Towards realistic patient-specific human models for virtual reality regional anaesthesia simulation

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Background

- **European project 2013 - 2016**
- 14 university, medical and industrial partners
- Regional anaesthesia: • Difficult technique to locate the nerve • Requires advanced medical skills • Is underused in medical routine
- **Need for extensive training and assistance**

Objectives

- Need for accurate virtual models of the human body
- Need for patient-specific virtual models for the simulator and the assistant

Project approach

- **Sparse patient data**
- **3D complete generic virtual model of the body**
- **Registration**
- **3D complete patient-specific virtual model**

Study objectives

- Building of a reliable 3D generic model for the use in regional anaesthesia
- Focus on the femoral region for femoral nerve block simulation and assistance

Study approach

- Start from an existing 3D model of the whole body
- Correction/Add of incorrect or missing structures important for femoral nerve block: femoral nerve and fascia iliacus and lata

Materials & Methods

- Manual planar displacement of the femoral nerve contour to correct its position in relation to the iliopsoas muscle contour of the model
- Automatic planar morphological merging and dilatation \cite{1} of the structures inside the subcutaneous fat to create the fascia lata contour
- Automatic 3D dilatation of the femoral nerve mesh to create the fascia iliacus mesh

Assistant

**Enhanced anatomy support**

- 3D view of the patient
- Patient-specific model
- Augmented ultrasound
- Interpretation of structures
- Probe/needle tracking

Results

- **Cross-section slices every 1 mm in the femoral region**
- **Visual quality check by an anatomist for use of the corrected model in the framework of the simulator**

Conclusion & Perspectives

- Use of image processing and computer graphic techniques to improve existing 3D models for regional anaesthesia simulation and assistance
- Validation of two 3D anatomical model, male & female, for femoral nerve block simulation within RASimAs

This study emphasizes the need for reliable 3D models for virtual-reality medicine.

- **Whole-body models: possibility of extension of the method in the future for other body regions**
- **Current study of registration of these whole-body models on patient-specific data for personalised simulation and assistance**

References
