Electromagnetically navigated laparoscopic ultrasound.

Abstract:
A three-dimensional (3D) representation of laparoscopic ultrasound examinations could be helpful in diagnostic and therapeutic laparoscopy, but has not yet been realised with flexible laparoscopic ultrasound probes. Therefore, an electromagnetic navigation system was integrated into the tip of a conventional laparoscopic ultrasound probe. Navigated 3D laparoscopic ultrasound was compared with the imaging data of 3D navigated transcutaneous ultrasound and 3D computed tomography (CT) scan. The 3D CT scan served as the "gold standard". Clinical applicability in standardized operating room (OR) settings, imaging quality, diagnostic potential, and accuracy in volumetric assessment of various well-defined hepatic lesions were analyzed. Navigated 3D laparoscopic ultrasound facilitates exact definition of tumor location and margins. As compared with the "gold standard" of the 3D CT scans, 3D laparoscopic ultrasound has a tendency to underestimate the volume of the region of interest (ROI) (Delta3.1%). A comparison of 3D laparoscopy and transcutaneous 3D ultrasonography demonstrated clearly that the former is more accurate for volumetric assessment of the ROI and facilitates a more detailed display of the lesions. 3D laparoscopic ultrasound imaging with a navigated probe is technically feasible. The technique facilitates detailed ultrasound evaluation of laparoscopic procedures that involve visual, in-depth, and volumetric perception of...
complex liver pathologies. Navigated 3D laparoscopic ultrasound may have the potential to promote the practical role of laparoscopic ultrasonography, and become a valuable tool for local ablative therapy. In this article, our clinical experiences with a certified prototype of a 3D laparoscopic ultrasound probe, as well as its in vitro and in vivo evaluation, is reported.