

## DIGITAL ELIMINATION OF IMAGE INTERFERENCES IN THE SURGEON'S FIELD OF VISION IN LAPAROSCOPY

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**Introduction:** In laparoscopy the surgeon's field of vision can be affected by various exogenous influences occurring in the abdominal cavity: Condensation of body fluids and pollution of the lens, production of surgical smoke during electrocautery and ultrasonic dissection, as well as reflections on moist structures, over- and underexposure are the most important disturbing effects. To guarantee safe operation and create a pleasant, clear image on the screen, the surgeon's viewing conditions have to be improved.

**Material and Methods:** This research project concentrates on the development of a new High-Dynamic-Range (HDR) sensor which can be installed in the laparoscopic camera system. Hence, over- and underexposure is avoided by taking three pictures of different exposure time simultaneously and directly fusing these pictures to one image. Additionally, dedicated image processing software is integrated in the system to reduce further negative effects. It allows digital elimination of smoke plumes hovering between the operation field and the laparoscopic camera by real-time level compensation.

**Results:** High-Dynamic-Range cameras provide great potential to improve the presentation of abdominal structures on the screen. The HDR-sensor enables an abdominal exposition, with bright near areas and dark distant areas appearing in consistent illumination. Contrast correction reduces the irritating surgical smoke plumes and achieves a clearer view on the operation field.

**Discussion:** The dynamic range of images can be increased by using a HDR-camera. Compared to conventional Low-Dynamic-Range (LDR) pictures, natural differences of brightness can be presented. However, this leads to a large raw data volume, which has to be processed in real-time. A further challenge is the realistic colour rendering of human structures. The natural colouring of organs is an important feedback for the surgeon to ensure safe operation. In conclusion, the HDR-camera sensor provides helpful potential for image quality corrections in laparoscopic surgery.