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Corrigendum to "Effects of polymyxin B hemoperfusion on hemodynamics and prognosis in septic shock patients" [J Crit Care 43 (2018) 202–206]

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ABSTRACT

Purpose: We designed this study to examine the clinical effects of polymyxin B hemoperfusion (PMX-HP) in septic shock patients.
Material and methods: We retrospectively examined the effects of PMX-HP in septic shock patients with intra-abdominal or gram-negative bacterial infection during October 2013–May 2016. A one-to-one matching between the PMX-HP and conventional groups was performed, and 28-day mortality, and change in inotropic score, Sequential Organ Failure Assessment (SOFA) score, and Acute Physiology and Chronic Health Evaluation II (APACHE II) score at 24 h in the two groups were compared. In addition, multivariable regression analysis and Cox proportional hazards regression model were applied in all eligible patients.
Results: Sixty-nine patients were eligible, of whom forty-eight patients were enrolled for matched cohort analysis. In matched cohort analysis, median change in inotropic score after 24 h (−23 [−33-−13] vs. −12 [−19-0], $p = 0.007$) differed significantly between the PMX-HP and conventional groups. Multivariable regression analysis revealed that PMX-HP was associated with lower 28-day mortality (odds ratio 0.18, 95% CI 0.04–0.92, $p = 0.039$) and greater improvement in inotropic and APACHE II scores.
Conclusions: PMX-HP may have potential benefits for hemodynamic and prognostic outcomes in septic shock patients with intra-abdominal or gram-negative bacterial infection.

1. Introduction

Endotoxin, a major component of gram-negative bacterial outer membrane, is a key factor in the pathogenesis of severe sepsis and septic shock, and endotoxin-targeted therapy has been developed in recent decades [1,2]. Polymyxin B immobilized fiber cartridge is one of the devices that has been proven to effectively remove endotoxin [3-5]. Many clinical studies have access the potential benefit of polymyxin B hemoperfusion (PMX-HP) in septic shock patients with intra-abdominal infection or systemic gram-negative bacterial infection. The EUPHAS randomized controlled trial [6] and a meta-analysis [7] have both suggested that PMX-HP significantly improves hemodynamics and reduces the risk of organ dysfunction and 28-day mortality in patients with septic shock. However, a recent Japanese nationwide database retrospective study [8] reported no survival benefit of PMX-HP in abdominal septic shock patients. In another recent randomized controlled trial [9], PMX-HP nonsignificantly increased the 28-day mortality by 8.2% in peritonitis-induced septic shock patients after surgery. These remarkable differences in the results is attributable to the differences in the studied populations, thus raising the question whether PMX-HP has clinical benefits only in well-defined septic shock patients [10] with appropriate disease severity and prompt initiation of PMX-HP treatment. Due to the discrepancy of results from different studies, we performed a retrospective study to examine the effects of PMX-HP in septic shock patients with intra-abdominal or gram-negative bacterial infection in a medical center of Taiwan.

Abbreviations: AKI, (acute kidney injury); APACHE, (Acute Physiology and Chronic Health Evaluation); CI, (confidence interval); CPR, (cardiopulmonary resuscitation); CRRT, (continuous renal replacement therapy); GI, (gastrointestinal); MD, (mean difference); OR, (odds ratio); PMX-HP, (polymyxin B hemoperfusion); SD, (standard deviation); SOFA, (Sequential Organ Failure Assessment).

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2. Materials and methods

2.1. Study design and selection of patients

This is a retrospective cohort study of critically ill patients diagnosed with septic shock during October 2013–May 2016 in five surgical intensive care units (5 SICUs; 61 beds) of a medical center in Taiwan. This study was approved by the Research Ethic Committee of National Taiwan University Hospital (201605108RINB). Septic shock patients who met one of following inclusion criteria were selected: (1) with intra-abdominal infection, having received emergent abdominal surgery or drainage procedure and (2) with evidence for systemic gram-negative bacterial infection under adequate antibiotic treatment. Septic shock was defined according to the consensus definition of the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference Committee [11]. The exclusion criteria were: (1) those who were younger than 20 years or older than 90 years, (2) pregnant women, (3) those who had experienced uncontrolled hemorrhage within 24 h before ICU admission, (4) those who had undergone cardiopulmonary resuscitation within 24 h before ICU admission, (5) those who had undergone organ transplantation within 1 year, (6) those diagnosed with immunodeficiency disorder, and (7) terminally ill patients with a do-not-resuscitate order. All septic shock patients received sepsis management according to the Surviving Sepsis Campaign guidelines in our hospital [12]. Patients who received PMX-HP treatment were allocated to the PMX-HP group, and the others were allocated to the conventional group. Hemoperfusion was performed for 2 h in the ICU by using an extracorporeal hemoperfusion cartridge with polymyxin B immobilized on polystyrene fibers (Toraymyxin, Toray Industries Inc., Tokyo, Japan). Unfractionated heparin was used as the anticoagulant according to the manufacturer instructions, and the dose of heparin was adjusted according to patients' clinical condition by intensivists. When required, the subsequent session of PMH was performed 24 h after the end of the prior session.

2.2. Data collection and outcomes

Patient characteristics, clinical data, and prognoses were collected through complete medical chart review. Inotropic score, Sequential Organ Failure Assessment (SOFA) score [13], and Acute Physiology and Chronic Health Evaluation II (APACHE II) score [14] were obtained at baseline and 24 h after. For patients admitted for septic shock, the baseline was defined as the ICU admission when the requirement of norepinephrine was >0.1 mcg/kg/min or when the requirement of norepinephrine increased to >0.1 mcg/kg/min. For patients not admitted for septic shock, the baseline was defined as the time when the norepinephrine requirement increased to >0.1 mcg/kg/min after septic shock onset. Inotropic score was calculated as 100 × epinephrine dose (mcg/kg/min) + 100 × norepinephrine dose (mcg/kg/min) + dopamine dose (mcg/kg/min) + dobutamine dose (mcg/kg/min) [15]. For this study, we defined hemodynamic outcome as the change in inotropic score after 24 h and prognostic outcomes as 28-day mortality, and the change in SOFA score or APACHE II score after 24 h.

2.3. Matched cohort analysis and regression analysis

A one-to-one matching between the conventional group and the PMX-HP group was performed on the basis of demographic data including age, gender, and baseline SOFA score. As matching excluded patients who were not selected in the process, we conducted regression analysis

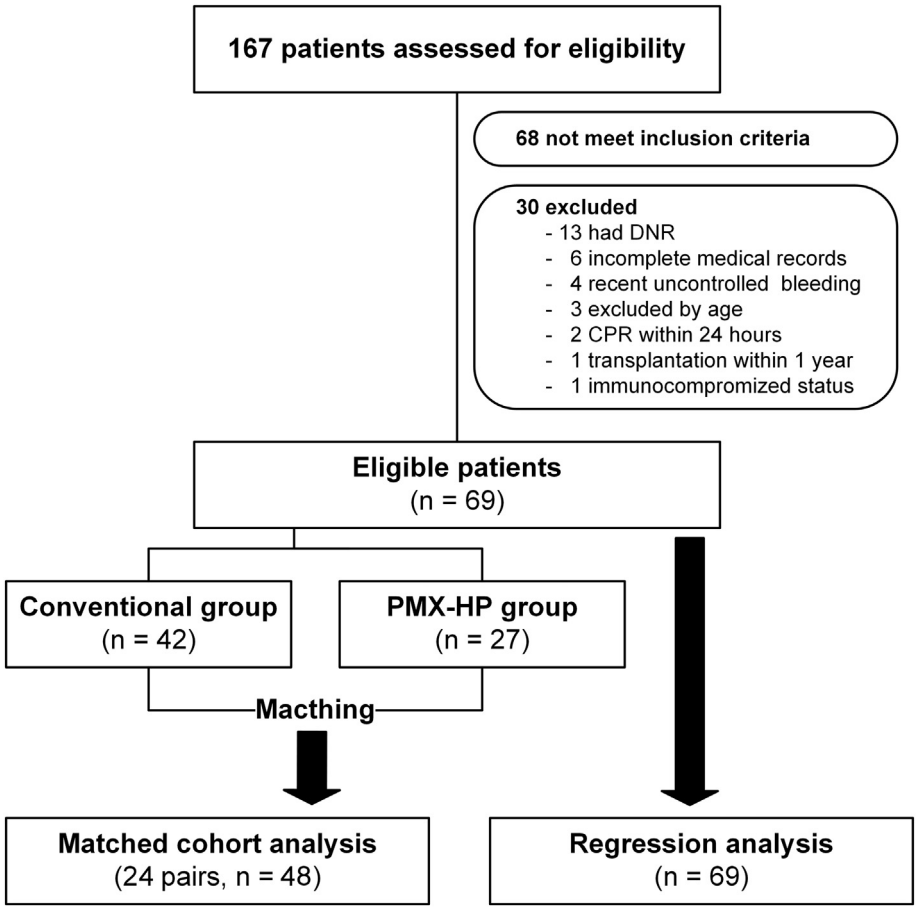

Fig. 1. Study flowchart CPR, cardiopulmonary resuscitation; DNR, do-not-resuscitate; PMX-HP, polymyxin B hemoperfusion.

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