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## Commentary: Intraoperative fluorescence with indocyanine green: A potentially useful adjunct modality to enhance intraoperative diagnosis and decision making?

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In this issue of the *Journal*, Said and associates<sup>1</sup> provide a nice description of their application of intraoperative fluorescence with indocyanine green (ICG) in congenital heart surgery operations. The value of any technical paper is in providing a sufficiently detailed description so that someone not familiar with a technique could find guidance if contemplating adopting it. The authors describe the equipment needed to perform intraoperative fluorescence with ICG, describe the different concentrations and preparation of ICG, and report on their experience with different applications in different types of patients and how their experience has informed their practice.

Intraoperative fluorescence with ICG is not new. Kogon and colleagues<sup>2</sup> reported on the use of this imaging technology for assessing the operative repair in different congenital heart lesions. They proposed that this technique could offer advantages for the assessment of coronary reimplantations, coarctation and arch repairs, aortopulmonary shunts, and pulmonary artery reconstructions. The potential advantages of using ICG to prevent coronary injury during reoperative congenital heart surgery procedures were then described.<sup>3</sup> The applications of



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### CENTRAL MESSAGE

Intraoperative fluorescence with indocyanine green can be applied successfully in several different congenital heart operations, but the utility of this diagnostic modality remains to be validated.

the technique were subsequently expanded to navigating surgery in patients with neonatal chylothorax.<sup>4</sup>

Several questions remain unanswered, however. Is there a real advantage to the routine use of this technology compared with the information the surgeon gets from transesophageal echocardiography, epicardial echocardiography, and intraoperative measurement of various pressures? When we proposed routine intraoperative angiography for the assessment of pulmonary artery residual lesions in certain congenital heart surgery reconstructions, there were several who questioned whether the additional information obtained is worth the trouble of scheduling these surgeries in the hybrid lab and the risk of the dye load associated with the angiogram.<sup>5</sup> The obvious advantage of the ICG fluorescent study is that the dye is well tolerated without apparent toxicities or complications. The technology is easy to use and does not change the operative environment or the flow of the operation.

It remains to be seen, however, if the information from the ICG study is superior to standard intraoperative assessment modalities and will thus improve the ability to recognize and, more importantly, address residual lesions. One could argue that in an arterial switch patient who comes off bypass with high left atrial pressures, electrocardiogram changes, and ischemia in part of the right or left ventricle, fluoroscopic examination using ICG may or may not add additional actionable information.

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To that extent, this technology will need to be tested in a clinical study environment and go toe to toe with other gold standard modes of assessment that surgeons use every day to evaluate the quality of their repairs. Said and colleagues demonstrate that several groups remain committed to exploring the merits of this imaging modality. I hope that one of these groups will lead the way to further explore its merits in a rigorous scientific way.

### References

1. Said SM, Marey G, Hiremath G. Intraoperative fluorescence with indocyanine green in congenital cardiac surgery: potential applications of a novel technology. *J Thorac Cardiovasc Surg Tech.* 2021;8:144-55.
2. Kogon B, Fernandez J, Kanter K, Kirshbom P, Vincent B, Maher K, et al. The role of intraoperative indocyanine green fluorescence angiography in pediatric cardiac surgery. *Ann Thorac Surg.* 2009;88:632-6.
3. Pourmoghadam KK, Mills Bunnell AP, O'Brien MC, DeCampi WM. Avoiding coronary injury in congenital heart surgery by laser-assisted indocyanine green dye imaging. *World J Pediatr Congenit Heart Surg.* 2014; 5:326-9.
4. Shiotsuki R, Uchida H, Tanaka Y, Shiota C, Yokota K, Murase N, et al. Novel thoracoscopic navigation surgery for neonatal chylothorax using indocyanine-green fluorescent lymphography. *J Pediatr Surg.* 2018;53: 1246-9.
5. Lamers L, Jimenez EE, Allen C, Hoyme D, Lushaj EB, Anagnostopoulos PV. Intraoperative completion angiogram may be superior to transesophageal echocardiogram for detection of pulmonary artery residual lesions in congenital heart surgery. *Pediatr Cardiol.* 2018;39:884-91.