Diagnosing Bacteraemia Early in Older Adults

Dear Editor,

Sepsis is a prevalent and important cause of morbidity and mortality in the general population. Approximately 750,000 patients in the United States alone develop severe sepsis each year. Of this, more than 60% are patients older than 65 years.[1] Morbidity and mortality remain high in spite of advances in the management of patients with sepsis,[2] and are increased in older adult patients.[3] However, early identification and institution of appropriate management in older adult patients with septic shock has been shown to improve outcome.[4]

Few studies have been done to analyse the difference in response to sepsis between older adults and younger patients. We performed a study comparing the clinical parameters and biochemical markers of patients with *Klebsiella Pneumoniae* bacteraemia, and assessed the differences between the older adults and younger population. We also hoped that the results would shed light on important factors that help identify sepsis in the elderly.

Materials and Methods

A total of 100 patients with *Klebsiella Pneumoniae* bacteraemia from September 2007 to December 2008 were retrospectively analysed in our study. Demographics, comorbidities, clinical parameters at the time of blood taking, biochemical markers, maximum body temperature and clinical outcomes were reviewed.

Results

Fifty patients were less than 65 years old and 50 were 65 and older. The mean age of patients was 62.7. There were 58 males and 42 females. Patients with known malignancy, end-stage renal failure, and those on immunosuppressant were excluded from the study.

Older adults patients had statistically significant higher incidences of diabetes mellitus ($P = 0.009$), hypertension ($P < 0.001$), hyperlipidaemia ($P = 0.002$), ischaemic heart disease ($P = 0.001$), cerebrovascular accidents ($P = 0.009$) and dementia ($P = 0.0032$) than younger patients. From reviewing the discharge summaries, 39 of the patients were diagnosed by the attending team to have a gastrointestinal source, 34 were genitourinary, 22 respiratory, and 5 from other or unknown sources.

There were 24 mortalities; 16 of them were in the older adults age group and 8 were in the younger age group. Older adult patients with *Klebsiella Pneumoniae* bacteraemia were 2 times more likely to die than younger patients. All of the 8 younger patients were admitted to intensive care unit (ICU) versus 5 in the older group.

Of all the variables analysed (Table 1), the temperature when blood culture was taken, maximum temperatures during hospital stay, and serum urea levels showed significant association with age. The mean temperature during bacteraemia in older adult patients was 37.13°C (95% CI, 36.82 to 37.45), whereas mean temperature in younger patients was 38°C (95% CI, 37.61 to 38.39). The mean maximum temperature during hospital stay in older adult patients was 38.15°C (95% CI, 37.84 to 38.46) and that in younger patients was 38.91°C (95% CI, 38.64 to 39.18).

We further analysed our results based on temperatures ≥37°C, ≥37.2°C and ≥37.5°C. Eighty percent of younger patients with bacteraemia had a temperature of ≥37°C at blood culture taking whereas only 46% of older adults had temperatures ≥37°C. Only one-third of older adult patients had a "significant febrile response" if a higher temperature of 37.5°C was used.

Mean serum urea level in older adult patients during bacteraemia was 12.49 mmol/L (95% CI, 10.09 to 1.49) compared to 9.55 mmol/L (95% CI, 7.33 to 11.78) in younger patients. Older adult patients were 1.6 times more likely to have a raised urea defined as >7 mmol/L than younger patients.

There was no statistical significance of the heart rate, respiratory rate, alteration in mental status, total white cell count, platelet count, coagulation profile, lactate, albumin, glucose, creatinine, C-reactive protein or procalcitonin between older and younger patients.

Discussion

The mean temperature when blood cultures were taken in the elderly was 37.13°C, whereas mean temperature when blood cultures were taken in younger patients was 38°C. Eighty percent of younger patients with bacteraemia had a temperature of ≥37°C within 24 hours of blood culture taking

Table 1. Comparison of Outcomes between Older Adults and Younger Patients

Variable	Age <65 (n = 50)	Age ≥65 (n = 50)	*P* Value
Outcome			
Death	8 (16%)	16 (32%)	0.061
Discharge to own home	38 (76%)	29 (58%)	0.056
Nursing home	0 (0%)	4 (8%)	0.041
Step-down care	3 (6%)	1 (2%)	0.307
Discharge against advice	1 (2%)	0 (0%)	0.315
ICU admission	15 (30%)	17 (34%)	0.668
No. of days in ICU	2.4	1.52	0.940
Duration of hospital stay (days)	14.94 ± 11.238	12.38 ± 9.678	0.252
Clinical markers			
Confused mental state	12 (24%)	16 (32%)	0.050
Sedation	5 (10%)	3 (6%)	0.050
Dementia	0 (0%)	3 (6%)	0.050
Functional decline	0 (0%)	4 (8%)	0.050
	Mean (± 2 SD)		
Mean temperature at time of culture	38 ± 2.71	37.132 ± 2.20	<0.001
Mean of max. temperature during stay	38.908 ± 1.90	38.146 ± 2.19	<0.001
Heart rate	104.82 ± 50.21	96.4 ± 43.51	0.101
Respiratory rate	23.4 ± 11.10	21.94 ± 15.46	0.090
Total white blood cell count ($x10^8$)	15.858 ± 16.00	14.1378 ± 15.34	0.188
Absolute neutrophil count	14.132 ± 14.99	14.098 ± 24.10	0.318
Platelet	220.92 ± 296.27	230.16 ± 244.38	0.450
Prothombin time	17.29 ± 8.91	17.052 ± 5.62	0.755
INR	10.833 ± 103.57	1.3407 ± 0.55	0.913
Partial thromboplastin time	40.967 ± 21.98	40.352 ± 17.79	0.867
Lactate	4.2 ± 7.14	2.895 ± 3.70	0.450
Albumin	31.21 ± 18.68	31.28 ± 14.67	0.750
Glucose	12.091 ± 15.42	12.598 ± 19.43	0.759
Urea	9.554 ± 15.31	12.494 ± 16.95	0.005
Creatinine	138.42 ± 227.02	138.74 ± 157.12	0.167
C-reactive protein	207.97 ± 212.74	168.07 ± 220.98	0.386
Procalcitonin	133.29 ± 333.33	56.7186 ± 112.06	0.813

ICU: Intensive care unit; INR: International normalised ratio

whereas only 46% of older adults had temperatures ≥37°C. Only one-third of older adult patients had a "significant febrile response" if a cut-off of 37.5°C was used. Also, the mean maximum temperature during hospital stay in older adult patients was 38.15°C, and that in younger patients was 38.91°C.

Currently, many hospitals and doctors use the cut-off of 38°C for taking blood cultures. We would like to use this study to stress how older people are unable to mount a similar response to sepsis. We also wish to recommend a review of the traditional cut-off to pick up bacteraemia. Our study showed a higher mortality in the older group with bacteraemia, similar to other studies. Early recognition and treatment of sepsis could improve mortality and morbidity drastically.

Blood urea nitrogen appears to be a significant marker of bacteraemia in the older adults. This could be due to several factors. Older adults are known to have impaired thirst sensation, which could be aggravated in the setting of bacteraemia due to debilitation and altered mental status. Impaired renal function is more likely to occur in the older adults and could result in decreased clearance of

urea in the setting of an acute catabolic stress. The CURB-65 score and pneumonia severity index (PSI) incorporate raised blood urea nitrogen into their models of predicting mortality in the setting of infection. Studies done to validate the CURB-65 score found that age >65 years and blood urea nitrogen >7mmol/L were associated with significantly higher mortality regardless of the overall CURB-65 score.[5] A raised urea could therefore lead the clinician to a higher index of suspicion of the presence of underlying bacteraemia in an older adult.

Conclusion

In summary, our results show that older adult patients respond differently to sepsis compared to younger patients. Clinicians need to have higher indexes of suspicion in older adults so as not to miss the underlying diagnosis. In particular, fever is a poor guide to bacteraemia in the older adults, and they warrant blood cultures at a lower threshold of temperature than younger patients. The role of urea as a marker of sepsis in the older adults has not been well studied. Its role as a prognostic factor and guide in the management of sepsis in the older adults should also be reviewed.

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