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ORIGINAL ARTICLE

Lower initial central venous pressure in septic patients from long-term care facilities than in those from the community

Chun-Yu Lin [a,b], Tun-Chieh Chen [a,b], Po-Liang Lu [a,b], Hui-Juan Chen [c], Kebba S. Bojang [b,d], Yen-Hsu Chen [a,b,*]

[a] *Division of Infectious Diseases, Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan*
[b] *Graduate Institute of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan*
[c] *Department of Emergency Medicine, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan*
[d] *Department of Emergency Medicine, Royal Victoria Teaching Hospital, Banjul, Gambia*

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Background/purpose: The cornerstone of emergency management of severe sepsis and septic shock is early (within 6 hours) goal-directed therapy, including maintenance of central venous pressure (CVP) at 8–12 mmHg. It is unclear whether there is a difference in initial (baseline) CVP between septic patients who are referred from the community and those who come from long-term care facilities (LTCFs) in Taiwan. We designed this study to investigate the difference in hemodynamic parameters between these two groups.
Materials and methods: Every patient with severe sepsis or septic shock who had a central venous catheter inserted via the internal jugular or subclavian vein at Kaohsiung Medical University Hospital between April 2007 and October 2007 was enrolled. CVP was measured immediately at the emergency department. Patient demographics, including residence, were retrospectively recorded and analyzed.
Results: There were 166 evaluable patients; 125 (75.3%) came from the community and 41 (24.7%) from LTCFs. There were no significant differences in age, sex, initial body temperature, heart rate, blood pressure, or leukocyte count between the two groups. However, patients who were referred from LTCFs had a significantly lower initial CVP than those from the community (5.0 ± 4.5 mmHg vs. 7.0 ± 4.8 mmHg, $p = 0.023$). The difference was more

* Corresponding author. Division of Infectious Diseases, Department of Internal Medicine, Kaohsiung Medical University Hospital, Number 100, Tz-you 1st Road, Kaohsiung City 807, Taiwan.
E-mail address: infchen@gmail.com (Y.-H. Chen).

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significant between mechanically ventilated patients from LTCFs and those from the community (5.0 ± 3.0 mmHg vs. 8.1 ± 5.6 mmHg, $p = 0.006$).
Conclusion: Severely septic patients referred from LTCFs may require more aggressive fluid resuscitation within the first 6 hours of the diagnostic criteria met at the emergency department to achieve the CVP target of early goal-directed therapy.

Introduction

Given the aging of the general population, the need for long-term care is expected to increase.[1] Age-related impairments in immunity, increasing comorbidity, functional limitations of extreme age, and residence in group quarters within long-term care facilities (LTCFs) have been reported to be associated with an increased risk of infectious disease.[2] Severe sepsis is challenging because of its high incidence, mortality rate, and associated costs.[3] Timely resuscitation (i.e., within 6 hours) is the cornerstone of emergency management of severe sepsis and septic shock. According to the protocol first proposed by Rivers et al[4] and subsequently adapted in Surviving Sepsis Campaign guidelines,[5] clinicians are advised to achieve a central venous pressure (CVP) of 8–12 mmHg in patients during the first 6 hours of resuscitation. Although CVP alone is not a reliable marker of fluid status among patients with severe sepsis and septic shock,[6] it is still an important variable and early management target in current Surviving Sepsis Campaign guidelines.[7] However, it is sometimes difficult to gain vascular access to measure CVP and complications may develop,[8] particularly within the first 6 hours.

To enable prediction of initial (baseline) CVP in the emergency department (ED) more rapidly, studies of the relationship between patient demographics and CVP are needed. It is unclear how demographics and comorbidity differ between patients with severe sepsis who are referred from the community and those who come from LTCFs in Taiwan. Another question is whether the different patient groups will have different in-hospital outcomes. We designed this retrospective, hospital-based study to investigate the difference in initial CVP between patients with severe sepsis or septic shock who were referred from LTCFs and those referred from the community.

Materials and methods

We reviewed the medical records of all patients who had a central venous catheter (CVC) inserted via the internal jugular or subclavian vein and had CVP measured between April 2007 and October 2007 in the ED of Kaohsiung Medical University Hospital, a 1600-bed tertiary care medical center in Kaohsiung City, Taiwan. Kaohsiung City has 83 LTCFs, with a maximal capacity of 3860 residents according to the Ministry of the Interior. The location of the CVC tip must be verified by chest X-ray to ensure proper placement. Patients meeting criteria for severe sepsis or septic shock[4,9] were enrolled in our study. Exclusion criteria were age < 18 years, death on arrival, transfer from another hospital, admission to an LTCF < 14 days earlier, discharge from a hospital ≤ 14 days earlier, acute coronary syndrome, acute cerebrovascular accident, acute pulmonary edema, active gastrointestinal hemorrhage, burn injury, major trauma, need for immediate surgery, and pre-existing do-not-resuscitate order. This study was approved by the local institutional review board.

Patients who had been admitted to an LTCF for >14 days and referred directly to the ED were assigned to the LTCF group. Patients who came from the community and had not been discharged from a hospital during the preceding 14 days were assigned to the community group. Patients' medical records were retrospectively and independently reviewed by two clinical physicians. If there was discrepancy between the two physicians, a third physician would join to discuss and make a decision about the diagnosis. Demographic characteristics, laboratory findings, comorbidity, initial CVP (measured immediately after insertion of the CVC at the ED), and in-hospital outcomes were recorded. The total volume of intravenous fluid resuscitation within the first 24 hours (after initial CVP measurement) was also recorded. For patients free of mechanical ventilator support, an initial CVP < 8 mmHg was defined as insufficient (i.e., under target)[7]; for those with mechanical ventilator support, an initial CVP < 12 mmHg was defined as insufficient (under target).[7] To describe the severity of individual patient's condition, Sequential Organ Failure Assessment (SOFA) score[10] and Mortality in the Emergency Department Sepsis (MEDS) score[11] were both counted and analyzed.

All analyses were conducted using SPSS software version 15.0 (SPSS Inc., Chicago, IL, USA). Student *t* test was used to compare continuous variables, and the χ^2 test or Fisher's exact test was used for nominal variables. Variables with $p < 0.05$ in the univariate analysis were included in a logistic regression model for multivariate analysis. All tests were two-tailed, and $p < 0.05$ was considered statistically significant.

Results

Between April 2007 and October 2007, 608 consecutive patients received a CVC via the internal jugular or subclavian vein and had CVP measured in the ED of Kaohsiung Medical University Hospital. Severe sepsis or septic shock was diagnosed in 206 patients. Of these patients, 11 had been transferred from other hospitals, 12 had been admitted to LTCFs < 14 days previously, and 17 had been discharged from a hospital within 14 days. All 40 of these patients were excluded. There was one case of diagnostic discrepancy between the two physicians, in which the patient was diagnosed as having pneumonia by the first physician and pulmonary edema by the second physician. In this case, a third physician contributed to the discussion and decision. The patient was finally diagnosed as having pneumonia and was enrolled in the study. Consequently, 166 patients with severe sepsis or septic shock were enrolled retrospectively. Mean age (±standard deviation) was 69.6 ± 14.7 years. Ninety-two patients (55.4%) were men and 74 (44.6%) were women. On arrival at the ED, 46 patients (27.7%) presented with fever (temperature > 38.0°C) and 32 (19.3%) presented with hypothermia (temperature < 36.0°C). Mean heart rate was 104 ± 30 beats/min, mean initial systolic blood pressure (BP) was 118 ± 39 mmHg, and mean diastolic BP was 71 ± 25 mmHg (Table 1). The lower respiratory tract was the primary source of infection (80 patients; 48.2%), followed by the urinary tract (26 patients; 15.7%).

Differences between patients referred from LTCF and the community

As shown in Table 2, 41 patients (24.7%) came from LTCFs and 125 individual (75.3%) came from the community. One hundred and ten patients (66.3%) experienced septic shock, and 56 individuals (33.7%) experienced severe sepsis. Acute or chronic respiratory failure requiring mechanical ventilator support developed in 63 patients (38.0%). Congestive heart failure was identified in 23 patients (13.9%), end-stage renal disease with hemodialysis in nine patients (5.4%), liver cirrhosis in 19 patients (11.4%), and chronic obstructive pulmonary disease in 17 patients (10.2%). Except for respiratory failure requiring mechanical ventilator support, the distribution of other conditions was not significantly different between patients from LTCFs and those from the community. Not surprisingly, patients from LTCFs had a higher MEDS score than those from the community because residence in an LTCF was a parameter that contributed to MEDS score.

Patients received some crystalloid solution prior to their CVP measurement. However, patients with heart failure and end-stage renal disease did not necessarily receive intravenous fluid infusion prior to measuring CVP. There was no significant difference in the amount of crystalloid solution administered prior to CVP measurement in the different groups (Table 2). Initial CVP was 7.0 ± 4.8 mmHg in the community group and 5.0 ± 4.5 mmHg in the LTCF group. The p value was 0.023, indicating a statistically significant difference. We also examined the relationship between initial CVP and patient age, body temperature, heart rate, systolic BP, diastolic BP, and initial laboratory data, using linear regression. There was no significant correlation between initial CVP and these variables (data not shown). For all 63 patients with respiratory failure, initial CVPs were measured when they were mechanically ventilated and the value was 7.0 ± 5.1 mmHg, in contrast to 6.2 ± 4.6 mmHg for the remaining 103 patients without mechanical ventilation ($p = 0.285$).

Table 1 Characteristics of the study cohort ($n = 166$)

Age (y)	69.6 ± 14.7
Male	92 (55.4)
On arrival at the ED	
Body temperature > 38°C	46 (27.7)
Body temperature < 36°C	32 (19.3)
Heart rate (beats/min)	104 ± 30
Respiratory rate (breaths/min)	18.5 ± 7.3
Minimal systolic BP in ED (mmHg)	78 ± 21
Minimal diastolic BP in ED (mmHg)	46 ± 13
WBC count ($10^3/\mu L$)	12.7 ± 11.5
WBC count > 12 × $10^3/\mu L$	63 (38.0)
WBC count > 4 × $10^3/\mu L$	21 (12.7)
Suspected source of infection	
Lower respiratory tract	80 (48.2)
Urinary tract	26 (15.7)
Intra-abdominal	21 (12.7)
Multiple foci	26 (15.7)
Others	13 (7.8)
Positive microbiologic culture	94 (56.6)
Escherichia coli	33 (19.9)
Klebsiella pneumoniae	25 (15.1)
Pseudomonas aeruginosa	9 (5.4)
Proteus mirabilis	7 (4.2)
Others	20 (12.0)

Data are presented as n (%) or mean ± standard deviation unless otherwise indicated.
BP = blood pressure; ED = emergency department; WBC = white blood cell.

Risk factors for initially insufficient (under target) CVP

As shown in Table 3, insufficient initial CVP was observed more frequently in patients referred from LTCFs and those with respiratory failure who depended on mechanical ventilator support. Other variables were not correlated with insufficient initial CVP.

In-hospital mortality

All patients were followed until their discharge from the hospital and outcomes were obtained. As shown in Table 4, the univariate analysis as well as multivariate logistic regression (data not shown) revealed that risk factors for in-hospital mortality included septic shock (vs. severe sepsis without shock), respiratory failure requiring mechanical ventilator support, liver cirrhosis, and underlying malignancy. By contrast, there was no correlation between in-hospital mortality and initial CVP level, whether the patient was referred from an LTCF or the community.

The useful predictors of in-hospital mortality included SOFA score and MEDS score. According to these two scores, nonsurvivors presented with more severe illness than survivors upon arrival at the ED.

Discussion

As mentioned in previous studies, CVP alone is not a good indicator of fluid balance and fluid management in patients with severe sepsis and septic shock who have a neck CVP line.[12,13] It is also not a good predictor for sepsis-attributable

Table 2 Characteristics of patients referred from the community and from long-term care facilities

Variable	Community (n = 125)	LTCF (n = 41)	p
Age (y)	68.8 ± 15.2	73.3 ± 12.0	0.053
Male	67 (53.6)	25 (61.0)	0.520
Vital signs at ED			
Initial body temperature (°C)	37.2 ± 1.5	37.2 ± 1.4	0.769
Heart rate (beats/min)	120 ± 28	113 ± 34	0.214
Minimal systolic BP in ED (mmHg)	78 ± 20	80 ± 22	0.646
Minimal diastolic BP in ED (mmHg)	46 ± 13	46 ± 15	0.999
Minimal mean arterial pressure in ED	57 ± 14	57 ± 16	0.829
Initial laboratory data			
pH	7.32 ± 0.14	7.32 ± 0.13	0.898
WBC count ($10^3/\mu L$)	12.4 ± 12.2	13.7 ± 9.0	0.533
HCO_3^- (mEq/L)	21.7 ± 13.5	21.2 ± 6.4	0.837
Arterial lactate	5.7 ± 6.5	4.8 ± 5.1	0.536
Acute/chronic comorbidity			
Septic shock	80 (64.0)	30 (73.2)	0.375
Respiratory failure with ventilator	41 (32.8)	22 (53.7)	0.028
Congestive heart failure	20 (16.0)	3 (7.3)	0.256
ESRD with HD	8 (6.4)	1 (2.4)	0.566
Liver cirrhosis	17 (13.6)	2 (4.9)	0.215
COPD	12 (9.6)	5 (12.2)	0.858
Time to insert CVC (hr), median (range)	4 (0–48)	2.5 (0–32)	0.371
IV fluid prior to CVP measurement (mL), median (range)	1000 (0–4000)	850 (0–2500)	0.571
Initial CVP			
All patients (mm Hg)	7.0 ± 4.8	5.0 ± 4.5	0.023
Patients with mechanical ventilator (mmHg)	8.1 ± 5.6	5.0 ± 3.0	0.006
Patients without mechanical ventilator (mmHg)	6.5 ± 4.3	5.1 ± 5.9	0.234
6 h CVP (mm Hg)	12.6 ± 6.0	10.8 ± 6.0	0.220
Total fluid resuscitation within 6 h (mL), median (range)	1240 (0–8500)	1750 (500–4500)	0.491
24 h CVP (mm Hg)	13.4 ± 6.9	10.4 ± 5.1	0.104
Total fluid resuscitation within 24 h (mL), median (range)	2575 (430–10,500)	3025 (1000–8500)	0.510
Time to achieve EGDT (hr), median (range)	2 (0.15–49)	1.5 (0.15–14)	0.506
Time to achieve CVP goal (h), median (range)	2 (0.15–32.5)	1.5 (0.15–10)	0.400
Total fluid resuscitation prior to reaching CVP goal (mL), median (range)	1500 (0–12 000)	2000 (500–5500)	0.926
Time to achieve MAP goal (h), median (range)	1.5 (0.15–30)	1.5 (0.15–10)	0.817
Time to achieve ScvO2 goal (h), median (range)	2 (0.15–49)	1.5 (0.15–14)	0.430
Patients achieved EGDT within 6 h	98 (78.40)	34 (82.9)	0.533
Achieve CVP goal within 6 h	106 (84.8)	36 (87.8)	0.635
Achieve MAP goal within 6 h	100 (80.0)	36 (87.8)	0.260
Achieve ScvO2 goal within 6 h	101 (80.8)	35 (85.4)	0.510
Severity score			
SOFA score	7.6 ± 3.7	8.4 ± 3.3	0.222
MEDS score	8.6 ± 4.3	12.2 ± 3.7	<0.001
In-hospital mortality	55 (44.0)	12 (29.3)	0.138

Data are presented as n (%) or mean ± SD, unless otherwise indicated.
BP = blood pressure; COPD = chronic obstructive pulmonary disease; CVC = central venous catheter; CVP = central venous pressure; EGDT = early (within the first 6 hours) goal-directed therapy; ESRD = end-stage renal disease; HD = hemodialysis; IV = intravenous; LTCF = long-term care facility; WBC = white blood cell.

mortality.[6] However, during early-phase (i.e., within 6 hours) resuscitation for those patients, the CVP level is still a clinically important target according to current guidelines.[7] Boyd and co-workers[12] also have concluded that CVP may be a practical measure of fluid status at ≤12 hours among patients with severe sepsis and septic shock, although it would be an unreliable marker thereafter. In the present study, we analyzed the differences between septic patients referred from LTCFs and the community, focused on their initial CVP levels, and identified useful information about early-phase resuscitation.

Early (within the first 6 hours) goal-directed therapy can be effective, therefore, rapid attainment is critical for the management of patients with severe sepsis and septic

Table 3 Risk factors of insufficient initial central venous pressure in study cohort

Variable	Insufficient CVP (n = 114)	Sufficient CVP (n = 52)	p
Age ≥ 65 y	82 (71.9)	35 (67.3)	0.673
Male	66 (57.9)	26 (50.0)	0.435
LTCF residence	37 (32.5)	4 (7.7)	0.001
Body mass index < 18.0	24 (21.1)	4 (7.7)	0.056
Acute/chronic comorbidity			
Septic shock	75 (65.8)	35 (67.3)	0.988
Respiratory failure with ventilator	54 (47.4)	9 (17.3)	<0.001
Congestive heart failure	14 (12.3)	9 (17.3)	0.530
ESRD with HD	6 (5.3)	3 (5.8)	1.000
Liver cirrhosis	12 (10.5)	7 (13.5)	0.773
COPD	11 (9.6)	6 (11.5)	0.923
Diabetes mellitus	36 (31.6)	18 (34.6)	0.835
Malignancy	28 (24.6)	13 (25.0)	1.000

Data are presented as n (%).
COPD = chronic obstructive pulmonary disease; CVP = central venous pressure; ESRD = end-stage renal disease; HD = hemodialysis; LTCF = long-term care facility; WBC = white blood cell.

Table 4 Characteristics of in-hospital survivors and non-survivors in the study cohort

Variable	Survivors (n = 99)	Nonsurvivors (n = 67)	p
Age (y)	70.2 ± 14.6	69.4 ± 14.7	0.724
Male	52 (52.5)	40 (59.7)	0.451
LTCF residence	29 (29.3)	12 (17.9)	0.138
Initial CVP (mmHg)	6.4 ± 4.7	6.5 ± 5.3	0.952
Acute/chronic comorbidity			
Septic shock	56 (56.6)	54 (80.6)	0.002
Respiratory failure with ventilator	27 (27.3)	36 (53.7)	0.001
Congestive heart failure	12 (12.1)	11 (16.4)	0.577
ESRD with HD	5 (5.1)	4 (6.0)	1.000
Liver cirrhosis	5 (5.1)	14 (20.9)	0.004
COPD	11 (11.1)	6 (9.0)	0.850
Diabetes mellitus	37 (37.4)	17 (25.4)	0.147
Malignancy	18 (18.2)	23 (34.3)	0.029
Severity score			
SOFA score	6.7 ± 3.3	9.3 ± 3.5	<0.001
MEDS score	8.6 ± 4.2	10.8 ± 4.5	0.002
Total fluid resuscitation within 24 h (mL), median (range)	2500 (430–9600)	4500 (500–10,500)	0.040
Achieve EGDT within 6 h	79 (79.8)	53 (79.1)	0.913
Achieve CVP goal within 6 h	87 (87.9)	55 (82.1)	0.298
Achieve MAP goal within 6 h	82 (82.8)	54 (80.6)	0.714
Achieve ScvO2 goal within 6 h	81 (81.8)	55 (82.1)	0.964

Data are presented as n (%) or mean ± SD, unless otherwise indicated.
COPD = chronic obstructive pulmonary disease; CVP = central venous pressure; ESRD = end-stage renal disease; HD = hemodialysis; LTCF = long-term care facility; MAP = mean arterial pressure; ScvO2 = central venous oxygen saturation; MEDS = Mortality in the Emergency Department Sepsis; SOFA = Sequential Organ Failure Assessment; WBC = white blood cell.

shock.[4,14] Maintenance of CVP at 8–12 mmHg is one part of early goal-directed therapy (for mechanically ventilated patients, 12–15 mmHg is recommended[5,7]). The first step in CVP measurement is to insert a CVC via the internal jugular or subclavian vein. However, it is sometimes difficult to insert a CVC successfully at the ED within the first few hours. In everyday practice, therefore, initial CVP may not be easily measured, especially in septic patients with multiple organ failure. To the best of our knowledge, studies of factors that may be related to initial CVP have been rare. The relationship between initial CVP and settings from which patients are referred has also not been previously clarified.

In our study, we found that patients with severe sepsis or septic shock with a CVP line who were referred from LTCFs had a significantly lower initial CVP than those who came from the community (5.0 mmHg vs. 7.0 mmHg). Furthermore, among 63 mechanically ventilated patients, mean CVP in the 22 patients from LTCFs was significantly lower than in the 41 patients from the community (Table 2). CVP level partially reflects preload, and maintenance of CVP with the target range is important to overcome tissue hypoxia.[15] Patients referred from LTCFs may have a higher risk of dehydration than patients from the community, and this may be especially true among patients who have experienced severe sepsis or septic shock. LTCF residents might have more problems with eating or feeding prior to the development of an infection, and detection of symptoms and signs of infectious diseases might be delayed.[1] Such reasons may explain why our LTCF patients presented with lower initial CVP. Therefore, taking a more precise history may help clinicians identify patients' fluid status more accurately during early-phase resuscitation. Our results provide clinicians with useful information to manage fluid therapy even prior to successful CVC insertion and CVP measurement. Our data also suggest that healthcare workers in LTCFs should monitor residents more carefully and prevent dehydration.

We compared initial CVP level among different age groups (elderly vs. nonelderly patients). The mean initial CVP was 6.4 ± 4.8 mmHg in patients ≥65 years old and 6.6 ± 5.2 mmHg in those < 65 years old (p = 0.749). By contrast, among patients ≥65 years old who were referred from LTCFs, there was a trend of lower initial CVP compared to patients referred from the community (5.1 ± 4.9 mmHg vs. 6.9 ± 4.7 mmHg, p = 0.075). However, we did not find a significant association between age and parameters such as LTCF stay, body mass index, and CVP. Additionally, when we adjusted for age and body mass index using the general linear model, patients from LTCFs still had lower initial CVP values compared to patients from the community ($\beta = -1.972$, $p = 0.049$).

In our study, we did not emphasize fluid resuscitation after the first 6 hours because some evidence has shown a positive fluid balance and elevated CVP is associated with increased mortality.[12,16] Instead, we emphasized that patients who were referred from an LTCF should be more vigilantly assessed for lower initial CVP levels than those referred from community. As shown in Table 4, there was no difference in initial CVP level between survivors and nonsurvivors. In agreement with Boyd et al[12] once again, our data suggest that not only CVP level, but also other parameters, including fluid responsiveness,[6,13] play important roles in the pathogenesis and disease progression of severe sepsis and septic shock. SOFA score and MEDS score were both reliable parameters to describe disease severity. In the present study, they were also strongly correlated with in-hospital mortality. As shown in Table 5, patients with MEDS score > 15 (ranked as very high risk) had a significantly higher in-hospital mortality rate than those with a MEDS score of 8–15 (ranked as moderate to high risk) or a MEDS score < 8 (ranked as very low to low risk).[11]

Initial body temperature > 38°C or <36°C was noted among only 78 patients (47.0%) on arrival at the ED. Typically, defined fever may be absent among more than one half of LTCF residents with serious infection.[1] In a large study, Mehr and co-workers[17] found that only 44% of nursing home residents with possible or probable pneumonia noted on a chest radiograph had a temperature > 38°C. Brooks et al[18] also found that typical symptoms and signs of urinary tract infection, such as fever, were not sensitive indicators of infection in LTCF residents. These studies may explain why our patients presented with lower body temperatures than expected. By contrast, heart rate and white blood cell count at the time of presentation at the ED were more compatible with systemic inflammatory response syndrome.

Patients from LTCFs presented with acute or chronic respiratory failure with ventilator support more often than those from the community, which could be explained by several reasons. First, patients from LTCFs were more likely to be older than those from the community. Second, tracheostomies were more common among those who lived in an LTCF than patients from the community. A tracheostomy would make ventilator support easier to carry out for those from LTCFs. Third, it was possible and easier to care for a patient with chronic respiratory failure and long-term ventilator support in an LTCF.

There were some limitations in the present study. First, it was a retrospective study and some data were unavailable when reviewing medical records, such as the individual positive end-expiratory pressure setting of patients with mechanical ventilators. Second, although the volume of fluid therapy within the first 24 hours after severe sepsis or septic shock development was significantly different between survivors and nonsurvivors [2500 mL (range 430–9600 mL) vs. 4500 mL (range 500–10,500 mL); $p = 0.040$; Table 4], a causal relationship could not be recognized in the present study. The sepsis patients without a CVP line inserted were not included in our study, so the results may not represent the whole sepsis patients group. This was a retrospective study and we could not conclude whether fluid overload led to death or whether dying patients received more fluid due to their critical illness.

In conclusion, our results, although limited by a retrospective design, suggest that initial CVP is significantly lower and MEDS score is significantly higher among patients with severe sepsis or septic shock who are referred to the ED from LTCFs, compared to severely septic patients from the community. The two groups did not differ significantly in the volume of total fluid resuscitation prior to achieving the CVP goal and in the first 6 hours. If central venous access cannot be established quickly and CVP cannot be measured immediately in patients with severe sepsis or septic shock at the ED, our findings may be referable. Although the LTCF patients in our study represent perhaps only 1% of all residents of LTCFs in Kaohsiung City, our data suggest that LTCF sepsis patients may require more aggressive fluid resuscitation within the first 6 hours. Large prospective studies are needed to provide clinicians with more detailed and reliable data.

Table 5 In-hospital mortality rates among patient groups with different MEDS score

MEDS score range	Survivors, *n*	Nonsurvivors, *n*	In-hospital mortality rate (%)
0–7	39	17	30.4
8–15	55	38	40.9
>15	5	12	70.6

MEDS = Mortality in the Emergency Department Sepsis.

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