

SSM20-01

Biomodeling and 3D Printing for Simulation of Surgical Separation of Conjoint Twins

Wednesday 3:00-3:10 PM | SSM20-01 | NA

PURPOSE

We describe a unique use of biomodeling and 3D printing in the setting of surgical simulation of thoracoabdominal conjoint twin separation.

METHOD AND MATERIALS

Surgical planning on thoraco-omphalo-pyopagus female twins commenced at 7 months for planned separation at 10 months of life. The modeling process was initiated by a volumetric CT using a 320 detector scanner with target mode prospective EKG gating for the cardiovascular structures, and helical ungated acquisition for the chest, abdomen and pelvis. Intravenous contrast was separately administered into both twins, while oral contrast was administered only into 1 twin. Image segmentation yielded individual segments of the skin, skeleton, heart, lungs, airway, GI tract, abdominal vasculature, urinary tract, and gynecologic structures. In preparation for 3D printing, structures to support the models in a vertical position were created. In one operation, polyjet multi-material 3D printing was used to print skeletal structures, base and supports in hard plastic resin, and the organs in rubber like material. The livers were printed as separate pieces of the transparent resin, with the hepatic and portal vessels in white for better visibility. Pegs were designed so the liver could be attached or removed from the assembly. The models were designed such that they could be assembled together or separated during the surgical planning process. Findings on biomodels and 3-D print were compared to findings at surgical separation.

RESULTS

The twins underwent surgical separation by a multidisciplinary surgical team. No discrepancy was noted involving the cardiopulmonary, hepatic, intestinal, renal and skeletal anatomy. Preoperative simulation successfully predicted assignment of the pelvic viscera to each twin based on the vasculature. There was one hemorrhagic complication at surgery, unrelated to preoperative anatomical characterization.

CONCLUSION

We have demonstrated a unique use of 3D modeling and 3D printing for simulation and planning of conjoint twin separation, with representation of the surgically relevant viscera and vasculature in a single 3D printed model.

CLINICAL RELEVANCE/APPLICATION

Describe a novel application of 3D printing for simulating conjoint twin separation, which involves representation of all surgically relevant visceral and vascular anatomy in a single 3D print.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15017835/15017835_kqh3.jpg