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Training of Regional Anaesthesia Supported by Patient-Specific Virtual Physiological Human (VPH)-Based Models

O. Grottke¹, J. E. E. de Oliveira², B. O'Donnel³, M. Van de Velde⁴, A. Greindl⁵, R. Rossaint¹, T. M. Deserno²

1. Uniklinik RWTH Aachen, Department of Anaesthesiology, Aachen, Germany
2. Uniklinik RWTH Aachen, Department of Medical Informatics, Aachen, Germany
3. University College Cork, Department of Anaesthesia, Cork, Ireland
4. Catholic University of Leuven, Department of Anaesthesiology, Leuven, Belgium
5. Uniklinik RWTH Aachen, Clinical Trial Center Aachen (CTC-A), Aachen, Germany

Background: Training tools for learning and improving regional anaesthesia's (RA) skills are currently limited. Therefore, the Regional Anaesthesia Simulator and Assistant (RASimAs) project has the goal of increasing the application, the effectiveness of RA by combining a simulator ultrasound-guided and electrical nerve-stimulated through an integration of image processing, physiological models and subject-specific data, and virtual reality (VR).

Methods: This on-going project is performed of experts from academia, industry, and clinics. For realistic and individualized modelling of RA, two commercial 3D anatomical models are extended with respect to structures (e.g., the fascia), and mechanical tissue properties. Patient-specific virtual physiological humans (VPH) models are composed registering the general mesh-based models with patient voxel-data recordings. The results include anatomical and mechanical properties of the tissues compatible with real-time simulation.

Results: Extending a previous prototype [1], the RA simulator component recreates RA procedures in a virtual environment, which allows the trainee to practice on various anatomies avoiding on-patient training. The medical simulator is applicable to all body regions of relevance and supports RA training using electrical nerve stimulation, ultrasound (US) guidance, or a combination of both. Also, an advanced haptic framework allows a complete immersion in a virtual environment combining stereoscopic rendering and US probe interaction.

Conclusion: Instead of relying on generic models and by fitting automatically relevant patient data into VPH template models, the RASimAs project will enhance the state of the art.

1. Grottke O, Ntouba A, Ullrich S, et al. Virtual reality-based simulator for training in regional anaesthesia. Br J Anaesth. 2009;103(4):594–600.