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Brief Report

A SURVEY OF THE FIRST-HOUR BASIC CARE TASKS OF SEVERE SEPSIS AND SEPTIC SHOCK IN PEDIATRIC PATIENTS AND AN EVALUATION OF MEDICAL SIMULATION ON IMPROVING THE COMPLIANCE OF THE TASKS

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☐ **Abstract—Background: Application of the sepsis resuscitation bundle is limited by clinician knowledge, skills, and experience. We used the adjusted first-hour basic care tasks in pediatric patients in three tertiary hospitals in Shanghai, China. Objective: The aim of this study is to survey the compliance of the adjusted tasks and to evaluate in situ simulation team training on improving the compliance. Methods: A prospective observational study was performed with the survey checklists from May 2011 to January 2012 in three pediatric intensive care units. A simulated case scenario was administered to the practitioners in one hospital. Results: Seventy-three patients were enrolled, including 47 patients in one simulation hospital (SH) and 26 patients in two nonsimulation hospitals (NSH). The total compliance of the tasks was 47.9% (35/73). The compliance in the SH was significantly higher compared to that in the NSHs (61.7% [29/47] vs. 23.1% [6/26], $p < 0.01$). Compared to the SH, the main problems in the NSH were giving intravenous or intraosseous fluid resuscitation in a longer time (35.3 min vs. 19.9 min, $p = 0.000$), a smaller percentage of measurement of accurate urine output (38.5% vs. 68.1%, $p = 0.027$), delivering high-flow oxygen (73.1% vs. 93.6%, $p = 0.028$), and measurement of lactate (69.2% vs. 100%, $p = 0.000$). Conclusions: In situ simulation team training is an effective method of teaching the tasks of septic shock care to clinicians and nurses on the front line and of improving the compliance of the tasks.** © **2015 Elsevier Inc.**

☐ **Keywords—sepsis; shock; simulation; pediatric**

INTRODUCTION

Pediatric severe sepsis and septic shock represent one of the leading causes of childhood mortality worldwide. The Surviving Sepsis Campaign (SSC) published guidelines and resuscitation bundles to standardize patient care and further drive change on mortality and morbidity in adult and pediatric sepsis (1–4). Improved resuscitation bundles compliance is known to lower mortality (8%) in pediatric septic patients and to reduce mortality risk (19%) in adult patients (5,6). Despite this, only 8–30% of pediatric septic shock patients were managed according to the guidelines and resuscitation bundles, and even lower bundle compliance was reached in China (2,5,7–10). Barriers that limit adherence to the bundles include complex diagnostic criteria leading to recognition delays and educational or behavioral gaps (8,10,11). In recognition of poor compliance and the barriers, we used the adjusted first-hour basic care tasks, which Robson and Daniels in 2008 designed to facilitate early intervention within the first hour in meeting the patients with sepsis and septic shock, and in situ simulation team training for pediatric intensive care unit (PICU) and emergency department (ED) residents and nurses, to improve the performance of the tasks (12,13).

The aim of this prospective observational study is to survey the compliance of the adjusted first-hour basic

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care tasks of septic shock in pediatric patients in Shanghai and to evaluate in situ simulation team training on improving the compliance of the tasks.

METHODS

Study Design and Setting

A prospective, observational cohort, multicenter survey on the management of pediatric patients with severe sepsis and septic shock in the first hour was conducted from May 2011 to January 2012 in three PICUs of tertiary teaching hospitals in Shanghai, China. Hospital participation was by direct invitation without financial incentive. All facilities were staffed with full-time intensivists responsible for triage and patient care. Informed consent was not required.

Hospital participants were asked to describe the typical management in the first hour (we used the adjusted first-hour basic care tasks, which Robson and Daniels in 2008 had designed) of these patients in their critical care units (12,13). The adjusted tasks of severe sepsis and septic shock consisted of seven protocols: 1) deliver high-flow oxygen, 2) take blood cultures and other cultures considering the source control, 3) get intravenous/intraosseous (i.v./i.o.) in 5 min, 4) administer empirical broad-spectrum intravenous antibiotics, 5) measure serum lactate, 6) start i.v. fluid resuscitation, and 7) measure accurate urine output.

Patient Selection

Included patients were diagnosed with severe sepsis or septic shock at an ED or ICU according to the guidelines for diagnosis of severe sepsis, septic shock, and acute organ dysfunction published by the International Sepsis Definitions Conference (2008) and SSC (4). Patients with trauma, surgical operation, seizure, acute congestive heart failure, hypovolemic or obstructive shock, and a do-not-resuscitate order were excluded.

Interventions and In Situ Simulation Team Training with Septic Shock Patients

Septic shock patient in situ simulation was performed in one hospital PICU every 3 months for 1 year prior to the survey. The Laerdal baby patient simulator (Laerdal Medical, Stavanger, Norway) provided a realistic patient in septic shock. The case scenario started with a 10-month-old male patient, with no previous medical history, presenting with a 2-day history of upper respiratory tract infection and fever. He was admitted to the PICU for septic shock. His vital signs included temperature 39.3°C, heart rate 182 beats/min, blood pressure 67/30 mm Hg, respiratory rate 52 breaths/min, and SaO_2 92%. He was lethargic and had prolonged capillary refill time and mottled skin, with petechiae and ecchymoses on both legs. The parameters were provided by the course instructor (PICU attending). The patient was then treated by a team of one chief resident, two nurses, and two residents (who rotate to PICU or ED). The team members played the role of a leader (the chief resident), a nurse for intravenous infusion, a nurse for the medication preparation, a proceduralist for i.o., intubation and other airway management, and a recorder. The team was given 20 min to complete the simulation. The team members were asked to provide details about resuscitation tasks including the laboratory investigations, fluid infusion, oxygen delivering, medications, and any other monitor or operational performance. The course instructor served as the role of family members, consultant, and laboratory technician, as needed. The instructor assisted the participants with task completion and provided general guidance as well.

Data Collection

Data were collected prospectively using a case report survey form. All participating centers and staff were provided with detailed study aim and data collection information. A single physician was individually designated for data collection supervision in each ICU. Each patient dataset was required to be complete by the residents who were supervised by the data collection physician in each ICU.

The survey form (Figure 1) included the patient's demographics, vital signs, laboratory data, diagnosis, source of infection, and management of the first-hour basic care tasks. The survey form was sent out in May 2011 by e-mail. Data collection was closed in January 2012.

Statistical Analysis

Qualitative data were described as numbers and percentages (n, %), normally distributed quantitative data were described as mean ± SD. Mean qualitative variables were compared using chi-squared tests or Fisher's exact test. When normality and homogeneity assumptions were satisfied, quantitative variables were compared with t tests. All significance tests were two-tailed. p-values < 0.05 were considered statistically significant ($p < 0.05$). Data were analyzed using SPSS 17.0 (SPSS Inc., Chicago, IL).

RESULTS

For the case reports, 73 patients were enrolled, including 47 patients in one simulation hospital (SH) and 26

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