MEFANET report 05

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ADVANCED CLINICAL CASE PLAYER FOR DATA-DRIVEN EDUCATION BASED ON REAL SEVERE SEPSIS CASES

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Abstract

The EPOSS/SEPSIS-Q project has been running in the Czech Republic since 2011. The key activity of this project includes a research database in which data about patients with severe sepsis and septic shock are inserted retrospectively. An advanced infrastructure has been developed enabling data utilization from everyday clinical practice for innovation of clinical teaching. The implementation of the first two pilot tutorial cases fulfilled the attractive idea of data-driven education.

Keywords

clinical education, e-learning, clinical cases, severe sepsis, intensive care medicine

Introduction

Severe sepsis and septic shock are still associated with high morbidity and mortality rates. Severe Sepsis Bundles have been designed recently by the international Surviving Sepsis Program (www.survivingsepsis.org) with the expectation of considerable reduction in mortality due to severe sepsis and septic shock. Since 2011 the EPOSS project (data-based Evaluation and Prediction of outcome in Severe Sepsis) has been running in the Czech Republic. The key activity of this project includes a multicentric research database in which data about all consecutive patients, who met criteria for severe sepsis within 24 hours of admission to ICU, are inserted retrospectively. The EPOSS project aims to advanced analytical reports on the typology of patients as well as on potential risk factors that can be used to optimize the management of severe sepsis patients.

In parallel to the EPOSS research database (http://eposs.registry.cz), an educational portal SEPSIS-Q (http://www.sepsis-q.cz) has been launched, which focuses on information and educational cultivation of this specific field of intensive care medicine. One of the main added values of the SEPSIS-Q portal is a clinical case collection drawn up in a tutorial manner. Source data for the tutorial cases are taken from the EPOSS research database. Thus, EPOSS
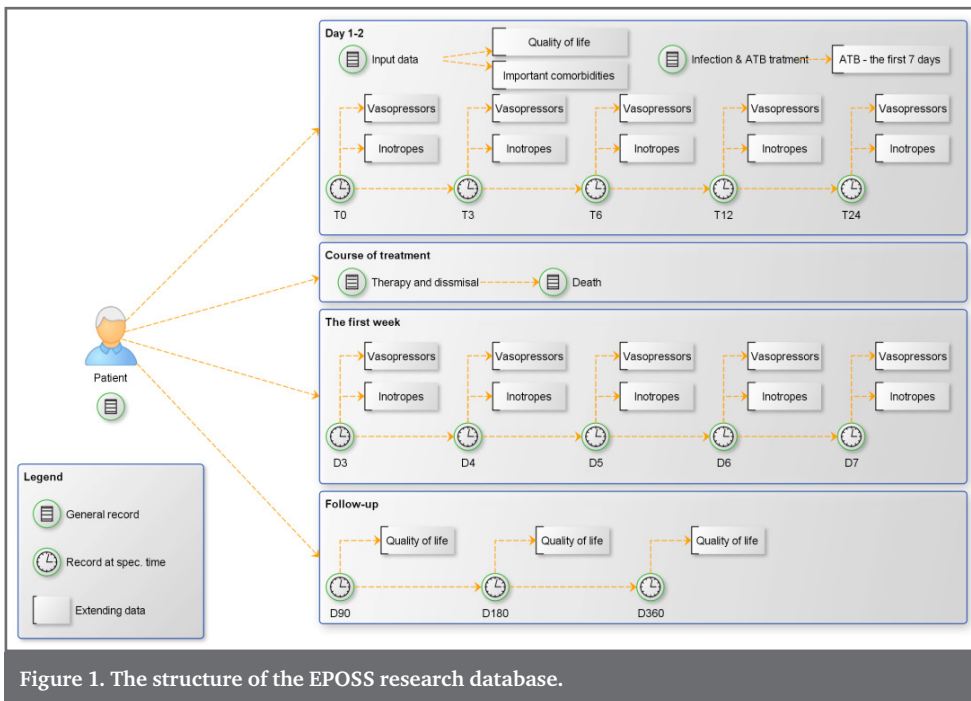
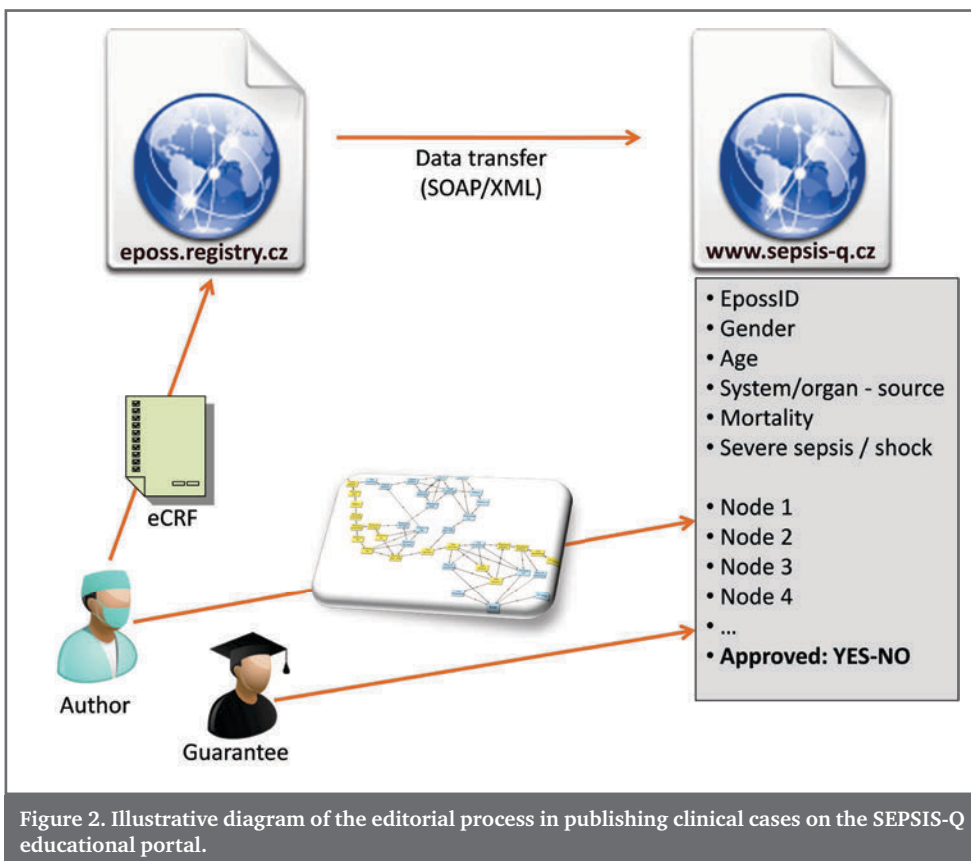**Figure 1. The structure of the EPOSS research database.**

Figure 2. Illustrative diagram of the editorial process in publishing clinical cases on the SEPSIS-Q educational portal.

Figure 3. A screenshot from the backoffice application of the SEPSIS-Q educational portal. The upper bar: list of available modules. The main frame: the module for clinical cases.

and SEPSIS-Q tools fulfill the attractive idea about data-driven medical education, which was presented by Dušek et al. in [1] as one of the main pillars for medical education in the MEFANET (MEdical FAculties NETwork) [2–4].

Our concept of the clinical cases for medical education was developed based on the Interactive Algorithms for Acute Medicine [5–6], which compose the main part of the digital content on the AKUTNE.CZ educational portal. The very important benefit of our case-based teaching lies in the information synthesis. It is not just a text chapter or an image material that is utilized by students in their learning process, but also the scenario, in which each student is drawn and within which he/she takes advantage of his/her knowledge. The real clinical cases may become the basis for Problem-Based Learning (PBL) sessions. PBL is one of methods used often in well-developed countries for training physicians and healthcare professionals to develop their clinical reasoning skills and competencies, often referred as abilities to think critically. This is not a revolutionary innovation – detailed information on PBL can be drawn from [7, 11]. Alternatively, clinical reasoning training can also be approached using the case-based learning (CBL) method. However, the CBL method does not include useful pedagogical features to ensure that students are not disconnected from real situations to a virtual computer world. This includes the following PBL principles: 1) classes are held in small groups of students, 2) sessions are not teacher-centered, but moderated by a tutor according to the principle of "too much teaching kills the learning", 3) students hustle learning
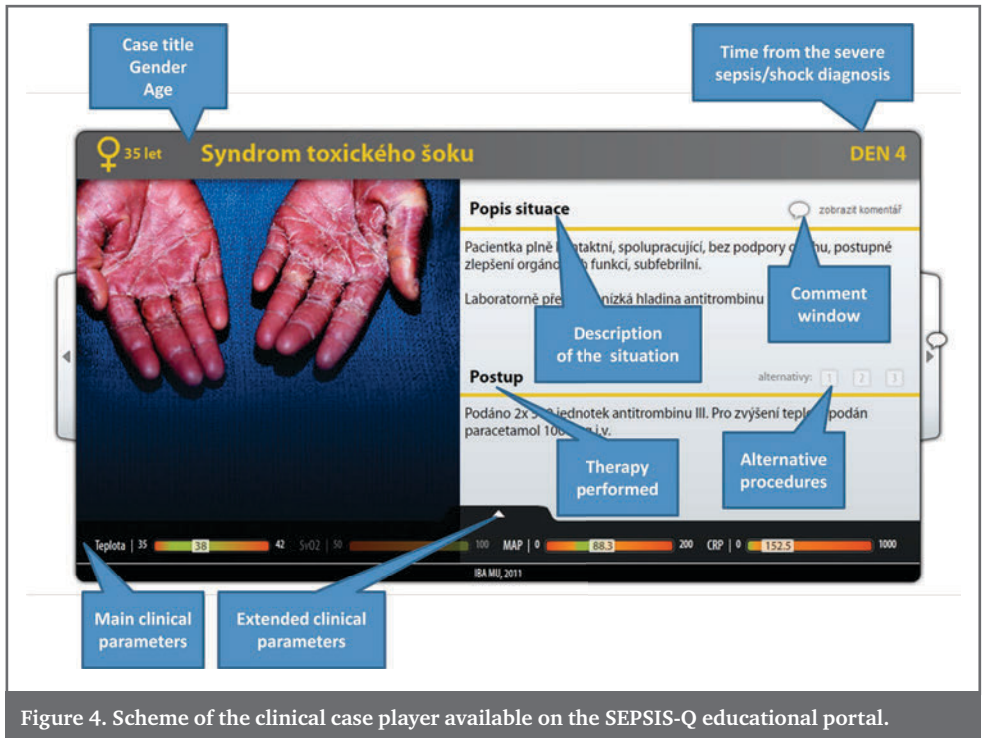
Figure 4. Scheme of the clinical case player available on the SEPSIS-Q educational portal.

materials themselves and lecture to each other, 4) PBL sessions are complemented with properly and coherently selected theoretical lectures.

Methods and tools: what is behind the SEPSIS-Q cases

EPOSS research database

The data acquisition system is operated in the academic environment of the Institute of Biostatistics and Analyses at Masaryk University in Brno. The system is constantly accessible over the internet, the EPOSS portal URL is: http://eposs.registry.cz. Parametric data are stored from a set of on-line forms that include input data (meeting the criteria of severe sepsis, birth date, gender, clinical workplace), clinical parameters in 10 time stages during the first seven days of hospitalization, as well as information on anti-infective therapy on the course of the disease and finally the information on dismissal, *see Fig. 1*. Further, there are data inputs for follow-ups in the 90th, 180th and 360th days from diagnosis, as well as a form to describe the causes and date of patient's death. Retrospective medical records are the only source of data for the EPOSS research database. No direct person identifiers are allowed to store in there.

SEPSIS-Q educational portal

The main content sections of the portal are: A) clinical cases, B) current events about sepsis, C) monitoring of scientific journals, D) calendar, E) best practices (guidelines), F) useful links. The glue between both the tools

www.sepsis-q.cz and eposs.registry.cz are the clinical cases. For hundreds of consecutive patients in the EPOSS research database, suitable cases are selected for education. Those are selected by experienced teachers from the participating clinical sites and subsequently upgraded to didactically appropriate level. This process includes also anonymisation of individual cases.

Editorial procedures for each individual case are illustrated in *Fig. 2*. It is clear from the diagram that all finished cases have to be additionally approved by a guarantee designated by the Board of the EPOSS/SEPSIS-Q project.

The SEPSIS-Q educational portal is equipped with a backoffice application (PHP/MySQL), which enables convenient and comprehensive web content management. For the purposes of clinical cases management a separate module has been developed – its screenshot is shown in *Fig. 3*. The module is operated by the authors of clinical cases as well as by the guarantees.

Player: how the clinical cases are presented

After a clinical case was completed and approved, it becomes immediately available on-line through the clinical case section of the SEPSIS-Q educational portal. The cases are sorted here by mortality, gender, severity of sepsis and with organ/systems that are the primary source of sepsis. Each case is presented by its title, abstract and information about the author. Selecting a case from the collection activates a player, which takes the form of a flash object executed in Adobe flash player environment. Clear presentation of one of the nodes in the case of toxic shock syndrome in a young woman is shown in *Fig. 4*.

Results

After one and a half years of collecting nearly 490 parametric records about severe sepsis and septic shock patients into the EPOSS research database, the first two pilot tutorial cases were created, both with seven nodes and both accompanied by pictures and video sequences. Summaries of these two cases follow.

Bleeding in the digestive tract as a major symptom of severe urosepsis
Patient with haematemesis and melaena admitted to perform an acute gastrofibroscopic examination. A surgical source of bleeding found, signs of sepsis were presented. When searching for origo, a dilatation of the right kidney hollow system found. Followed by a development of septic shock and respiratory failure. The patient was sent to ICU for further treatment. Massive inotropic and vasopressor support, CRRT and haemodynamic monitoring. Progressive stabilization of circulation, decreasing the dose of catecholamines, repeated bleeding into the nephrostomy – coagulopathy and thrombocytopenia. Nephrostomy extracted, JJstent introduced, then, after a short time, patient was extubated. Rehabilitation initiated and intermittent hemodialysis

continued. Patient translated to internal medicine department's ICU on the 14th day and sent to the local hospital on the 18th day.

Toxic shock syndrome

Young woman admitted unconscious to the clinic of infectious diseases, a history taken from her husband: vomiting, diarrhea and fever lasting one day. Laboratory and clinical examination confirmed the diagnosis of septic shock. A much used vaginal tampon removed from the patient. Empirical antibiotic therapy started, circulation supported by vasopressors, patient transported to ICU. Followed by stabilization of circulation, correction of the internal environment and septic coagulopathy, normalization of the fluid balance, rehabilitation. Development of the erythema on the legs and chest followed by hands, wrists and feet. Increased sensitivity and burning in tongue. On the 5th day, patient translated back to the clinic of infectious diseases. On the 15th day, patient's dismissal to home care, no problems, no swelling, no erythema.

Conclusions

The EPOSS/SEPSIS-Q research project aimed on monitoring of medical care in patients with severe sepsis and septic shock allowed development of an advanced infrastructure enabling data utilization from everyday clinical practice for innovation of clinical teaching. The implementation of the first two pilot tutorial cases fulfilled the attractive idea of data-driven education.

The web-based tools eposs.registry.cz and www.sepsis.cz belong to the top of the field of Medical education informatics – thanks to the applied technology and methodology. The learning objects created with the two tools can be used both for face-to-face teaching, as well as for CBL/PBL sessions. The EPOSS/SEPSIS-Q project not only delivers the first comprehensive information on how severe sepsis and septic shock is treated in the Czech Republic, but may also advance the education of future clinicians who will be able to influence the outcome of the medical care.

Acknowledgements

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