SHORT REPORT

Hospital-acquired pneumonia incidence and diagnosis in older patients

LOUISE A. BURTON1, ROSEMARY PRICE1, KAREN E. BARR1, SEAN M. McAuley1, JENNIFER B. ALLEN1, AOIBHINN M. CLINTON1, GABBY PHILLIPS2,CHARIS A. MARWICK1, MARION E. T. McMURDO1, MILES D. WITHAM1

1Medical Research Institute, University of Dundee, Dundee, UK
2Department of Microbiology, NHS Tayside, Dundee, UK

Address correspondence to: M. D. Witham. Tel: (+44) (0)1382 383086. Email: m.witham@dundee.ac.uk

Abstract

Background: hospital-acquired pneumonia poses a hazard to older people who are hospitalised, yet few data exist on the incidence or risk factors in non-intensive care patients. This study aimed to determine the incidence of hospital-acquired pneumonia (HAP) in a sample of hospitalised older people.

Methods: prospective survey of hospitalised older patients (>65 years) at a single centre over a 12-month period. Casenote and chart data were collected on acute medical, orthopaedic and Medicine for the Elderly wards. HAP was defined in accordance with the European and Scottish National Prevalence Survey 2011 definition. Key analyses were incidence of clinically suspected and case definition clinically confirmed HAP.

Results: one thousand three hundred and two patients were included in the analysis. Five hundred and thirty-nine (41%) were male; mean age was 82 years (SD 8). Median length of hospital stay was 14 days (IQR 20). One hundred and fifty-seven episodes of HAP were clinically suspected in 143 patients (10.9% of admissions), but only 83 episodes in 76 patients met the diagnostic criteria (5.8% of admissions). The risk of HAP was 0.3% per day in hospital. Reasons for failure to meet the diagnostic criteria in 75 cases were lack of radiographic evidence in 60/75; lack of evidence of inflammation in 42/75, and lack of respiratory signs or symptoms in 13/75; 35/75 (47%) of cases lacked evidence in two or more domains.

Conclusion: HAP is common but over-diagnosed in older hospitalised patients.

Keywords: older people, diagnosis, hospital-acquired pneumonia, incidence

Introduction

The incidence of hospital-acquired pneumonia (HAP) is not well studied outside the intensive care unit, but estimates range from <1% of all hospital admissions [1–4] to between 8 and 10% of patients admitted to medicine for the elderly units [5–8]. Older people spend longer in hospital, have relative immune compromise and are commonly exposed to multiple courses of antibiotics. They are more likely to have swallowing dysfunction leading to aspiration of oropharyngeal material, which in older hospitalised patients includes pathogenic bacteria in 45% of cases; such bacteria are associated with an increased risk of HAP [9, 10].

Studies of HAP to date have focused mainly on ventilator-associated pneumonia in intensive care units; patient characteristics, risk factors and preventative approaches may be very different in older, ward-based patients [11–13]. Few studies have attempted to estimate the incidence of, or risk factors for, HAP among the general population of older hospitalised patients. In addition, clinical experience suggests that a diagnosis of HAP is often made without reference to standardised diagnostic criteria, potentially overestimating the incidence. We therefore conducted a prospective survey to determine the incidence of HAP and to determine how often clinically diagnosed HAP meets standardised diagnostic criteria in older hospitalised patients.

Methods

Study design, setting and population

We surveyed older people admitted to Ninewells Hospital and Royal Victoria Hospital, NHS Tayside, Dundee, from 1st August 2012 to 31st July 2013. We capped the number of
consecutive admissions sampled during each quarter (400 for first quarter, 300 for subsequent quarters) to allow follow-up from medical notes to be completed. We studied the first admission for each patient during the study period; subsequent admissions were not included, but readmissions for pneumonia within 28 days of discharge were counted as episodes of suspected or clinically confirmed HAP. We selected four Acute Medical and Medicine for the Elderly wards at Ninewells Hospital, four sub-acute Medicine for the Elderly wards at Royal Victoria Hospital, Dundee and three Orthopaedic wards at Ninewells Hospital, Dundee. The admission window for each patient was taken as the date of admission to any acute hospital ward to the date of discharge from either the acute or sub-acute hospital (thus discharge to home, care home, intermediate care or community hospital was taken as the date of discharge).

To avoid selection bias resulting from the requirement to obtain consent, we did not approach patients directly as part of this survey; instead, we used routinely collected data from medical notes, nursing notes and prescribing charts. We gained approval from the local Caldicott Guardian (data protection officer) prior to commencing data collection. All patients aged ≥65 admitted to the targeted hospital wards were included in the survey. Ethics committee approval was not required as the only data used were routinely collected healthcare data without additional patient contact.

Data collection
Data on baseline demographics, medication use at admission, co-morbid disease recorded in the hospital and primary care medical notes, pre-hospital antibiotic use noted on the GP admission letter (in the 14 days prior to hospital admission) and all episodes of in-hospital antibiotic use for prophylaxis or treatment were collected. We recorded swallowing problems (noted by the patient or by nursing staff without formal testing) and the presence or absence of dentures from hospital nursing notes. We ascertained new episodes of infection by scrutinising the prescription charts of all admitted patients for new antibiotic prescriptions. These patients then underwent notes review by medically qualified researchers to ascertain the clinical indication for prescription and to ascertain whether the case definition for clinically confirmed HAP was met.

The case definition of clinically confirmed HAP [14] was onset >48 h after admission, plus (i) two or more serial chest radiograph or computed tomography (CT) scans with a suggestive image of pneumonia for patients with underlying cardiac/pulmonary disease (or one definitive chest radiograph or CT scan if no underlying disease) as noted by either the attending clinician or reporting radiologist; and (ii) a fever >38°C with no other cause or white cell count <4 × 10^9/l or >12 × 10^9/l and (iii) at least one of: new-onset purulent sputum or change in character of sputum, cough/dyspnœa/tachypnoea, suggestive auscultation (crepitations or bronchial breath sounds), rhonchi or wheezing, worsening gas exchange. Suspected but not clinically confirmed episodes were defined as episodes where the clinical team had at any point recorded a diagnosis of ‘pneumonia’ or ‘respiratory tract infection’ or ‘chest infection’ and started antibiotic therapy, but which did not fulfil the case definition above.

Data analysis
All data analyses were performed using SPSS v21 (IBM, NY, USA). We calculated the percentage of patients with suspected HAP, the percentage of those with clinically confirmed HAP and the cumulative risk of HAP by duration of admission as well as the risk of HAP event per day of hospital admission. We determined the case fatality rate (i.e. the percentage of those who died prior to hospital discharge) in those with suspected and clinically confirmed HAP episodes. We generated descriptive statistics for the reasons leading to failure to confirm the diagnosis of HAP in suspected, but not clinically confirmed cases.

Results
We studied a total of 1,307 patients, of whom 1,302 had complete data and are included in this analysis. Baseline characteristics are given in Supplementary data, Appendix, available in Age and Aging online. Medical records were not available for scrutiny for the five patients excluded from analysis.

The number of HAP episodes per patient group is shown in Table 1. There were a total of 157 episodes of suspected HAP in 143 patients (10.9% of all studied admissions) but only 83 episodes in 76 patients met the diagnostic criteria (5.8% of all studied admissions). The overall risk of clinically confirmed HAP per day of admission was 0.3% and remained constant through to at least 80 days after admission. The in-hospital death rate was 22/76 (29%) in patients with

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Acute (n = 729)</th>
<th>Sub-acute (n = 235)</th>
<th>Orthopaedic (n = 338)</th>
<th>All (n = 1,302)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients with suspected HAP (%)</td>
<td>77 (10.6)</td>
<td>35 (14.9)</td>
<td>31 (9.2)</td>
<td>143 (10.9)</td>
</tr>
<tr>
<td>Suspected HAP episodes</td>
<td>84</td>
<td>42</td>
<td>31</td>
<td>157</td>
</tr>
<tr>
<td>No. of patients with clinically confirmed HAP (%)</td>
<td>43 (5.9)</td>
<td>23 (9.8)</td>
<td>10 (3.0)</td>
<td>76 (5.8)</td>
</tr>
<tr>
<td>Clinically confirmed HAP episodes</td>
<td>47</td>
<td>26</td>
<td>10</td>
<td>83</td>
</tr>
<tr>
<td>% Suspected cases confirmed clinically</td>
<td>56</td>
<td>62</td>
<td>32</td>
<td>53</td>
</tr>
<tr>
<td>Total days spent in hospital</td>
<td>14,753</td>
<td>8,177</td>
<td>4,833</td>
<td>27,763</td>
</tr>
<tr>
<td>Risk of HAP per day in hospital</td>
<td>0.32%</td>
<td>0.32%</td>
<td>0.21%</td>
<td>0.30%</td>
</tr>
</tbody>
</table>

HAP, hospital-acquired pneumonia.
clinically confirmed HAP, 13/67 (19%) in patients with suspected but not clinically confirmed HAP cases and 97/1,159 (8%) in patients with no episodes of suspected HAP. Of the patients with clinically confirmed HAP, 72 (87%) had a single episode. Only 9 (6.3%) of patients with suspected HAP and 4 (5.3%) of patients with clinically confirmed HAP had multiple episodes of HAP.

For the 75 suspected cases not meeting the diagnostic criteria for HAP, the reasons for failing to meet the criteria were lack of radiographic evidence, lack of inflammatory evidence or lack of respiratory evidence (Figure 1). No significant differences in reasons were noted between different ward types.

Discussion

Our estimate of HAP incidence is at the upper end of previous estimates [5, 15]. Some previous studies with high reported incidence included intensive care settings, which our study did not. Previous studies found that HAP incidence rates were higher in patients in intermediate (8.3%) and long-term care (5.3%) compared with short-term care (0.5%) [5]. The high mortality that we found in clinically confirmed cases of HAP is both expected and consistent with other studies [2, 15].

Previous studies have shown that in non-ICU settings, HAP was more common in post-operative patients [10, 16], contrary to our findings. This may be due in part to the longer length of stay and greater co-morbidities of the patients admitted to Medicine for the Elderly wards compared with those on orthopaedic wards, many of whom were elective patients undergoing surgery with spinal anaesthesia. Of note, older patients with lower limb fracture (a frailer group with multiple co-morbidity) had a HAP rate of 10% in a recent study [10].

Almost half of suspected HAP cases did not fulfil the diagnostic criteria used in this survey. The criteria may be overly rigorous and hence miss atypical presentations of genuine pneumonia in this population. However, in approximately half of cases not reaching the criteria, two or three domains of evidence were lacking, making a diagnosis of HAP unlikely. Potentially, large numbers of patients may thus receive inappropriate antibiotic therapy or have an alternative, treatable diagnosis overlooked. Even in those patients where antibiotic therapy might still have been appropriate, an alternative diagnosis may have altered the choice, duration or dose of antibiotic therapy.

Using routinely collected ward data allowed us to include patients with delirium and dementia, enhancing the generalisability of our findings. We used predefined criteria for identifying HAP which allowed more accurate diagnosis than relying on hospital episode statistics. The criteria used have not been validated specifically for older people so some genuine cases of HAP may have been coded as suspected but not confirmed; for instance, some changes may have been missed by plain chest radiography, but might have been detectable on CT. Microbiological data were not available for the vast majority of patients, and we were unable to collect a formal measure of frailty. Patients were not followed up after discharge; hence, the HAP rate and mortality following HAP may be underestimated. Similarly, a lack of data on pneumonia rates among this cohort in the community makes it impossible to calculate the excess risk of pneumonia attributable to hospitalisation, rather than to the presence of other risk factors.

Our findings suggest that further work is needed: incidence studies in other populations, exploration of the reasons for misdiagnosis, refinement of diagnostic criteria for use in older patients, development of risk scores to identify low- or high-risk subgroups of patients, and finally development and evaluation in trials of multicomponent interventions to prevent this common and dangerous condition.

Key points

- Little work has been done on incidence or diagnosis of HAP in older people.
- There is a lack of proven preventative interventions outside the intensive care environment.
- The incidence of HAP in older hospitalised patients in this study was 6%.
- HAP was clinically over-diagnosed twofold compared with standardised criteria.

Conflicts of interest

None declared.

Funding

From NHS Tayside endowment grant funds.

Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.
References


Received 2 July 2015; accepted in revised form 7 October 2015