curac2004
3. Jahrestagung der Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie e.V.

Die Entwicklung eines computerbasierten Endoskopischen Ultraschall Simulators (EUS), Zieldefinition und Ergebnisse

Developing a computerized simulator for Endoscopic Ultrasound (EUS)

Stefania Petra[1]

[1]PolyDimensions GmbH

Purpose

Endoscopic Ultrasound has become an important imaging method for the diagnosis and staging of gastrointestinal disorders. It is a highly demanding procedure requiring the mastering ofspecial skills. The current system for education and training lacks skilled instructors, standard training programs, and faces problems of time efficiency, high costs and patient safety. This work describes the release of a computerized simulator for Endoscopic Ultrasound procedures, which includes comprehensive training programs and practice of the complicated manoeuvring required with the EUS scopes, anatomical interpretations, therapeutic applications and feedback on performance.

Methods

The first challenge to be achieved was anatomical correctness: The solution was found in the creation of the 3D-model sets based on real patient CT/MRI images. For a real-time performance, the resulting 3D-models need to be very small with regard to polygon count without losing detail or information. Also no intersections or gaps are allowed between organs or within themselves. Since not every needed anatomical structure is to be seen in the one chosen set a combination of more sets is necessary. This goal is reached with the help of different programs and several collision detection tools. To generate the EUS images in real-time using the 3D anatomical model as mentioned above,
innovative software was developed, based on EUS medical parameters. A special algorithm was used to present the correct „slice" of the 3D set for the linear and the radial image, maintaining a high frame-rate while creating the complex and correct EUS image on screen.

Results

The resulting EUS simulation software is an Add-On Module to the Simbionix GI Mentor. It consists of a mannequin, on which the procedure is performed and a real endoscope modified for simulation needs. A highly sensitive tracking system translates position and direction of the camera into realistic computer generated images. The EUS Module allows the trainee to switch from the endoscopic view to the corresponding Ultrasonographic Image as true-to-life images in real-time. The user has virtually unlimited EUS situations offering unlimited training possibilities. Many implemented tools
and guides further improve the quality of teaching: instant labelling of organs in EUS view, various color illustration for different organs, split-screen, zoom capabilities, calliper tool, documentation of the examination, evaluation and more.

Conclusion

On one simulation platform, trainees are able to practice and improve their competence in performing EUS procedures on a wide variety of virtual patients at different levels of complication and difficulty. He reduces costs in education and risks for patients, enables objective assessments and evaluation. This unique EUS training tool will enable to standardize the training. Subsequently the EUS Simulator can and should be considered as an essential step in the teaching and training of physicians.