We limited access to the platform with a password. Editing rights were restricted to users with an account provided by the wiki administrator only. Of course, no confidential patient data were to be introduced in the database and all illustrations had to be anonymized carefully before upload.

We analyzed data logged by the server for a period of 6 month, including time spent on the wiki, number of access and daytime access.

Results: The wiki actually consist of 247 pages assigned to 14 categories and generated within 1.5 years. The number of files (★.pdf, ★.swf, ★.jpg) uploaded is 345.

During the 6 month period, an increase in number of users, pages visited and data volume accessed was observed. However traffic from within the hospital is directed over a proxy-server and therefore counted as one single user. The access statistics demonstrated a clear circadian course, during working hours with a second peak at 9 pm. This clearly indicates the necessity for out of work accessibility.

Two thirds of the visited pages related to team scheduling and the main page containing actual information. One third of all accesses were for medical articles dealing with anesthesia management and echocardiography.

One half of the visits on the wiki lasted for maximum 15 min; the other visits lasted up to 1 h.

Discussion: This wiki implementation compares quite favourably with the more cumbersome setup of intranet solutions requiring the long term commitment of group members and redirecting manpower away from the clinical core business and teaching (7).

Transesophageal echocardiography (TEE) is a widely used diagnostic tool for the evaluation of heart structure and function during cardiac surgery (8). The video extension in the wiki is an exceptionally valuable tool to display loops and images from TEE recordings. This is used in the actual development of an interactive online textbook for teaching and learning TEE.

The limitations to the system consist actually in forwarding the IP address through the proxy server for the editing function.

Moreover, every wiki underlies the network effect, where quality improves when more users contribute. Since we cannot lower the effort it takes for writing articles, we have to maximize the value a user obtains from the platform to profit from this effect.

An important point for the future is quality management. A peer review system where every editing has to be controlled by selected reviewers is under development.

Conclusion: A wiki knowledge database is well suited for medical SOP documentation, learning and access and easily edited for up to date information. It can improve development and maintenance of collective knowledge, especially with continuous staff turnover.

REFERENCES

1. Schüpfer G. Anästhesisten lernen - lernen Institutionen auch? Der Anästhesist 2007 - 56: 983–991.
2. Cunningham W, Leuf B. The Wiki Way. Collaboration and Sharing on the Internet. Boston, MA: Addison–Wesley Professional, 2001.
3. Stahmer T. "Think Outside the Blog." Technology & Learning. 2006; 26(6):28.
4. Harris ST, Zeng X. Using wiki in an online record documentation systems course. Perspect Health Inf Manag. 2008 Jan 30; 5:1.
5. McGee JB, Begg M. What medical educators need to know about "Web 2.0". Med Teach. 2008 Mar; 30(2):164–9.
6. Sauer IM, Bialek D. "Blogs" and "wikis" are valuable software tools for communication within research groups. Artif Organs. 2005 Jan; 29(1):82–3.
7. Weiss JB, Campion TR Jr. Blogs, wikis, and discussion forums: attributes and implications for clinical information systems. Medinfo. 2007; 12(Pt 1):157–61.
8. Sheikh KH, de Bruijn NP, Rankin JS, et al. The utility of transesophageal echocardiography and Doppler color flow imaging in patients undergoing cardiac valve surgery. J Am Coll Cardiol 1990;15:363–72.

10. REGIONAL ANAESTHESIA IN VIRTUAL ENVIRONMENTS

Grottke, O[1]; Ullrich, S[2]; Fried, E[3]; Deserno, T[3]; Kuhlen, T[2] & Rossaint R[1]
[1]*Department of Anaesthesiology, RWTH Aachen University Hospital, Aachen, Germany;* [2]*Virtual Reality Group, RWTH Aachen University, Aachen, Germany;* [3]*Department of Medical Informatics, RWTH Aachen University, Aachen, Germany*

Introduction: The successful accomplishment of regional anaesthesia (RA) requires profound theoretical knowledge and repeated performance of RA to gain sufficient manual skills [1]. Despite the increasing use of simulators to learn and improve medical skills, the adoption of mannequins for RA training is limited by patient variance, inaccurate representation of biological tissue, and physical wear from repeated use. However, interactive virtual reality (VR) simulators are potentially valuable to overcome these constraints [2]. In an interdisciplinary approach, we

therefore launched the Regional Anaesthesia Simulation (RASim[a], http://www.rasim.info/) project [3, 4].

Methods: Individual subject-specific data is obtained non-invasively without contrast agent from magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) representing morphology and vascular structures, respectively. For data handling, registration, and segmentation, an application is developed on the basis of the Medical Imaging Interaction Toolkit (MITK), the Insight Segmentation and Registration Toolkit (ITK), and the Visualization Toolkit (VTK). Additional segmentation algorithms are integrated, and a hierarchical tree data structure is created to simulate the flexible anatomical structures of peripheral nerve cords. The simulator is implemented in the VR toolkit ViSTA. Several modules for collision detection, virtual humanoids, interaction, and visualization are applied. To simulate needle interaction and electric impulse transmission, a novel approach based on electric distances is developed. A pilot study among ten residents, who had to perform a femoral nerve block, is carried out with the simulator (Figure 1a) and systematically evaluated using a 24-item questionnaire on a 5 point Likert-scale ranking between 1 (best) and 5 (worse). Furthermore, our individualized image data is compared with a current state-of-the-art commercial dataset (Zygote, USA), [5] that consists of geometry and textures representing the anatomy of a male subject (Figure 1b). The PHANTOM Omni Haptic Device (SensAble Technologies, USA) is used for realistic control of the instruments and to provide the optional force feedback. Results are expressed as mean ± SD.

Results: MRI and MRA data were obtained from 5 individuals from the inguinal region. Relevant data were successfully extracted employing our new software. Further differentiation of anatomical structures was realised using an ontology subdividing and describing tissue types as well as cavities. As nerves cannot be sufficiently visualized, virtual nerve cords were modelled according to a hierarchical data structure along anatomical landmarks. The simulator utilized this data and consistently applied the developed modules for collision detection, virtual humanoids, interaction, and visualization. Needle interaction and electric impulse transmission was simulated realistically.

The user study showed an overall acceptance (1.8 ± 1.6) with the ease of use of the simulator. Also the anatomy and identification of landmarks were highly rated (2.2 ± 1.6), both for our and the Zygote datasets. Further, we did not reveal any advantage of the commercial dataset. Despite the use of a 3D navigation, 90% of the participants stressed the importance of the incorporation of sophisticated haptic feedback allowing the tactile perception of tissue resistance.

Discussion: In order to create a VR-based simulator, we successfully introduced a highly flexible software structure using sophisticated algorithms and multimodal representations of anatomy. This approach allows creating individualised VR patients for training a variety of RA blocks to enhance realism and user acceptance. The success of this concept was also confirmed by our pilot study, which further showed, that the quality of our imaging approach is comparable to commercial available data sets. Prospective research will include the extension of other anatomical regions and the integration of ultrasound to perform peripheral nerve blocks.
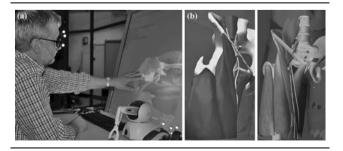

Fig. 1. (a) User exploring the VR-based simulator (left); (b) A manual segmented dataset (middle) and the commercially available Zygote dataset (right) are shown.

REFERENCES

1. Smith AF, Pope C, Goodwin D, Mort M. What defines expertise in regional anaesthesia? An observational analysis of practice. Br J Anaesth 2006; 97: 401–7.
2. Gurusamy K, Aggarwal R, Palanivelu L, Davidson BR. Systematic review of randomized controlled trials on the effectiveness of virtual reality training for laparoscopic surgery. Br J Surg 2008; 95: 1088–97.
3. Grottke O, Ntouba A, Ullrich S, Liao W, Fried E, Prescher A, Deserno TM, Kuhlen T, Rossaint R. Virtual reality-based simulator for training in regional anaesthesia. Br J Anaesth 2009, in press.
4. Ullrich S, Grottke O, Fried E, Frommen T, Liao W, Rossaint R, Kuhlen T, Deserno TM. An intersubject variable regional anaesthesia simulator with a virtual patient architecture. Int J Comput Assist Radiol Surg 2009, in press.
5. Zygote Media Group (2009) 3D Models and 3D Animations of the male and female anatomy. http://www.3dscience.com (accessed July 2009).