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Hemodynamic management of critically ill burn patients: an international survey

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Fluid resuscitation is a cornerstone of the initial management of severely burned patients with the dual purpose of avoiding both under- and over-resuscitation [1–3]. There is a lack of consensus regarding the ideal amount and type of fluid and vasopressor use during initial resuscitation in this population [4, 5].

This international survey focuses on the current practices regarding hemodynamic management of severely burned adult patients (total body surface burn area (TBSA) > 20%, with mechanical ventilation) in the early phase after injury.

The study was designed as an electronic survey addressed to intensive care unit (ICU) physicians. Experts of the European Society of Intensive Care Medicine (ESICM) Burn ICU working group were invited to review the original survey. The final questionnaire (32 questions) is provided in Additional file 1. A link to an electronic questionnaire was sent to all ESICM members (with reminding emails on a bimonthly frequency) and was posted on the ESICM website. The link was active between 31 August and 18 October 2017.

There were 173 total respondents to the questionnaire. The respondents were from 58 different countries (72% were high-income countries) with most in Europe (62%). The background of the respondents was mainly intensive care (61%) and anesthesiology (31%). Most of the respondents (61%) declared working in a mixed ICU, and 60% of the responders worked in centers with less than 50 adult burn patients admitted annually. Additional file 2 summarizes the difference in participant responses between burn centers and nonspecialized centers. In 76% of the cases, a local protocol for fluid resuscitation was used. The Parkland formula (4 ml/kg/%TBSA) is used to start volume therapy on admission by 54% of the responders. In the first 48 h, the five most frequently used parameters to guide volume therapy are represented in Fig. 1a. Fifty five % of the respondents declared monitoring cardiac output and 65% among them use echocardiography. Techniques used to monitor cardiac output continuously are presented in Fig. 1b. The most commonly used crystalloid and colloid were respectively Ringer Lactate and albumin 20%. Triggers to initiate colloid infusion are presented in Fig. 1c. While considering other strategies to reduce fluid requirements, 80% of responders consider early norepinephrine administration (Fig. 1d).

The results of this international survey highlight the use of albumin (> 60%) and vasopressors (80%) during the early resuscitation phase. Heterogeneous results were reported regarding monitoring strategies, early

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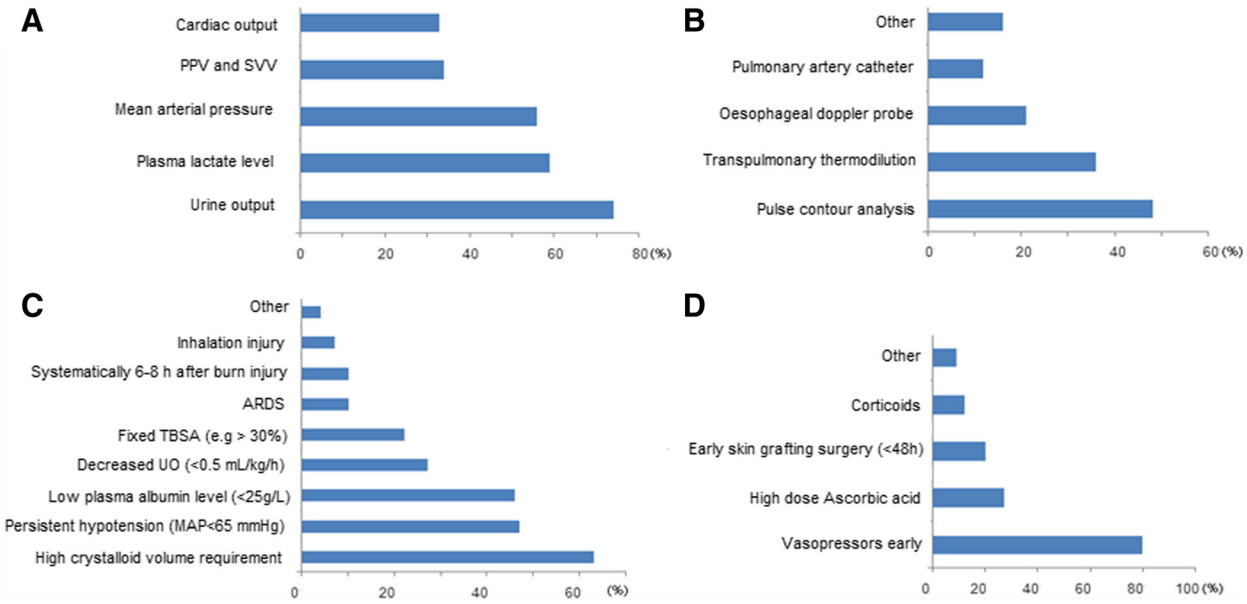

Fig. 1 **a** The five most frequently used parameters to guide volume therapy in severely burned patients. **b** Techniques used to monitor cardiac output continuously. **c** Triggers to initiate colloid infusion. **d** Adjunctive therapies to reduce initial volume administration. ARDS acute respiratory distress syndrome, MAP mean arterial pressure, PPV pulse pressure variation, SVV stroke volume variation, TBSA total body surface burn area, UO urine output

vasopressors, and albumin use between burn centers and nonspecialized centers. Large clinical trials should be initiated in the near future to determine optimal strategies to treat burn-related shock.

Additional files

Additional file 1: Survey questions. (PDF 131 kb)

Additional file 2: Comparison of participant responses between burn centers and nonspecialized centers. CO cardiac output, *n* number of respondents per group. The results are reported as numbers and percentages (%). The chi^2 and Fischer tests were used as appropriate ($p < 0.05$). (PDF 155 kb)

Abbreviations
ESICM: European Society of Intensive Care Medicine; ICU: Intensive care unit; TBSA: Total body surface burn area

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Availability of data and materials
Figure 1 is original and has never been published.

Authors' contributions
SS and ML collected and analyzed the data. The manuscript was written by SS and ML and critically revised by all coauthors and ESICM Burn ICU working group experts. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Not applicable.

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Competing interests
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