The CURB (confusion, urea, respiratory rate and blood pressure) criteria in community-acquired pneumonia (CAP) in hospitalised elderly patients aged 65 years and over: a prospective observational cohort study

SIR—Community-acquired pneumonia (CAP) is common in the UK, affecting 250,000 adults per year, of whom 33% are admitted to hospital (67% for patients aged 65 years and over) [1]. It is also the most common reason for admission to hospital [2] and the fourth most common cause of death in the UK [3]. The presence of co-morbidities and physiological changes associated with ageing can influence the presence or absence of clinical and laboratory markers of severe pneumonia. Moreover, because of associated cardiovascular diseases and/or impaired humoral defences, pneumonia in older people has increased mortality and morbidity compared with younger patients [4]. In patients over 65 years, the associated mortality is 16–40% [5].

Background

The British Thoracic Society (BTS) and the Public Health Laboratory Service published results of a 14-month study of patients admitted to hospital [6], and two simple rules were derived. BTS1 defined severe pneumonia as the presence of two out of three criteria (blood urea on admission, respiratory rate and diastolic blood pressure). BTS2 included confusion instead of blood urea. Neill et al. derived a modified BTS rule (mBTSr). Severe CAP is suggested by the presence of two or more of: confusion, respiratory rate (RR) of ≥30/minute, diastolic BP ≤60 mmHg and blood urea >7 mmol/l at the time of admission. Those who satisfied mBTSr had a 36.5-fold greater risk of dying compared with 22 and 9.9, respectively, with BTS1 and BTS2 [7].

We have confirmed the value of mBTSr in identifying those with severe pneumonia who have a greater chance of dying [8]. Recently developed CURB (confusion, urea, respiratory rate and blood pressure) criteria are similar to mBTSr, but systolic BP <90 mmHg was added [either systolic BP (sbp) <90 mmHg or diastolic BP (dbp) ≤60 mmHg scores 1]. Authors also suggested CURB-65 where ≥65 years score 1, making a total score of 5 [9].

The aims of our study were: (1) to evaluate the usefulness of CURB in hospitalised older adults aged ≥65 years in terms of sensitivity, specificity, positive and negative predictive values for mortality within 6 weeks; and (2) to identify the parameters in CURB that had a higher association with mortality in this age group.

Method and results

We prospectively identified CAP in elderly patients between December 2002 and May 2003 by screening of chest X-rays (CXR) of all patients ≥65 years admitted to the Medical Admission Unit (catchment population = 568,000) using the hospital Picture Archived Communication System, a computer-linked image system where all radiological images and reports performed in the hospital can be viewed.

For this study, CAP was defined by evidence of a new CXR shadow (at least segmental) and clinical features of pneumonia. Only patients with a confirmed radiological report or in whom the radiographic diagnosis was made by at least two physicians were included. Patients with possible aspiration pneumonia, including patients admitted with stroke and swallowing difficulty, known recurrent aspiration pneumonia or who were fed through percutaneous endoscopic gastrostomy with possible aspiration, clinical diagnoses of CAP without a new CXR shadow, patients with tuberculosis, carcinoma of lung or other active malignancies were excluded.

Data regarding age, sex, clinical features, white cell count (WCC), C-reactive protein (CRP), oxygen saturation, parameters in the CURB criteria and co-existing chronic illnesses were collected. First recorded parameters were collected to minimise the confounding effect of initial treatment such as intravenous fluids or oxygen therapy. Confusion of new onset or worsening confusion in those with background confusion from the history was used to satisfy the confusion criterion.

All patients were followed up at 6 weeks using the Patient Administration System (PAS) for all-cause mortality outcome. PAS records the movement of the patients and whether an individual is alive or dead at any given time by having a system where local general practitioners report deaths that occur in the community.

Data were analysed using Statistics Package for Social Scientists (SPSS) 11.5. Chi-square or Fisher’s exact tests were used. Univariate logistic regression was performed to see which variables were the best predictors of deaths. Areas under the receiver operating characteristic (ROC) curves were also calculated.

We identified 100 patients with CAP over 6 months (56 males). The total number of CXR screened was 2966. Median age was 81.5 years (range 65–96 years). Median hospital stay was 11 days (range 1–80 days).

Cough (73%), shortness of breath (63%) and expectoration (51%) were common. Confusion (26%), fever (19%) and chest pain (17%) were less common. Twenty-one patients died, all as inpatients (median hospital stay 7 days,
range 1–37 days). Using CURB, 55 had severe pneumonia; three of them were managed in an intensive therapy unit and all died. Seventeen deaths occurred in the severe group and four in the non-severe group. Severe CAP was significantly associated with mortality ($\chi^2 = 7.23$, $P = 0.007$).

Univariate logistic regression showed that the CURB rule was significantly associated with death. Systolic BP, RR, confusion and blood urea were of borderline significance. BP criteria [systolic (sbp) or diastolic blood pressure (dbp)] and dbp were least associated with mortality (Table 1). When blood urea, RR, sbp and dbp were analysed as continuous variables, higher RR ($OR = 1.07$, 95% CI $= 1.01–1.14$, $P = 0.03$) and lower sbp ($OR = 0.98$, 95% CI $= 0.96–1.00$, $P = 0.028$) were significantly associated with mortality.

The CURB criteria were 81% (95% CI $= 58–95$) sensitive and 52% (95% CI $= 40–63$) specific; positive predictive value (PPV) was 30% (95% CI $= 19–45$) and negative predictive value (NPV) was 91% (95% CI $= 79–98$) for mortality in this series.

Neither WCC ($OR = 0.93$, 95% CI $= 0.85–1.01$, $P = 0.10$, $n = 100$) nor CRP ($OR = 1.00$, 95% CI $= 0.99–1.01$, $P = 0.96$, 75) nor $O_2$ saturation on air ($OR = 0.96$, 90, 101), $P = 0.12$, 62] predicted mortality. The number of associated chronic diseases ranged from zero to five in our cohort. Fisher’s exact test showed no evidence of an association between mortality and number of chronic illnesses ($P = 0.51$).

**Discussion**

CAP in older people is associated with a high mortality of 21%, which is in agreement with previous studies in this age group [10–12].

The study by Kamath et al., which studied severe CAP (mean age $= 58.8$ years), showed a sensitivity of 82% and specificity of 73%, PPV of 27% and NPV of 97% in identifying death or intensive care admission for severe CAP. The values for death were 100%, 72%, 21% and 100%, respectively [8]. We have shown that in patients $\geq$ 65 years, the CURB criteria are as sensitive at predicting deaths as they are in younger patients, identifying 81% of deaths. However, the CURB criteria appear to have a lower specificity of 52% in older patients.

Our findings suggest that raised urea and low dbp are not predictive of mortality in older patients (Table 1). This may be due to dehydration, with high urea level, being common in acutely ill elderly people. dbp is relatively low in the normal elderly population since mean dbp increases with age up to 55–60 years then levels off before a reduction in later life [14, 15]. Criteria may therefore not have the same implication as in the younger population.

In contrast to previous studies [10, 16], our study shows no evidence of an association between mortality in CAP and the number of associated chronic illnesses. Therefore, the presence of co-existing chronic diseases should not preclude active treatment and intensive care in this population. Where clinically appropriate, intensive care facilities should be readily available to those who satisfy the severity criteria for CAP regardless of age.

The major limitation of our study was small sample size, which made it difficult to draw firm conclusions. Further studies will be needed to confirm the findings, as borderline results may have been significant in a larger sample. Moreover, we had strict inclusion criteria and studied only older people who are already at higher risk by virtue of age compared with the general population.

In summary, our study suggests that currently available criteria used to identify severe CAP are nearly as sensitive but less specific in the elderly compared with younger patients. Although they remain useful and identified 81% of those who died, there is a need to develop a simple rule which will improve identification of severe CAP in the elderly. With the ageing population and previous evidence showing higher hospitalisation rates for older people with CAP, a case can be made for developing a better clinical rule to identify severe CAP in the elderly.

**Key points**

- Community-acquired pneumonia in the elderly is common and associated with high mortality.
- CURB criteria for severity assessment of CAP are as nearly as sensitive but less specific in the elderly compared with younger patients.
- Our study highlights the need to develop a simple rule that will better identify severe CAP in the elderly.

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**Table 1.** Associations between criteria (dichotomised) in CURB and mortality from CAP

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>$P$</th>
<th>Area under ROC curve (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>2.74 (0.99–7.57)</td>
<td>0.053</td>
<td>0.61 (0.46–0.75)</td>
</tr>
<tr>
<td>Urea $&gt; 7$ mmol/l</td>
<td>7.24 (0.91–57.36)</td>
<td>0.061</td>
<td>0.61 (0.49–0.73)</td>
</tr>
<tr>
<td>RR $\geq 30$/minute</td>
<td>2.86 (1.00–8.19)</td>
<td>0.051</td>
<td>0.60 (0.46–0.75)</td>
</tr>
<tr>
<td>BP (sbp $&lt; 90$ or dbp $\leq 60$ mmHg)</td>
<td>2.07 (0.76–5.62)</td>
<td>0.15</td>
<td>0.58 (0.44–0.72)</td>
</tr>
<tr>
<td>sbp $&lt; 90$ mmHg</td>
<td>6.42 (1.00–41.27)</td>
<td>0.050</td>
<td>0.56 (0.41–0.71)</td>
</tr>
<tr>
<td>dbp $\geq 60$ mmHg</td>
<td>1.70 (0.62–4.68)</td>
<td>0.30</td>
<td>0.56 (0.42–0.70)</td>
</tr>
<tr>
<td>CURB (severe or not)</td>
<td>4.59 (1.42–14.85)</td>
<td>0.011</td>
<td>0.66 (0.54–0.79)</td>
</tr>
</tbody>
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Predictors of impaired cognitive function in men over the age of 80 years: results from the Health in Men Study

SIR—There is a need to improve our understanding of potentially modifiable risk factors for dementia and cognitive impairment. In older people, medically related health conditions may be directly detrimental to cognitive function or may precipitate cognitive decline in vulnerable individuals. One such factor is hypertension. Failing to treat hypertension increases the risk of cognitive decline [1], whereas treatment reduces the incidence of cognitive impairment [2]. Forette et al. [3] reported a 50% reduction in the incidence of dementia [both vascular dementia and Alzheimer’s disease (AD)] in older patients treated for isolated systolic hypertension.

Other medical and lifestyle factors have been less intensively investigated. The Rotterdam Study [4] reported a positive association between diabetes and dementia with increased risk even for those subjects treated with insulin and oral medications. It is now clear that smoking is not protective for the development of dementia, but may increase the risk of AD [5]. Other potentially modifiable factors relate to diet. For example, participants in the Personnes Agées QUID (PAQUID) study [6] who ate seafood (rich in omega-3 fatty acids) at least once a week had reduced risk of developing dementia during follow-up.

Laurin et al. [7] reported that high levels of physical activity were associated with reduced risk of cognitive impairment and dementia of any type. Cognitively stimulating activities were also associated with reduced decline in global cognition and risk of AD in a cohort study of Catholic nuns and priests [8]. Against this background we designed the present study to evaluate the associations between lifestyle factors and the risk of cognitive impairment in men aged 80 years or over.

**Method**

Between 1996 and 1998, 12,203 male subjects aged 65 years or more were recruited via the electoral rolls for a controlled study of screening for aortic aneurysm [9]. These men were all resident in the Perth metropolitan area and the response to invitations was 70.5%. During the years 2001–2002, those men aged 80 years or over (75+ years at inception) were invited for reassessment. Of the remaining 2,022 surviving men, 1,351 refused reassessment despite two reminders. Of the 671 men (33%) who were reassessed, 618 had completed the cognitive test. The mean period between assessments was 4.8 years (SD = 0.6) (range 3.3–6.6 years). The Human Research Ethics Committee of the University of Western Australia approved the study protocol and all subjects gave informed consent.

At baseline, the extent of formal education, previous medical history, histories of hypertension and hypercholesterolaemia, as well as treatment for these conditions were recorded. Resting blood pressure was measured in the sitting position with a mercury sphygmomanometer. A brief dietary history included questions on the weekly frequency of eating meat and fish, usual type of milk consumed and the addition of salt to meals. Assessment of lifestyle covered self-reported frequency of exercise, both vigorous and non-vigorous, along with current smoking status and history of smoking. Consumption of alcohol was summarised as the number of standard drinks per week. Height, weight and hip and waist circumference were measured, and body mass index (BMI) and hip to waist ratio calculated.