Acquisition of quantitative Flow 800 vascular mapping from qualitative intraoperative ICG angiography

TO THE EDITOR: I read with interest the article by Marbacher et al., who have confirmed the accuracy of intraoperative indocyanine green (ICG) angiography comparable to that of the gold-standard intraoperative digital subtraction angiography (Marbacher S, Mendelowitsch I, Grüter BE, et al: Comparison of 3D intraoperative digital subtraction angiography and intraoperative indocyanine green video angiography during intracranial aneurysm surgery. J Neurosurg [epub ahead of print July 13, 2018. DOI: 10.3171/2018.1.JNS172253]). This ensures the acquisition of equivalent results, avoiding the limitations of intraoperative digital subtraction angiography (DSA), such as technical complexities and prolonged operative time as well as minimizing associated risks of radiation hazards and neurological complications. The addition of a Flow 800 study that can be auto-generated from the ICG study can provide quantitative assessment with regard to the pattern of flow velocities owing to simple analysis of the results of the average absorption intensity (AI) and time lag in the appearance of the dye.

This assessment can further safeguard us in identifying patients who are at risk for developing postoperative vasospasm, especially those in whom there is significant discrepancy in AI and time lag values between the parent and the branching vessels. Prophylactic as well as rescue management can be initiated in a timely manner with added measures to minimize complications such as the placement of a Swan-Ganz catheter in preventing pulmonary edema during augmented normovolemic hypertensive therapy.

This simple additive measure of the acquisition of Flow 800 quantitative data from quality images of the ICG study can provide both diagnostic and therapeutic benefits, thereby ensuring better patient safety.

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References

Disclosures
The author reports no conflict of interest.

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Response
We thank Dr. Munakomi for his interest in our findings and appreciate the opportunity to further discuss the implications of our study related to his comments. We agree that intraoperative ICG video angiography (ICGVA) can be an extraordinary tool in cerebrovascular cases, specifically in intracranial aneurysm (IA) surgery. In this regard, we recognize the potential benefit that Dr. Munakomi pointed out when generating blood flow dynamics data from ICGVA via the semiquantitative software analyzing tool Flow 800 (ZEISS), which can expand our diagnostic armamentarium during surgical IA occlusion.2,3,6

Dr. Munakomi ascertained equal results with ICGVA that could avoid the limitations of intraoperative DSA (iDSA). Despite the undisputed utility of ICGVA, our study detected a 6% rate of false-negative findings, as determined by 3D-iDSA, which necessitated immediate surgical intervention. Such results confirm iDSA as the gold standard for the assessment of surgical outcome.
However, the value of ICGVA and iDSA cannot be evaluated separately because they influence each other. Each vascular monitoring tool (i.e., visual inspection, Doppler ultrasonography, ICGVA, iDSA, endoscopy, electrophysiological monitoring) offers a distinct advantage, but when combined they can be further optimized for each patient’s safety.

To date, 3D-DSA is considered the most accurate technique to assess the clipped IA; in fact, some authors insist on its routine postoperative use. In the hybrid operating room, however, validation of the surgical result can be achieved intraoperatively with 3D-iDSA, thus maximizing patient safety. High-quality 3D-iDSA eliminates the need for postoperative DSA, warrants unselected control of all IAs undergoing surgical obliteration, and thus holds the potential to become the standard of care in surgical IA treatment. In our recent analysis of 32 clipped IAs in 26 patients who underwent both intraoperative and postoperative 3D-DSA, imaging quality was equally excellent for both modalities, and no discord occurred in our assessment of the surgical result in any of these aneurysms (Fig. 1).

At our institution, unselected routine use of iDSA, including 3D visualization of the clipped IA, has replaced postoperative 3D-DSA as our quality control; it also serves as a baseline to further monitor all surgically treated IA patients. In this era when surgeons have less exposure to and experience with open IA surgery, 3D-iDSA has improved intraoperative understanding of the angioarchitecture of the vascular complex that consists of the clip, the aneurysm, and the parent arteries. As recognized by Dr. Munakomi, 3D-iDSA can facilitate decision-making and strategies that can immediately improve the surgical result or manage intraoperative and early postoperative hemodynamics if needed.

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References


FIG. 1. In multiplanar 3D-iDSA, virtual rotation of the clipped aneurysm allows visualization in any direction, and therefore enables detection of even the smallest aneurysm remnant (white arrow) hidden behind the clipped aneurysm complex. The hybrid operating room delivering high-quality 3D-iDSA eliminates the need for postoperative DSA and warrants unselected use by supplanting postoperative angiography as the standard of care in surgical IA treatment.