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NAVIGATED LAPAROSCOPY - LIVER SHIFT AND DEFORMATION OF MODEL TUMORS IN AN ANIMAL MODEL DUE TO PNEUMOPERITONEUM

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Precise laparoscopic liver resection requires accurate planning and visualization of important anatomy such as vessels and tumors. Combining laparoscopic ultrasound with navigation technology could provide this. Preoperative images are valuable for planning and overview of the procedure, while intraoperative images provide an updated view of the surgical field.

To validate the accuracy of navigation technology based on preoperative images, we need to understand how much the liver shifts and deforms due to heartbeat, breathing, surgical manipulation and pneumoperitoneum. In this study, we evaluated liver tumor shift and deformation due to pneumoperitoneum in an animal model.

Five multimodal tumor models were injected into a porcine liver, and 3D cone beam CT images were acquired intraoperatively before and after insufflation. Tumor translation between pre- and post-insufflation images was determined manually in three axes by subtracting absolute coordinates of the centre of the tumors. Tumor deformation was determined visually after segmentation and overlay of the pre- and post-insufflation image volumes.

The results showed significant tumor position shift due to pneumoperitoneum, with a maximum of 28 mm in cranio-caudal direction. No significant tumor deformation was detected. Small standard deviations suggest rigid body transformation of the liver as a whole, but this needs further investigation.

Tumor translation due to insufflation seems significant and values are in the same order of magnitude as translations due to breathing. The findings therefore indicate a need for anatomic shift correction of preoperative images before they are used in combination with LUS guidance during a laparoscopic liver resection procedure.