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Brief Report

Prognostic factors of health care–associated bloodstream infection in adult patients ≥40 years of age

Hsuan-Yin Ma MD, PhD [a], I.-Chen Hung RN [b], Ya-Huei Huang RN [b], Ying-Ying Chang RN [b], Wang-Huei Sheng MD, PhD [b,c,*], Jann-Tay Wang MD [b,c], Wei-Chu Chie [d,e], Jen-pei Liu PhD [f], Yee-Chun Chen MD, PhD [b,c]

[a] *Derchen Women and Children Hospital, Kaoshiung, Taiwan*
[b] *Infection Control Center, National Taiwan University Hospital, Taipei, Taiwan*
[c] *Department of Internal Medicine, National Taiwan University Hospital, Taipei, Taiwan*
[d] *Department of Family Medicine, National Taiwan University Hospital, Taipei, Taiwan*
[e] *School of Public Health, National Taiwan University, Taipei, Taiwan*
[f] *Department of Agronomy, National Taiwan University, Taipei, Taiwan*

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We investigated 401 geriatric patients and 453 middle-aged patients with health care–associated bloodstream infection (HABSI) at a medical center during January-December 2014. Compared with middle-aged patients, the geriatric group had higher 30-day mortality (31.2% vs 23.4%, $P = .01$). Body mass index, serum albumin concentration, Charlson comorbidity index score, vancomycin-resistant *Enterococcus* bacteremia, and high C-reactive protein levels predict poor outcomes for HABSI among adult patients.

Health care–associated bloodstream infection (HABSI) has high occurrence rate and mortality.[1,2] A previous study revealed that patients with HABSI had higher mortality rate (49.4% vs 33.2%), longer hospital stay (29.2 vs 20.2 days), and higher medical costs ($102,276 vs $69,690) than those without HABSI, respectively.[1]

Geriatric patients were considered more vulnerable because of more chronic comorbidities, more severe dysfunction, and multiple intravascular devices usage.[2,3] A study revealed geriatric patients had a higher chance of acquiring healthcare-associated infection,[4] but there were few studies which compared the outcomes between geriatric and middle-aged patients with HABSI. Furthermore, whether age composed an independent prognostic factor of HABSI still requires further study.

The primary aim of our study was to find the prognostic factors regarding HABSI and impact of elderly age on prognosis.

METHODS

Data collection

This was a retrospective observational study. The surveillance data of hospitalized patients in the acute care ward aged ≥40 years with HABSI between January 1, 2014, and December 31, 2014, were collected from the database at National Taiwan University Hospital, a tertiary medical center in Taiwan. HABSI was defined according to guidelines of the Centers for Disease Control and Prevention.[5]

We collected basic demographic data, discharge diagnosis, laboratory data, and usage of central venous access during infection and outcome parameters of each patient from the medical record. Charlson comorbidity index score was calculated based on the discharge diagnosis.[6] Geriatric population was defined as ≥65 years of age, and middle-aged group included those between 40 and 64 years of age.

Statistical analysis

SAS version 9.3 (SAS Institute, Cary, NC) was used for analysis. A P value <.05 was considered significant. We calculated the crude odds ratio (OR) of factors for 30-day mortality post-HABSI and included those with significant crude OR into multiple logistic regression. We stratified the OR by different age groups. We used SAS version 9.3 predictive mean matching FCS method[7] to do imputation for study parameters with >20% of missing data.

Ethics

This study was proved by the institutional review board committee at National Taiwan University Hospital (no. 201507085RIND).

* Address correspondence to Wang-Huei Sheng, MD, PhD, Department of Internal Medicine, National Taiwan University Hospital, 7 Chung-Shan S Rd, Taipei, Taiwan.
E-mail address: whsheng@ntu.edu.tw (W.-H. Sheng).
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RESULTS

A total of 854 adult patients had HABSI during the study period, among which 401 were geriatric population and 453 were middle aged. The geriatric group had higher average Charlson comorbidity index score (5.6 vs 4.7, $P < .001$), lower albumin level (3.5 vs 3.6, $P = .02$), and higher 30-day mortality rate (31.2% vs 23.4%, $P = .01$) than the middle-aged group, respectively.

Table 1 lists the prognostic factors of 30-day mortality. The crude OR of age group was 1.48 (95% confidence interval [CI], 1.09-2.00), but the adjusted OR did not reach significance. Body mass index (OR, 0.94; 95% CI, 0.90-0.98; $P = .005$), serum albumin concentration (OR, 0.78; 95% CI, 0.64-0.96; $P = .02$), Charlson comorbidity index score (OR, 1.27; 95% CI, 1.17-1.38; $P < .001$), vancomycin-resistant *Enterococcus* spp (VRE) bacteremia (OR, 2.84; 95% CI, 1.36-6.22; $P = .01$), and C-reactive protein (CRP) levels (OR, 1.06; 95% CI, 1.04-1.09; $P < .001$) were significant prognostic factors.

The prognostic factors of 30-day mortality stratified by age group are listed in Table 2. Charlson comorbidity index score and CRP levels were significant in both groups. Getting treatment in the medical department (OR, 0.51; 95% CI, 0.30-0.86; $P = .01$) and VRE bacteremia (OR, 2.75; 95% CI, 1.03-7.35; $P = .04$) were significant prognostic factors only in the geriatric group, whereas low albumin concentration (OR, 0.57; 95% CI, 0.39-0.84; $P = .004$) was a significant prognostic factor only in the middle-aged group.

DISCUSSION

The survival rate of HABSI in geriatric patients in our study was 68.8%, lower than middle-aged patients. However, age was not an independent prognostic factor. The prognostic factors differ in 2 age groups, which indicated that age might modify the effects of some prognostic factors.

In our study, Charlson comorbidity index score and CRP concentration remained 2 independent prognostic factors after being stratified by age group. The CRP level reflects the severity of HABSI, whereas the Charlson comorbidity index score indicates the baseline health status. The lower albumin level represents poor nutritional status,[8] which may result in higher infection-related mortality. However, only in the middle-aged group was albumin concentration an independent prognostic factor. The albumin concentrations in geriatric patients did not vary much between those who died and survived; therefore, the albumin concentrations did not reach statistically significance.

However, body mass index and VRE bacteremia were newly found prognostic factors in our study. Another study found that vancomycin-sensitive enterococci and VRE had different virulence.[9] Furthermore, the empirical antibiotics used in our study were not effective for VRE, resulting in failure to timely use of appropriate antibiotics against VRE. However, an interesting phenomenon observed in our study was that higher body mass index seemed to have

Table 1
Prognostic factors of health care–associated bloodstream infection associated with 30-day mortality

Factor	Death (n = 231)	Survive (n = 623)	Crude OR (95% CI)	aOR (95% CI)	*P* value
Age group (geriatric/middle age)	125/106	276/347	1.48 (1.09-2.00)	1.21 (0.85-1.71)	.28
Sex (M/F)	129/102	346/277	1.01 (0.75-1.37)	0.97 (0.69-1.36)	.86
BMI*	22.0 ± 4.0	22.8 ± 3.9	0.95 (0.91-0.99)	0.94 (0.90-0.98)	.005
At admission					
White blood cell count†	11,883.3 ± 22,147.5	10,528.7 ± 21,731.7	1.00 (1.00-1.00)		
Albumin‡	3.3 ± 1.1	3.7 ± 0.7	0.61 (0.49-0.76)	0.78 (0.64-0.96)	.02
Comorbidities					
Renal disease (Y/N)	53/178	123/500	1.21 (0.84-1.74)		
Diabetes (Y/N)	63/168	158/465	1.10 (0.78-1.55)		
Hematology malignancy (Y/N)	48/183	176/447	0.67 (0.46-0.98)	1.20 (0.73-1.98)	.48
Liver cirrhosis (Y/N)	31/200	45/578	1.99 (1.23-3.23)	1.60 (0.90-2.85)	.11
Chronic lung disease (Y/N)	23/208	35/588	1.86 (1.07-3.22)	1.83 (0.98-3.42)	.06
Solid cancer (Y/N)	152/79	335/288	1.65 (1.21-2.26)	1.01 (0.64-1.59)	.98
Congestive heart failure (Y/N)	31/200	59/564	1.48 (0.93-2.36)		
Cerebrovascular accident (Y/N)	30/201	68/555	1.22 (0.77-1.93)		
Charlson comorbidity index score	6.3 ± 2.5	4.7 ± 2.4	1.30 (1.22-1.39)	1.27 (1.17-1.38)	<.001
Central venous catheter (Y/N)	167/64	420/199	1.24 (0.89-1.73)		
Ward (surgery/total)	52/231	165/623	0.81 (0.56-1.15)		
Recent causative pathogens					
Polymicrobial	34/197	100/523	0.90 (0.59-1.38)		
CRE	9/222	12/611	2.06 (0.86-4.97)		
MRSA	9/222	17/606	1.45 (0.63-3.29)		
VRE	20/211	18/605	3.19 (1.65-6.14)	2.84 (1.30-6.22)	.01
Pseudomonas aeruginosa	12/219	28/595	1.16 (0.58-2.33)		
Candida spp	36/195	45/578	2.37 (1.49-3.78)	1.64 (0.91-2.96)	.10
MDRAB	5/226	8/615	1.70 (0.55-5.25)		
ESBL pathogens	22/209	59/564	1.00 (0.60-1.68)		
Other pathogens	134/97	461/162	0.49 (0.35-0.67)	0.71 (0.46-1.08)	.11
Laboratory results of initial presentation of health care–associated bloodstream infection					
White blood cell count§	11,038.8 ± 12,279.7	7,657.3 ± 72,487.6	1.00 (1.00-1.00)		
Absolute neutrophil count¶	9,478.1 ± 9,829.1	6,743.8 ± 5,456.2	1.00 (1.00-1.00)		
C-reactive protein**	12.8 ± 9.0	7.5 ± 6.9	1.07 (1.05-1.09)	1.06 (1.04-1.09)	<.001

NOTE. Values are mean ± SD, number of patients, or as otherwise indicated.
aOR, adjusted odds ratio; *BMI*, body mass index; *CI*, confidence interval; *CRE*, carbapenem-resistant *Enterobacteriaceae*; *ESBL*, extended-spectrum β-lactamase; *F*, female; *M*, male; *MDRAB*, multidrug-resistant *Acinetobacter baumannii*; *MRSA*, methicillin-resistant *Staphylococcus aureus*; *N*, no; *OR*, odds ratio; *VRE*, vancomycin-resistant *Enterococcus* spp; *Y*, yes.
*Death: n = 229, survive: n = 614.
†Death: n = 231, survive: n = 619.
‡Death: n = 133, survive: n = 375.
§Death: n = 231, survive: n = 621.
¶Death: n = 186, survive: n = 484.
**Death: n = 174, survive: n = 470.