which could either be coagulated or clipped (Fig 1). In this situation the vascular control was taken by temporary aneurysm clips and the injured artery was repaired with 8/0 Prolene® in round bodied needle. The temporary clips were removed and blood flow was established. This was confirmed by intra-operative Doppler study. Her recovery was uneventful.

Case 2:

A thirty year old man was admitted with a left MCA giant thrombosed aneurysm. After craniotomy was done, the Sylvian fissure was split and the neck of the aneurysm was identified. Then the neck was clipped and the aneurysm was dissected out. After removal of the aneurysm, there was a thin stream of blood coming from the MCA. After thorough examination, it was determined that it was from an avulsed branch of the MCA. In this situation the vascular control was taken by temporary aneurysm clips and the injured artery was repaired with 8/0 Prolene® in round bodied needle. The temporary clips were removed and blood flow was established. This was ensured by intra-operative Doppler study (Fig 2).

Case 3:

A twenty six year old female was admitted to our department with a giant craniopharyngioma. It had extended from the sella and parasellar region upto the right temporal lobe. During the final dissection and removal of the tumour, an aberrant vessel was noticed which had originated from the inferior part of the intracranial part of the right ICA and had supplied the tumour. Even after taking utmost care to save the tiny vessel, it was torn from the ICA with much bleeding. Immediately temporary aneurysm clips were applied and the wall of the artery was repaired with 7/0 Prolene® in round bodied needle. The temporary clips were removed and blood flow was established. This was ensured by intra-operative Doppler study. Fig 3

Case 4:

A forty two years old man admitted with right sided MCA occlusion. He had undergone craniotomy and STA-MCA bypass. During harvesting the STA, there was a small injury on the wall of the STA. this resulted in leaking of blood. Immediately vascular clamps were placed and the leak was repaired with 7/0 Prolene® in round bodied needle. Then the surgery proceeded as planned and the STA-MCA bypass was carried out successfully.

Discussion:

Described techniques of vascular repair include the following: a primary repair via a micro-suture or nonpenetrating clips; wrapping or plugging; coating; occlusion of the parent artery with or without a bypass; packing with further endovascular management⁷.

Blackwood et al, determined four main categories for initial consultation. These included revascularization of an injured vessel, control of ongoing active hemorrhage, assistance with exposure or dissection, and vascular embolic protection⁸. The types of vascular surgery were divided by retroperitoneal approach, embolization, primary closure or ligation, thrombectomy, bypass or interposition, or end-to-end anastomosis⁹. These skills can be achieved by hands-on training of surgical skills for the surgical residents and fellows, including lectures, dry lab, wet lab and cadaveric dissection¹⁰.

Manzur et al has described that most referrals were unplanned and in emergencies during surgery (43vs 33 patients)². In another study, of the 225 consults, 183 (81.3%) were unexpected, without any prior

thought or knowledge of the need for an intraoperative vascular surgery consultation³.

According to Tomita et al, most vascular surgery consultations were elective (n = 212; 70.9%) and requested preoperatively (n = 224; 74.9%). There were more vascular repairs done in the emergent setting (n = 68; 78.1%) than in the elective setting (n = 42; 19.3%; $P < .001$)⁴.

Articles discussing intravascular repair or bypass during the neurosurgical procedure is scarce. Thorough search of Medline and Google scholar did not return much results. Therefore it is unknown how intraoperative injuries to the intracranial vessels during brain tumour resection were dealt with.

Conclusion:

Intraoperative vascular injury during neurosurgery is an uncommon incidence but still it can happen. Microvascular suturing skill is invaluable for the intraoperative repair of the injured site. This can prevent neurological deficit as well as save the patient. Therefore, we should learn open anatomic exposures and microvascular procedures very well.

References:

1. Shah D, Surapaneni A, Rajagopalan D, Wang M, Miley J, Ashour R. Intraoperative middle cerebral artery injury salvaged by intracranial stent placement during surgical resection of necrotizing neurosarcoidosis. *Interdisciplinary Neurosurgery*. 2021;24:101048. DOI:<https://doi.org/10.1016/j.inat.2020.101048>.
2. Manzur MF, Ham SW, Elsayed R, Abdoli S, Simcox T, Han S, et al. Vascular surgery: An essential hospital resource in modern health care. *J Vasc Surg*. 2017;65(6):1786-92. DOI:10.1016/j.jvs.2016.12.126.
3. Danczyk RC, Coleman J, Allensworth J, Azarbal AF, Mitchell EL, Liem TK, et al. Incidence and outcomes of intraoperative vascular surgery consultations. *J Vasc Surg*. 2015;62(1):177-82. DOI:10.1016/j.jvs.2015.02.033.
4. Tomita TM, Rodriguez HE, Hoel AW, Ho KJ, Pearce WH, Eskandari MK. Implications of Intraoperative Vascular Surgery Assistance for Hospitals and Vascular Surgery Trainees. *JAMA Surgery*. 2016;151(11):1032-8. DOI:10.1001/jamasurg.2016.2247.
5. Barrow DL, Spetzler RF. Cotton-clipping technique to repair intraoperative aneurysm neck tear: a technical note. *Operative Neurosurgery*. 2011;68(suppl_2):294-9. DOI:10.1227/NEU.0b013e31821343c6.
6. Safavi-Abbasi S, Moron F, Sun H, Oppenlander ME, Kalani MYS, Mulholland CB, et al. Techniques and long-term outcomes of cotton-clipping and cotton-augmentation strategies for management of cerebral aneurysms. *Journal of Neurosurgery JNS*. 2016;125(3):720-9. DOI:10.3171/2015.7.Jns151165.
7. Van Der Veken J, Simons M, Mulcahy MJ, Wurster C, Harding M, Van Velthoven V. The surgical management of intraoperative intracranial internal carotid artery injury in open skull base surgery—a systematic review. *Neurosurgical Review*. 2022;45(2):1263-73. DOI:10.1007/s10143-021-01692-1.
8. Blackwood SL, O'Leary JJ, Scully RE, Lotto CE, Nguyen LL, Gravereaux EC, et al. Emergency intraoperative vascular surgery consultations at a tertiary academic center. *J Vasc Surg*. 2020;71(3):967-78. DOI:10.1016/j.jvs.2019.05.064.
9. Park SB, Park KM, Jeon YS, Cho SG, Hong KC. Intraoperative Vascular Surgical Consultation during Non-Vascular Surgeries in Tertiary Centers by Vascular Surgeon. *Vasc Specialist Int*. 2017;33(4):156-60. DOI:10.5758/vsi.2017.33.4.156.
10. Han SM. Oncovascular Surgery: There Would Be No Such Thing without Vascular Surgeons. *Vasc Specialist Int*. 2019;35(2):53-4. DOI:10.5758/vsi.2019.35.2.53.