Evaluation of a 3-Dimensionally Printed Simulation Model for Kidney Transplantation



Background

• Surgical simulators have become an integral learning tool for surgery residents

• Three-dimensionally (3D) printed models may provide a low cost option for technical skill development and preoperative planning

• Training models to develop skills necessary for transplant surgery are limited

• We designed a low-cost, reusable, interactive 3D-printed model to simulate vascular anastomoses in kidney transplantation

Methods

• A de-identified high-resolution abdominal and pelvic computed tomography (CT) scan was imported into open source software for segmentation of structures

• Computer-aided design (CAD) software was used to design fasteners to hold Penrose drains to simulate the "recipient" external iliac blood vessels and "donor" renal vessels

• General surgery residents were asked to create end-to-side anastomoses of both the simulated arteries and veins and complete a survey to assess the utility of the model

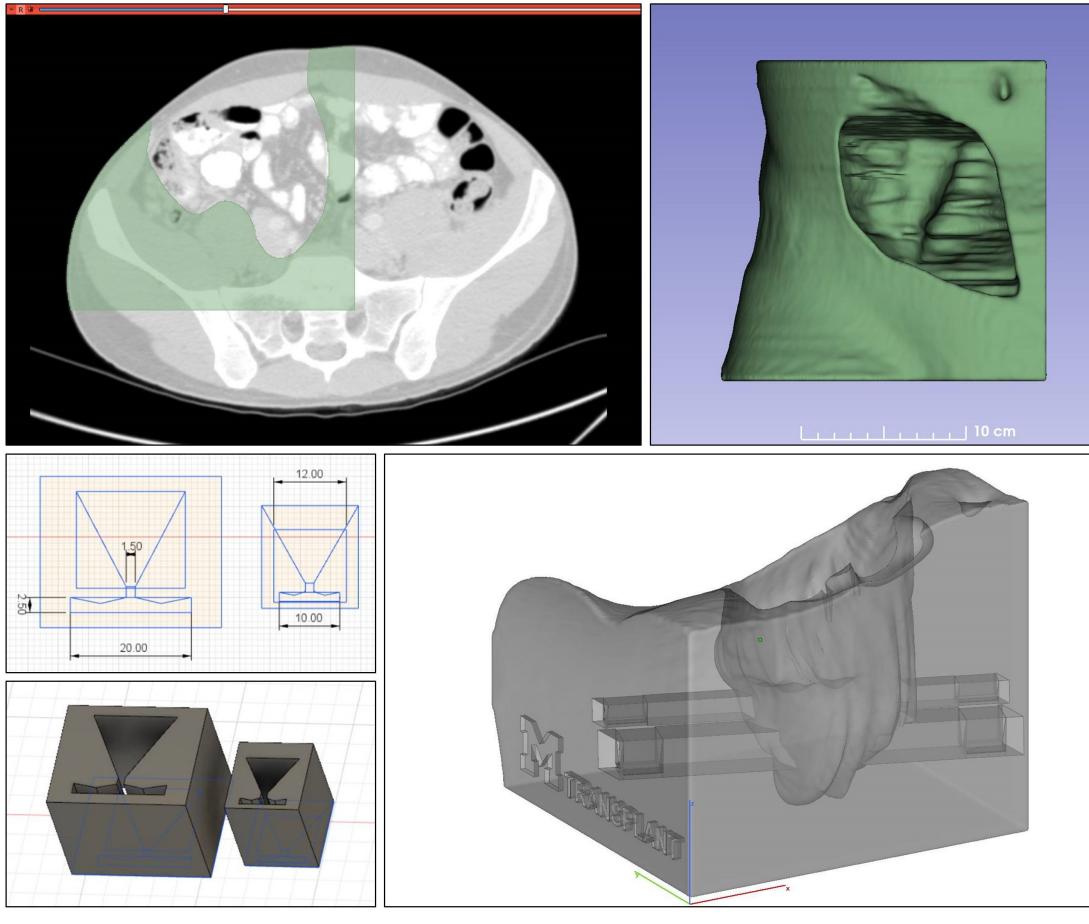


Figure 1: Segmentation of the recipient abdomen (**top**); design of Penrose drain fasteners (**bottom left**); final merged design (**bottom right**)

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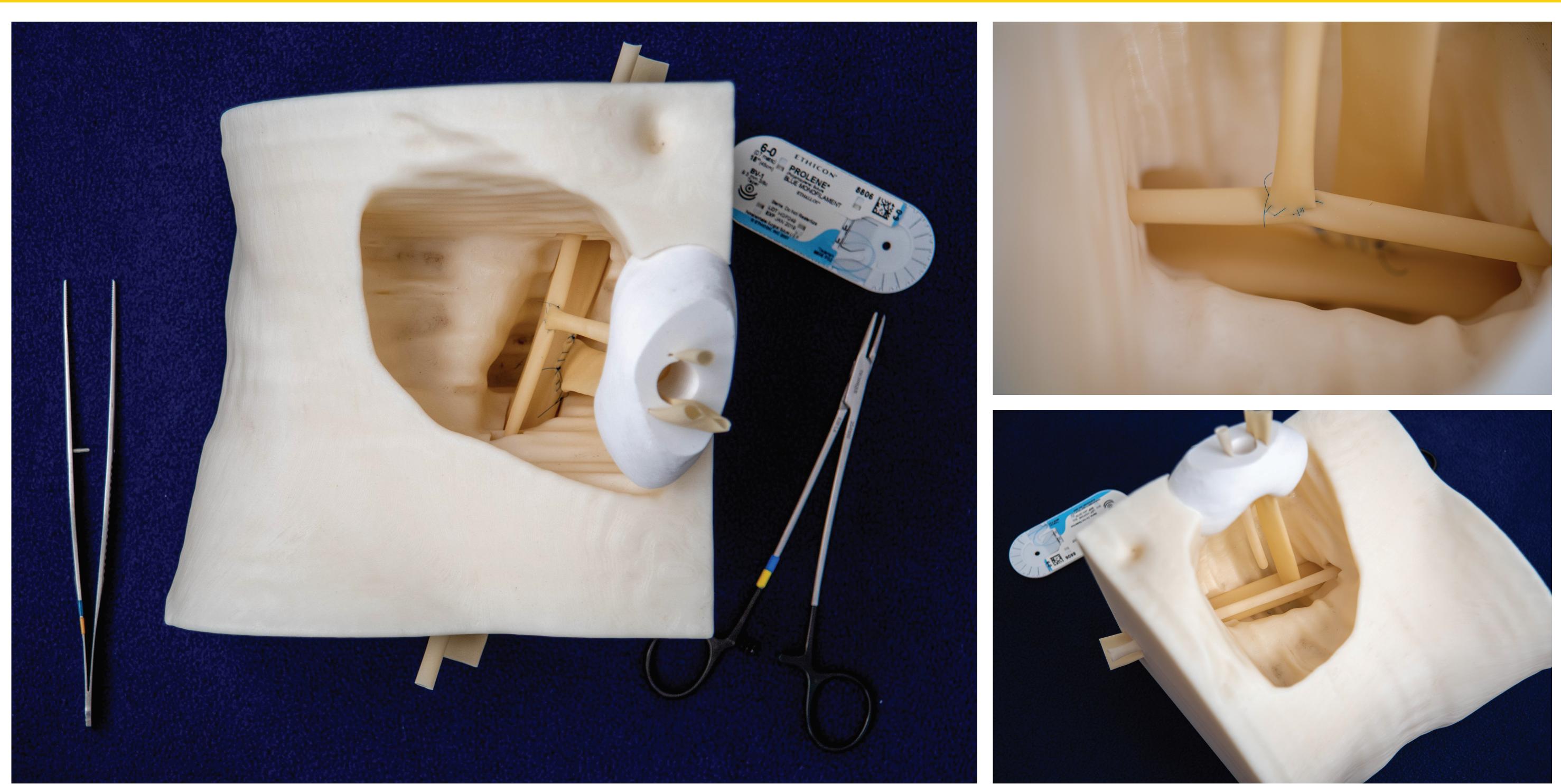
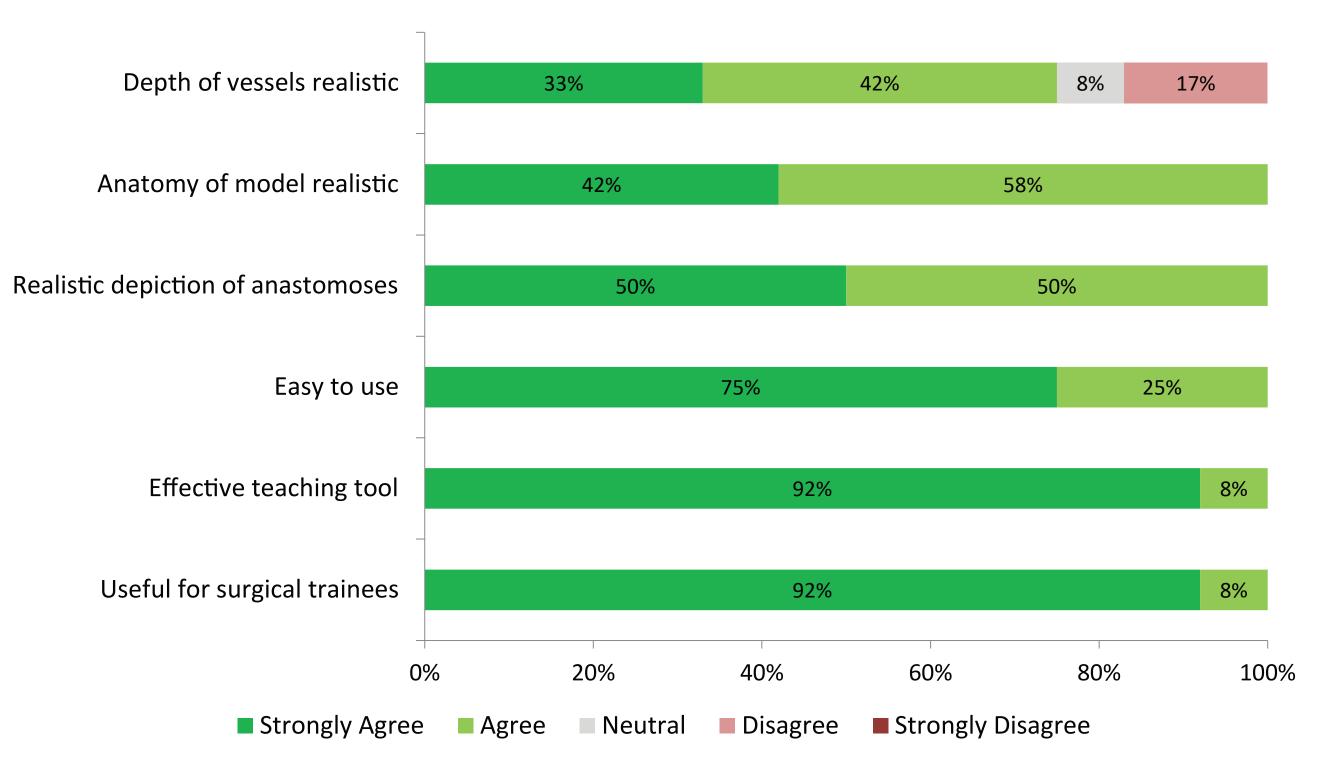


Figure 2: Final 3D-printed model. All components are 3D-printed with the exception of the Penrose drains representing the "recipient" right external iliac artery and vein and the "donor" renal artery and vein. Before (**bottom right**) and after (**left, top right**) tying anastomoses.

Resident Perceptions of Model



Results

- models
- cation



Conclusions

• 3D printing is a cost-effective way to design reusable surgical training

• Residents at our institution found our training model for vascular anastomoses in kidney transplant to be realistic, easy to use, and useful for surgical edu-

This model can be printed and used for education at other institutions

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