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Commentary: 3-Dimensional models in adult cardiac surgery: A gimmick or a futuristic concept?

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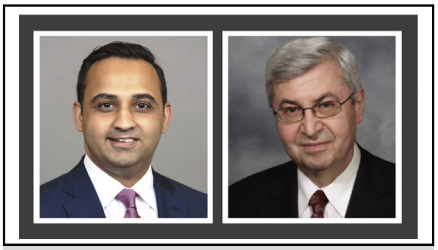

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CENTRAL MESSAGE

The role of 3-dimensional models appears to be emerging in adult cardiac surgery, but the long-term marginal benefit remains to be determined.

Primary cardiac sarcomas account for the majority of malignant primary cardiac tumors and predominantly occur in young patients without risk factors. Although these tumors often have variable phenotypes, they tend to be generally aggressive in nature, resulting in a limited median survival, ranging from 6 to 24 months based on recent series.[1-3] Despite advances in medical therapy and improvement in surgical techniques, surgical debulking is often warranted to improve the oncologic efficiency and overall disease survival.[1-3] A large recent epidemiologic study of 442 patients, for instance, found that both surgery and chemotherapy were associated with improved survival.[3] Some tumors, especially the right-heart sarcomas, often tend to be bulky and infiltrative, which can make the surgical resection challenging. In some cases, extensive resection and reconstruction may be required, but the extent cannot be determined until the time of surgery.

We read with great interest the case report by Kim and colleagues,[4] in which they used 3-dimensional (3D) printing to assist with preoperative surgical planning during the resection of a large primary cardiac tumor penetrating the right ventricle. To achieve an R0 resection, the authors conducted a series of repeated hands-on simulation using a 3D printing model to ensure that they were familiar with the right surgical strategy. To their credit, the procedure did require extensive reconstruction of the right ventricle, the atrial septum, and the coronary sinus orifice, all of which were successful. Fortunately, for the patient, the final pathology was benign with negative margins. First of all, the authors are to be congratulated for their excellent outcome, especially given the high rates of morbidity and mortality associated with surgical resection.[5,6] Second, the authors are commended for their novel use of 3D models to assist in the planning of such a complex procedure. An important limitation was that the authors did not use preoperative magnetic resonance imaging for myocardial tissue characterization, did not perform a biopsy for preoperative tissue diagnosis, as well as did not pursue neoadjuvant chemotherapy despite accumulating evidence supporting its role.[1-3]

In recent years, there is growing interest in adopting 3D models to aid in preoperative surgical planning, especially for complex cases. While the use of 3D models is more prominent in congenital heart cases,[7] thoracic oncologic surgery, and emerging in the planning of complex structural heart procedures such as transcatheter mitral valve replacement,[8] its role for traditional adult cardiac open surgical procedures is still in its infancy.[9] This is likely due to the standardization of most cardiac surgical procedures and the high costs associated with 3D printing. This case provides some food for thought regarding the potential role of 3D models in cardiac surgery but also raises some concern regarding their feasibility, given the lack of robust

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data and standardized guidelines for 3D printing. Thus, although 3D models may aid to minimize short-term complications, their long-term benefit and cost-effectiveness remains to be determined. Time will tell whether this is a gimmick or a futurist concept.

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