A Glimpse Into the Heart: Innovative Cardioscope Captures Stunning Views of a Heart in Motion

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In this report, Karimov et al publish an update on previously described cardioscopic platform including exciting advances in both design and technique.[1] In their first report, Mihaljevic et al successfully visualized intracardiac structures in a beating heart on cardiopulmonary bypass using a modified gastroscope.[2] The method relied on continuous infusion of a transparent perfusate delivered through the pulmonary artery for visualization of left-sided structures or via the cavae for right-sided visualization. In a subsequent study, Shiose et al show expanded capabilities of the platform by successfully performing transapical edge-to-edge repair of both the mitral and tricuspid valves under direct cardioscopic visualization.[3] In the current study, Karimov et al present a substantial advance in the technology with the introduction of a totally percutaneous cardioscopic platform. The authors reliably and clearly visualized left-sided structures including the mitral apparatus, left ventricle, and outflow tract in a beating heart in a thoughtfully designed and carefully executed experimental study.

While progress is undeniable, the utility of this technology in a clinical setting remains uncertain. Direct percutaneous endoscopic visualization of intracardiac structures is extremely attractive proposition though in its current form yields too little at too high a cost. As a diagnostic adjunct, it is difficult to envision a scenario where the described technology could outperform or displace modern imaging techniques such as real-time 3D echocardiography[4] or cardiac MRI.[5] Remarkable advances in both echocardiography and cross-sectional imaging have given valve surgeons exquisite physiologic and morphologic data regarding performance of the native valve and have become an indispensable part of preoperative planning. The surge in machine learning and artificial intelligence are sustaining the pace of development in diagnostic cardiology and will only strengthen the dependence on noninvasive and minimally invasive imaging modalities.

As an interventional modality, the possibilities afforded by this technology are truly exciting, though at the current moment they remain out of reach. Miniaturized robotically actuated tendon sheath mechanisms are being integrated into interventional endoscopic platforms greatly extending the reach and capability of minimally invasive techniques[6,7] including single-incision laparoscopic surgery, and natural orifice endoscopic surgery (NOTES). These technologies could conceivably be incorporated into the described platform in so doing opening a wholly new branch of interventional cardiology. Once far-fetched cardiac interventions have now been made plausible with the advance described by Karimov et al though more work is required before these can be realized. Specifically several safety concerns must be addressed before this technique can be responsibly adopted in a clinical setting. In the current form, several liters of crystalloid must be infused through the pulmonary vascular bed for adequate visualization of left-sided cardiac structures and further study is required to demonstrate the safety of this maneuver, especially considering

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Central Message

Exciting development of a novel percutaneous cardioscopic platform capable of providing intracardiac visualization in a beating heart.

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Conflict of Interest: None.

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the delicate fluid balance in the patient population who might benefit from its use. Additionally, transcarotid introduction of the endoscope represents a risk of stroke and access site complications that must be investigated fully.

This is a fascinating technology that represents a significant and formidable advance though must be tempered by concerns regarding the devices safety, efficacy, and utility.

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