

A modular and open OR integration system and its application to neurosurgery

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Background: Integration of medical devices and IT systems as well as centralized control of the integrated system in the operating room (OR) has been recognized for its potential to increase the overall surgical efficacy, ergonomics and the clinical workflow. Today, commercially available integrated OR systems are characterized by a proprietary and closed design. This work presents an OR integration infrastructure, which is based on open and standardized communication protocols that has been clinically evaluated.

Methods: The design of the open OR integration system is based on clinical requirements and use cases that have been recorded using a structured requirements engineering approach. The integration system is based on the concept of a service-oriented architecture and interconnects medical devices, imaging modalities, hospital information systems and systems for computer assisted surgery, e.g. navigation. The functionality of the integrated OR system is available at a control console within the sterile field. Thus, the clinical personal has centralized access to preoperative imaging and planning data within PACS, customized display configurations, data acquisition, medical device functions and OR documentation close to the surgical situs. The overall system has been evaluated within neurosurgical interventions. Functional and ergonomic aspects as well as clinical user acceptance have been recorded using questionnaires addressing 15 different aspects.

Results: The clinical evaluation study successfully demonstrated the practical feasibility and clinical benefits of the integrated OR system. The proposed system integrates relevant information at ceiling mounted displays in the surgeon's direct line of sight. This enables the surgeon to better assess the current clinical situation and increases the overall ergonomic conditions within the OR. Basic functions, which formerly interrupted the surgical workflow, e.g. adjusting device parameters or acquiring screenshots can be immediately accomplished by the surgeon or scrub nurse using the sterile control console. Data acquired during intervention are automatically labeled with the electronic patient context and can be seamlessly documented within PACS, thus eliminating the need for removable media. Current research efforts aim on the development and extension of the integrated system towards a surgical workflow management system to further improve surgical processes within the operating room.