

A Fascinating Technique Searching for a Clinical Problem



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The surgical treatment of extensive complex thoracoabdominal aortic aneurysms remains a high-risk endeavor fraught with significant morbidity and mortality. As in all complex cardiovascular surgery, comprehensive and thorough preoperative planning is critical for obtaining the best possible results. Just a couple of decades ago, most patients undergoing open thoracoabdominal aortic aneurysm repair would have had preoperative imaging performed that depended upon aortography—in contemporary practice, this has been primarily usurped by computed tomography (CT).

In aortic surgery, CT scanning historically and initially was with two-dimensional slices.¹ From this, surgeons familiar with anatomy could mentally develop a three-dimensional (3D) construct, from which to plan their approach to repair. Ultimately, CT imaging proved to be vastly superior to angiography, requiring a less invasive approach and delivering a far more desirable, simpler, and safer imaging technique for patients. Software, soon thereafter, was developed to readily create a 3D image that could be accessed by surgeons on the average computer screen. For experienced surgeons, this proved to be a very valuable adjunct and an important step forward in planning surgery.

In another step forward, the authors describe using 3D printing technology to create a mock-up of a thoracoabdominal aortic aneurysm in order to premodify the aortic graft to save time in the operating theater and create a better, anatomically based reconstruction at the time of repair and replacement.² The 3D-printing process is used to generate prototypes from virtual objects using computer-aided design software. The 3D-printing has become of age in personalized medicine and has been a useful tool for reconstructive surgery, such as in maxillofacial surgery, neurosurgery, orthopedics, and now cardiovascular surgery.³

In addition to surgical planning, 3D models can also be useful for training and education, the engineering of personalized



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Central Message

Kim and colleagues describe using three-dimensional (3D) printing technology to create a mock-up of a thoracoabdominal aortic aneurysm in order to premodify the replacement aortic graft to save time in the operating theater and create a better, anatomically based reconstruction at the time of repair and replacement.

aortic devices, vascular tissue bioprinting, and more. Ultimately, there is a future potential for bioprinting of complex organs to be used for transplantation and research. In their manuscript, the authors attribute the 3D-printing model with an improvement in their technical procedure with regards to constructing a vascular graft based on the 3D model and claim that it reduced the operative time by promoting a more straight-forward process of serial anastomosis along with an easier identification of key intercostal arteries.² The authors maintain there is a clear potential for 3D printing to substantially improve surgical outcomes in thoracoabdominal aortic aneurysm repair. Despite explaining their 3D model and utilizing intraoperative photography, as well as photographs and scans of their model, the authors do not precisely describe exactly how the 3D model specifically led to an improved result in this particular case. Finally, this is a single case report with obvious limitations. Essentially, it will be incumbent upon other surgeons to confirm any benefit

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through a larger experience and by comparison to more contemporary experience; benefits potentially include a reduction in operative time and ischemic time for various organs as well as improved anatomical reconstruction.

The authors are to be congratulated for pushing this technology forward and beginning the embryonic process of establishing its benefit.

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