Structure and benefits of a telemedicine supported emergency ambulance system

Objectives: Demographic change, rising co-morbidity and an increasing number of emergencies are the main challenges that Emergency Medical Services (EMS) in several countries worldwide are facing. In order to improve quality in EMS, highly trained personnel and well-equipped ambulances are essential. However several studies have shown a deficiency in qualified EMS physicians. Telemedicine emerges as a complementary system in EMS that may provide expertise and improve quality of medical treatment on the scene. Hence our aim was to develop, to test and to introduce a specific tele-consultation emergency system in routine care.

Methods: Telemedical functionalities including audio communication, real-time vital data transmission, 12-lead electrocardiogram, picture transmission on demand and video streaming from a camera embedded into the ceiling of each ambulance and in mobile devices which were used at the scene outside the ambulance were incorporated in the hardware part of the system. The developed medical software is algorithm and guideline-based. Upon completion, technical field tests were performed under realistic conditions to test system properties such as robustness, feasibility and usability providing end-to-end measurements. Finally, the system was used in real out of hospital emergencies as part of routine care.

Results: In the pilot phase six ambulances were equipped with telemedical facilities based on the results of the requirement analysis and 55 scenarios were tested under realistic conditions in one month. The results indicated that the developed system performed well in terms of usability and robustness. The major challenges were as expected, mobile communication and data network availability which was possible in >99% at the end of the development period. After demonstrating the feasibility of the telemedical approach more than 1000 patients were treated within the project phase. In the meanwhile all ambulances of the city of Aachen are staffed with this telemedicine equipment and the system has been established as an additional structure in the care of out-of-hospital EMS. So far, more than 2000 patients have been treated with the help of this telemedicine-based out-of-hospital emergency system.

Conclusions: An innovative concept for the use of telemedicine for medical consultations in EMS was developed. Organizational and technical aspects were considered and practical requirements specified. The feasibility of the telemedical approach was demonstrated. Tele-consultation enabled early initiation of treatments by paramedics operating under the real-time medical direction. Tele-consultation can be used to provide advanced care until the patient is under a physician's care; moreover, it can be used to support the paramedics who work alone to provide treatment in non-life-threatening as well as in life-threatening emergencies.

Biography

Rolf Rossaint is a Professor and Head of the Department of Anesthesiology at the University Hospital (since 1997). Prior to his present appointment, he was Associate Professor in the Clinics for Anesthesiology and Surgical Intensive Care at the Humboldt University of Berlin. He is member of the National Academy of Science Leopoldina. He has (co) authored over 500 articles in peer-reviewed journals. His clinical and research interests include pulmonary pathophysiology, ARDS treatment, extracorporeal lung assist, xenon anesthesia, coagulation management, and telemedicine in emergency medicine. He developed a holistic telemedicine system for a broad spectrum of different pre-hospital emergency cases, which acts now on a routine basis synergistically to the existing ground- and air-based rescue systems.

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