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Predicting value of prehospital body temperature for ICU admission of septic shock patients

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Abstract

To specify whether an association exists between pre-hospital body temperature collected by the emergency medical services (EMS) call centre, and intensive care unit (ICU) admission of patients with septic shock.

An observational study based on data collected by the EMS of Paris. All septic shocks were included.

Among the 140 calls concerning septic shock, 22 patients (16%) were admitted to ICU. The mean core temperature was $37.4 \pm 1.6^\circ\text{C}$ for ICU and $38.6 \pm 1.1^\circ\text{C}$ ($p < 4.10^{-5}$) for non-ICU patients. Using propensity score analysis, the relative risk for ICU admission of patients with pre-hospital fever or hypothermia was 0.31 and 2 respectively.

The study highlights the potential usefulness of early temperature measurement in septic shock patients to allow early proper orientation.

Introduction

The incidence of septic shock has been stable in the last years, reaching 250 per 100 000 inhabitants per year in the United States.^{1,2} Its epidemiology and consequences in terms of care-related morbidity and mortality are well known, with an estimated mortality rate of 30% at day 28 and an overall hospital mortality rate of 40%.^{3,4}

The prognosis of septic shock relies on the early identification of patients at high risk of poor outcome to rapidly implement appropriate treatments.⁵ In the prehospital setting, patient's evaluation is usually based on their past medical history and physical examination. In France, the *Service d'Aide Médicale d'Urgence* (SAMU), equivalent to the Emergency Medical Service (EMS), manages out-of-hospital emergencies, using a national access call number, the number 15.⁶ The SAMU regulation call centre dispatches to the scene a paramedic team for non-severe cases, or a medical team for life-threatening emergencies.⁷ Thereafter, based on the related patient's clinical status, the call centre allows proper orientation of the patient either to the emergency department (ED) or directly to the intensive care unit (ICU). Decision-making is left to the physician's discretion and usually based on organ failure evaluated by vital signs (Glasgow coma scale, blood pressure, heart rate and respiratory rate). Fever, defined as a body temperature over 38°C , is one of the most often used criteria to get the diagnosis of sepsis, and is included in most scores and guidelines.⁸

In this retrospective work from the SAMU registry, we evaluated whether an association exists between prehospital body temperature and admission to the ICU of septic shock patients managed by an EMS team.

Results

Between April 1st and May 31th 2011, 30 642 calls were received by the regulation call centre at the SAMU 15 of Paris. One hundred forty calls concerned patients with septic shock.

Patient's demographic data and **initial (parameters collected at the first medical contact)** prehospital clinical characteristics are summarized in Table 1. The mean prehospital body temperature reached $38.4 \pm 1.3^\circ\text{C}$.

The suspected and documented origins of septic shock are given in Table 2. Origin of septic shock was mainly pulmonary (49%) (Table 2). No microbiological documentation was found in 22% of the cases (Table 2).

Twenty-two patients (16%) were admitted to the ICU and 118 were admitted to the ED. Patients admitted to the ICU were more hypotensive, had higher respiratory rate, lower pulse oximetry value and were more frequently immunosuppressed. **Immunosuppression was defined by the presence of one or more elements between: diabetes mellitus, chronic renal insufficiency, immunosuppressive treatment, infection by human immunodeficiency virus and/or C hepatitis viral. These elements were collected in prehospital reports established from patient and/or relatives' declarations and from hospital medical reports.**

The mean prehospital body temperature of patients admitted to the ICU was $37.4 \pm 1.6^\circ\text{C}$ and reached $38.6 \pm 1.1^\circ\text{C}$ ($p < 4.10^{-5}$) for those admitted to the ED. The mean length of stay in the ICU reached 8.5 ± 3 days (1–45). Thirteen patients (9%) were dead at day 28.

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Table 1. Septic shock patient's demographic data and clinical characteristics.

Quantitative data are expressed as mean with standard deviation and qualitative as absolute value and percentage. P value corresponds to the comparison between patients admitted to the ICU and to the ED.

Variable	Overall patients (n=140)	Patients admitted to the ICU (n=22)	Patients admitted to the ED (n=118)	P value
Age (years)	64±23	67±14	64±24	0.53
Male gender	76 (54%)	15 (68%)	61 (52%)	0.15
Immunosuppression	86 (61%)	19 (86%)	67 (57%)	8.10 ⁻³ *
Systolic blood pressure (mmHg)	117±28	96±12	121±28	8.10 ⁻³ *
Diastolic blood pressure (mmHg)	67±19	53±14	69±19	0.002*
Mean blood pressure (mmHg)	83±21	67±12	86±21	3.10 ⁻⁵ *
Heart rate (beats/min)	109±21	112±20	108±21	0.46
Respiratory rate (cycles/min)	25 [15-49]	28 [22-40]	24 [15-49]	0.03*
Pulse oximetry (%)	96 [50-100]	90 [55-98]	96 [50-100]	0.007*
Glasgow coma scale	15 [10-15]	15 [12-15]	15 [10-15]	0.06
Temperature (°C)	38.4±1.3	37.4±1.6	38.6±1.1	4.10 ⁻⁵ *

The receiver operating characteristic (ROC) curve presented an area under the curve (AUC) of body temperature of 0.74 [0.63-0.86] for ICU admission (Figure).

In the multivariate analysis prior adjustment, a significant association between ICU admission and body temperature (OR = 0.54 [0.32-0.85], $p=0.01$), diastolic blood pressure (OR = 10.28 [1.59-92.71], $p=0.02$), mean blood pressure (OR = 0.03 [0.01-0.48], $p=0.02$) and systolic blood pressure (OR = 3.20 [1.24-9.82], $p=0.02$) was observed. No significant association was found between ICU admission and the immunosuppression status. After adjusting for confounding factors using a propensity score, including systolic blood pressure, heart rate, respiratory rate and immunosuppression status, the relative risk (RR) of ICU admission of septic shock patients for prehospital fever was 0.31, while the RR for hypothermia reached 2, suggesting that patients

with fever were less frequently admitted to the ICU compared to hypothermic patients which were twice more frequently admitted to the ICU. **The overall mean NEWS (national early warning score)⁹ was 7±3, 9±4 in the hypothermia group and 7±4 in the fever group ($p<0.05$).**

Discussion and conclusion

Sepsis is a complex multifactorial entity with individual and collective clinical and biological involvement in organizational and economic terms. In this observational study, we observed an association between prehospital body temperature and ICU admission in patients with septic shock.

A relationship between time-to-treat sepsis and mortality is currently widely accepted, suggesting

Table 2. Suspected and confirmed origin of septic shock.

Data are expressed as absolute value and percentage.

	Suspected origin	Confirmed origin
Pulmonary	74 (53%)	69 (49%)
Abdominal	22 (16%)	20 (14%)
Urinary	20 (14%)	13 (9%)
Subarachnoid	7 (5%)	0 (0%)
Ear Nose Throat	3 (2%)	3 (2%)
Dermatological	3 (2%)	0 (0%)
Gynaecological	1 (0.5%)	2 (1%)
Bone	1 (0.5%)	2 (1%)
Unknown	9 (6%)	31 (22%)

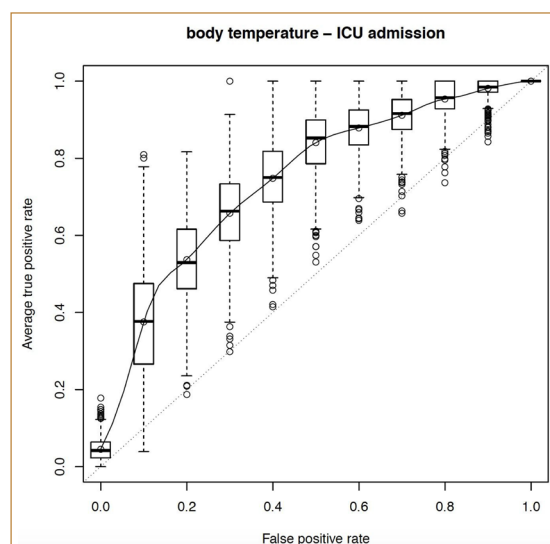


Figure. Receiver operating characteristic (ROC) curve of body temperature for ICU admission

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that early recognition and prompt initiation of treatments are key elements to improve patient's outcome.^{5–8,10} The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)² pinpointed that efforts had to be made to improve the early identification and the severity of septic patients with high risk of poor outcome. None in-hospital scores showed efficiency in the pre-hospital setting,¹¹ including the qSOFA score which remains highly controversial. In septic shock, fever was reported in 82–88% of the cases.^{12–14} Indeed, fever is a common symptom often used as an alarm sign to get the diagnosis of sepsis, despite the fact it may not always be related to an infectious state.¹² In a recent work, fever was indeed considered infectious in 80%, with a mortality rate reaching 62%.¹³ Still, a meta-analysis by Rumbus *et al.* reported that fever was associated with reduced mortality in septic patients.¹⁶ An hypothesis may be that fever early

triggers the initiation of specific therapeutics, mainly antibiotics.¹⁶

Some limitations deserved considerations as the limited sample size, the single-centre and observational design with data retrospectively retrieved from registry reports. Furthermore, temperature measurement sites may be different between EMS teams, with applied correction factors.

Beyond these limitations, this study clearly suggested body temperature as a suitable tool in the context of prehospital emergency triage of septic shock patients, with a particular focus on hypothermia of which clinical relevance is often undervalued despite its influence on the prognosis. Further studies should be performed to confirm these preliminary results.

Declaration of competing interests
none.

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