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Generating panoramic images of the urinary bladder for the digital documentation of cystoscopy findings using Endorama®: Development and first clinical experience

Eur Urol Suppl 2016;15(3);e31

Print!

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INTRODUCTION & OBJECTIVES: In modern urology cystoscopy is essential for diagnosis of various abnormalities of the urinary bladder. Nevertheless, the documentation of suspicious findings is often observer-dependent, barely objective and not always reproducible. The aim of our work is to create panoramic images of the urinary bladder from image data of a video-cystoscopy using the Endorama software®. The achieved bladder panoramas should facilitate a comprehensive and high-quality digital documentation of the cystoscopy findings.

MATERIAL & METHODS: We performed systematic cystoscopies of a bladder phantom (modified CLA 6/4, Coburg, Germany) and subsequently of human urinary bladders (n=10) before and after transurethral resection of a bladder tumour using conventional rigid endoscopes (Ch. 17 and 22, 30° optic). Applying the panorama software, distortion of the images was firstly adjusted based on a calibration reference pattern that was acquired prior to the cystoscopy. Afterwards, automatically selected video frames were registered to each other and overlaid on the basis of appropriate visual features such as vascular formations, in order to arrange them as mosaic in a common coordinate system. This allowed generating partial-panoramic images that were consequently complemented to form a comprehensive panorama of the urinary bladder.

RESULTS: The data of the video-cystoscopy of the hemispheric bladder phantom was transformed digitally and in real-time to a panoramic survey, on which essential land marks of the bladder phantom were reproducible. Die intraoperative video- endoscopies were analyzed using the Endorama® Software. We were able to create panoramic images of the respective human urinary bladders, on which important structures such as the orifices or bladder tumours could well be identified and scoped using zoom and translational function. The movement of the endoscope during the examination could be illustrated as an overlay track onto the panoramas. Comparing panoramic images from endoscopies before and after the resection of a bladder tumour allowed digital documentation of the outcome of the respective surgery.

CONCLUSIONS: Our work proves that generating comprehensive panoramic images of the urinary bladder is technically feasible using the software Endorama®. This could help to facilitate digital documentation of cystoscopy findings and to reduce the observer-dependency of this examination, which has to be evaluated in clinical trials. In the future, a three-dimensional reconstruction of the whole bladder is meant to further improve the digital documentation.