Letter to the Editor

The future of surgical simulation

Florentine Huettl, Tobias Huber

Department of General, Visceral and Transplant Surgery, University Medical Center of the Johannes Gutenberg-University Mainz, Mainz, Germany
Correspondence to: PD Dr. med. Tobias Huber. Department of General, Visceral and Transplant Surgery, University Medicine of the Johannes Gutenberg-University Mainz, Langenbeckstraße 1, 55131 Mainz, Germany. Email: Tobias.Huber@unimedizin-mainz.de.
Response to: Yang J, Li E, Wu L, *et al.* Application of VR and 3D Printing in Liver Reconstruction. Ann Transl Med 2022. doi: 10.21037/atm-22-3115

Submitted Jul 13, 2022. Accepted for publication Aug 17, 2022.
doi: 10.21037/atm-2022-44
View this article at: https://dx.doi.org/10.21037/atm-2022-44

It is well investigated that it takes years of experience to mentally reconstruct a 2D CT or MRI scan for anatomical orientation in the liver (1,2). In addition, other disciplines can benefit from 3D reconstructions such as neurosurgery, plastic surgery and cardiothoracic surgery (3). We would like to thank Jun Yang and co-authors for their interest in our work and share their opinion about the importance of new technologies for surgical and anatomical education as well as the improvement of current clinical practice (4). The authors see also a great benefit of 3D reconstructions for anatomical education during medical school. We absolutely support this idea of implementing 3D modeling techniques in medical education.

One more addressed aspect in their comment is the limited use of new technologies due to a technical difficulties and financial costs. We believe that with increasing digitization and rapidly advancing technical innovations, surgeons will have less reticence towards new technologies. Furthermore, healthcare providers will hopefully see the benefits of these technical innovations and enable financing. Furthermore, hard- and software costs for these technologies will be reduced over time. Nonetheless, innovation always require a scientific evaluation of the new technical possibilities according to IDEAL criteria (5). Therefore, we started a prospective randomized clinical trial to evaluate the influence of 3D reconstruction and its visualization technologies on resection planning in liver surgery that includes 3D PDF, 3D PR and 3D VR and a control group (6). Since our own experiences confirm the authors' opinion that 3D reconstruction is not beneficial in simple minor resections, inclusion criteria for the i-LiVR-Trial are major liver resections or minor resections with high complexity. The aim of this study is to evaluate the influence of 3D visualization on volumetry, procedural planning as well as surgical teaching.

The future of medical education lies in the field of virtual and augmented reality. Other professions such as pilots have established VR training for decades. Nevertheless, in surgery structured simulation training prior to operating on patients has still not been fully implemented, yet (3).

In our opinion, for all surgical specialties, realistic and patient-specific procedural simulation will be the key to overcome (parts of) learning curves even in highly demanding procedures. This means not only the mere planning of a procedure, but an actual "test" on individual patient datasets, combined with realistic tissue modelling algorithms and a possibility for complication management. Technological innovations and collaborative efforts will be the only way to reach this level as a new dimension of surgical simulation and preoperative planning.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Annals of Translational Medicine*. The article did not undergo external peer review.

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-2022-44/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Yeo CT, MacDonald A, Ungi T, et al. Utility of 3D Reconstruction of 2D Liver Computed Tomography/Magnetic Resonance Images as a Surgical Planning Tool for Residents in Liver Resection Surgery. J Surg Educ 2018;75:792-7.
2. Huettl F, Saalfeld P, Hansen C, et al. Virtual reality and 3D printing improve preoperative visualization of 3D liver reconstructions-results from a preclinical comparison of presentation modalities and user's preference. Ann Transl Med 2021;9:1074.
3. Meyer-Szary J, Luis MS, Mikulski S, et al. The Role of 3D Printing in Planning Complex Medical Procedures and Training of Medical Professionals-Cross-Sectional Multispecialty Review. Int J Environ Res Public Health 2022;19:3331.
4. Yang J, Li E, Wu L, et al. Application of VR and 3D Printing in Liver Reconstruction. Ann Transl Med 2022. doi: 10.21037/atm-22-3115
5. Bilbro NA, Hirst A, Paez A, et al. The IDEAL Reporting Guidelines: A Delphi Consensus Statement Stage Specific Recommendations for Reporting the Evaluation of Surgical Innovation. Ann Surg 2021;273:82-5.
6. Huber T, Hanke Li, Boedecker C, et al. Patient-individualized resection planning in liver surgery using 3D print and virtual reality (i-LiVR)-a study protocol for a prospective randomized controlled trial. Trials 2022;23:403.

Cite this article as: Huettl F, Huber T. The future of surgical simulation. Ann Transl Med 2022;10(16):916. doi: 10.21037/atm-2022-44

