

Intraoperative Fluorescence Angiography for Cerebrovascular Neurosurgery in Universiti Sains Malaysia

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Dear Editor,

We read with interest the manuscript titled "Present and Future of Neurosurgery Training and Education" published in *Malaysian Journal of Medical Sciences*, Volume 21, Issue 1, 2014, about the advances made in neurosurgery in the United States of America (USA) (1). We report the first intraoperative fluorescence angiography done in Malaysia as part of an advanced neurosurgery initiative. Intraoperative fluorescence video angiography is an adjunctive technology that provides a neurosurgeon with invaluable, real time imaging of cerebrovascular anatomy as well as flow dynamics. This method is relatively new in Malaysia and Hospital Universiti Sains Malaysia is one of the first centers in the country to utilise this technology in the management of intracranial cerebrovascular pathology. We share a brief description of the principles behind this method while highlighting an example of its utility in our centre.

Fluorescence angiography was first utilised by ophthalmologists to measure retinal blood flow using the fluorescent dye, fluorescein. Feindel et al. (2) is credited with first applying fluorescence angiography for intra operative visualisation of cerebral micro circulation. The use of indocyanine green (ICG) and its integration with the modern operative microscope has led to this modality being used increasingly in cerebrovascular procedures.

The integration of fluorescence video angiography with the operating microscope enables high resolution and high contrast near-infrared (NIR) images of the cerebral vasculature to be taken following administration of intravenous ICG. ICG is given via the intravenous (IV) route with a recommended dose of 0.2–0.5 mg/kg with a maximum daily dose of 5 mg/kg (3,4). The surgical field is illuminated by a light source (NIR-light) with a wavelength encompassing the ICG absorption bandwidth (3).

Cerebrovascular surgical procedures such

as aneurysm clipping, excision of arteriovenous malformations (AVM) or vascular bypasses require the intraoperative integration of angiographic information to yield optimal results. The advent of fluorescence angiography has significantly simplified this process and enabled angiographic visualisation to be performed rapidly and directly through the operating microscope. Identification of the aneurysm as well as adjacent parent vessels and perforators facilitate better the complete obliteration of the aneurysmal sac while preserving flow in adjacent vessels. In AVM surgery, the arterial feeders, nidus and draining veins are also more easily, rapidly and completely identified intraoperatively. Patency of a vascular bypass anastomotic site may also be determined early using this method.

Our early experience with this technique was for the purposes of aneurysm clipping. A 57 years old female patient presented with sudden severe generalized headache to our institution. Her Glasgow Coma Scale (GCS) Score was 15/15 on admission (WFNS Grade 1) and imaging revealed diffuse subarachnoid haemorrhage in her brain occurring due to a ruptured anterior communicating artery aneurysm. The aneurysm was noted to measure 5 cm in height with a neck corresponding to 3.5 cm and projected postero-inferiorly. Patient underwent a pterional craniotomy and clipping of her aneurysm which was assisted by video angiography intraoperatively (Figure 1). Aneurysms projecting inferiorly in this location are closely related to multiple perforators as well as to the optic chiasm. Thus, care is necessary during clip placement in order to ensure complete obliteration of the sac while preserving adjacent neural and vascular structures. With the use of ICG angiography, the vasculature was clearly defined pre- and post-clipping and this helped to ensure complete obliteration without no inadvertent injury or occlusion to the surrounding structures. The patient subsequently recovered

well from her surgery with no neurological deficits.

From our experience in patients such as that described above, we find that fluorescence angiography is a safe and effective adjunctive method in the management of neurovascular conditions like aneurysms and AVM's. Thus, we advocate its future widespread use in order to improve surgical outcome.

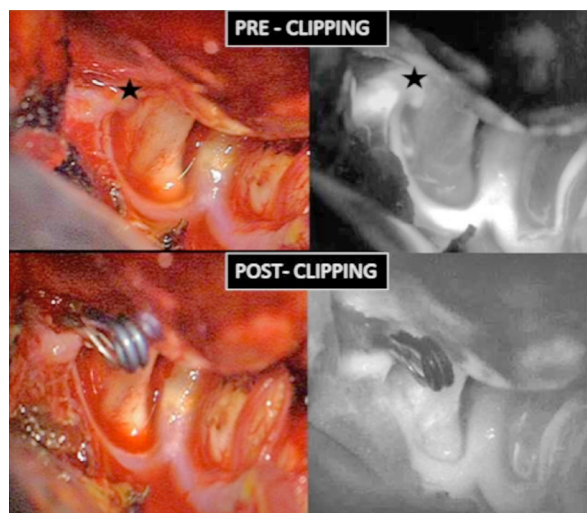


Figure 1: Serial Intraoperative Microscopic and Fluorescence Angiography images taken pre- and post-clipping of the anterior communicating artery aneurysm. The aneurysm sac is labelled with a black star in the pre-clipping images while the clip occluding the aneurysm sac is seen in the post-clipping images. Absence of contrast within the dome during video angiography after clipping confirms the complete occlusion of the sac. Unimpeded flow within the adjacent vessels can also be well visualised in the post-clipping images.

Authors' Contributions

Conception and design: RK, BI

Analysis and interpretation of the data, drafting of the article: RK, TYC

Critical revision of the article, administrative, technical, or logistic support: RK, ARIG

Final approval of the article: RK, ZI

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