UNIVERSITÄT BERN
ARTORG CENTER
BIOMEDICAL ENGINEERING RESEARCH

3D Ultrasound based planning for surgical resection of liver tumors

Background

Surgical resection of liver tumors involves removing the part of the liver, typically half (hepatectomy) or a segment (segmentectomy), where the tumor is located and referred to as anatomical resection. Recently, non-anatomical resection approaches are getting popular, as they try to spare as much healthy tissue as possible. This way, only the tumor and a safety margin of 5 – 10 mm are removed and therefore allows multiple resections and re-treatments. However, especially in non-anatomical resections, maintaining the safety margin is challenging as the tumor is removed by cutting around the tumor in a conical shape rather than a plane along anatomical landmarks. To guide the surgeon during this process, we propose an intraoperative 3D ultrasound-based planning method to acquire a cutting plan for the resection.

Aim

To develop and evaluate the accuracy and clinical applicability of 3D ultrasound-based surgical planning methods for non-anatomical resections of liver tumors.

Materials and Methods

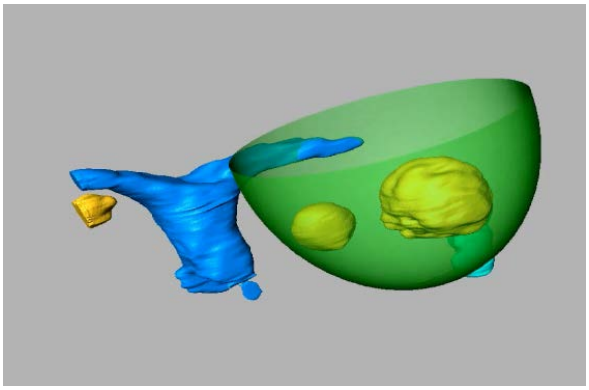
During this project the candidate will develop a surgical planning software that will enable a surgeon to plan a non-anatomical surgical resection based on intraoperative ultrasound data. The candidate will visit laparoscopic liver surgeries at the University hospital to acquire relevant medical knowledge and understand the clinical problem. For planning, anatomical structures (tumor, vessels, surface) will be annotated, extracted from the ultrasound images and merged into a 3D context. Based on this information an optimal cutting surface (e.g. cone, plane) that optimizes the distance between vessels and the tumor (incl. safety margin) will be calculated and visualized in 3D. These steps will be integrated into a software workflow and evaluated in a phantom or ex-vivo experiment. Additionally, the planning method can also be validated on clinical data from previous surgeries.

Work shares of the Thesis

- Image processing: 40 %
- Software development: 40 %
- Experimental study: 20 %

Skills and interests of thesis candidate

- Programming in C++/Python
- Ultrasound image processing
- Interest in soft-tissue surgery
- Image-guided surgery



References

1. Peterhans M, Oliveira T, Banz V, Candinas D, Weber S (2012) Computer-assisted liver surgery: clinical applications and technological trends. Crit Rev Biomed Eng 40:199–220 . doi: 0483b4b8086bdd9c,0c177de128fd39e4

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