

Endoscopic navigation and real-time image processing

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Abstract:

A new visual navigation support system (VNS) for endoscopic interventions allows to extract 3D-information from endoscopic video data and to superimpose 3D-information onto such live video sequences.

Materials and Methods : The endoscope is coupled to a position measurement system and a video camera as components of a calibrated system. We can measure and display anatomical landmarks of the patient as viewed from the current position of the camera. Another module, the so-called *virtual map*, allows the storage of endoscopic images (2-4 images per second) in map form and - in the case where the direct view is lost (bleeding) - the retrieval of virtual images, thus helping the surgeon to maintain a visual impression of the operating field. A special version of the virtual map module with red detector allows to identify in "*red-out*" situations the source of bleeding in previously stored images. This makes an intervention (coagulation) possible for the first time in such situations.

Results: The navigational part of the VNS was used up to now in 10 endoscopic interventions with good success. The coagulation without direct view was successfully tested in animal experiments (175 bleeding situations) resulting in 89,1% successful bleeding stops.

Conclusion: An endoscopic navigation system has been developed which offers the surgeon various modules by directly accessing the image information. The new modules could lead to a revolutionary advance in image-guided surgery. As spin-off, the VNS can be used as comfortable video archiving and retrieval system for high-quality endoscopic images and as a system for training by navigating through endoscopic images from previous operations.