

# Three-dimensional intraoperative ultrasound for intradural spinal tumor

In 11 patients, [Three-dimensional intraoperative ultrasound](#) was performed before and after [tumor resection](#). [Intraoperative computed tomography](#) (iCT) was used for automatic patient registration for spinal [navigation](#); [fiducial](#)-based registration was performed in 1 case. The outlines of the vertebra were defined in preoperative image data by automatic mapping; risk and target structures were segmented manually; all these data were rigidly and if necessary non-rigidly registered with iCT. For 3D-iUS acquisition, tracked convex-shaped [ultrasonic transducers](#) (contact surface: 29 x 10 mm; scanning frequency: 10-3.8 MHz or 13-5 MHz) were used.

Navigated 3D-iUS was successfully implemented in all cases; 3D-iUS [datasets](#) were acquired and could be used as 3D image data for further navigation after iUS scanning. The 3D objects defined in preoperative image data, outlining the [vertebra](#), target and risk structures, could be visualized in the 3D-iUS data. Navigated 3D-iUS allowed to reliably evaluate the [extent of resection](#) in all cases and updating of [navigation](#), ensuring high navigational accuracy. The target registration error applying iCT-based automatic registration was  $0.78 \pm 0.23$  mm. The effective dose for iCT was  $0.11 \pm 0.077$  mSv for cervical and  $1.75 \pm 0.72$  mSv for thoracic scans.

Using 3D-iUS can be successfully integrated into spinal navigation. Automatic registration applying low-dose iCT and non-linear image registration offer to display preoperative images in the same orientation as the 3D-iUS scan, as well as visualizing segmented structures in the navigated 3D-iUS data. This greatly facilitates image interpretation. Navigated 3D-iUS provides a possibility for navigation updating and immediate online quality control <sup>1)</sup>.

<sup>1)</sup>

Saß B, Bopp M, Nimsky C, Carl B. Navigated 3-Dimensional Intraoperative Ultrasound for Spine Surgery. World Neurosurg. 2019 Nov;131:e155-e169. doi: 10.1016/j.wneu.2019.07.188. Epub 2019 Jul 31. PubMed PMID: 31376550.

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Last update: 2024/06/07 02:58

