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

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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

Results

Resident Perceptions of Model

![Resident Perceptions of Model](image)

- **Depth of vessels realistic**: 92%
- **Anatomy of model realistic**: 92%
- **Realistic depiction of anastomoses**: 75%
- **Easy to use**: 50%
- **Effective teaching tool**: 58%
- **Useful for surgical trainees**: 42%

Conclusions

- **3D printing is a cost-effective way to design reusable surgical training models**
- Residents at our institution found our training model for vascular anastomoses in kidney transplant to be realistic, easy to use, and useful for surgical education
- This model can be printed and used for education at other institutions