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Diagnosis and features of hospital-acquired pneumonia: a retrospective cohort study

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SUMMARY

Background: Hospital-acquired pneumonia (HAP) is defined as radiologically confirmed pneumonia occurring ≥48 h after hospitalization, in non-intubated patients. Empirical treatment regimens use broad-spectrum antimicrobials.

Aim: To evaluate the accuracy of the diagnosis of HAP and to describe the demographic and microbiological features of patients with HAP.

Methods: Medical and surgical inpatients receiving intravenous antimicrobials for a clinical diagnosis of HAP at a UK tertiary care hospital between April 2013 and 2014 were identified. Demographic and clinical details were recorded.

Findings: A total of 166 adult patients with a clinical diagnosis of HAP were identified. Broad-spectrum antimicrobials were prescribed, primarily piperacillin–tazobactam (57.2%) and co-amoxiclav (12.5%). Sputum from 24.7% of patients was obtained for culture. Sixty-five percent of patients had radiological evidence of new/progressive infiltrate at the time of HAP treatment, therefore meeting HAP diagnostic criteria (2005 American Thoracic Society/Infectious Diseases Society of America guidelines). Radiologically confirmed HAP was associated with higher levels of inflammatory markers and sputum culture positivity. Previous surgery and/or endotracheal intubation were associated with radiologically confirmed HAP. A bacterial pathogen was identified from 17/35 sputum samples from radiologically confirmed HAP patients. These were Gram-negative bacilli ($N = 11$) or *Staphylococcus aureus* ($N = 6$). Gram-negative bacteria tended to be resistant to co-amoxiclav, but susceptible to ciprofloxacin, piperacillin–tazobactam and meropenem. Five of the six *S. aureus* isolates were meticillin susceptible and all were susceptible to doxycycline.

Conclusion: In ward-level hospital practice 'HAP' is an over-used diagnosis that may be inaccurate in 35% of cases when objective radiological criteria are applied. Radiologically confirmed HAP represents a distinct clinical and microbiological phenotype. Potential risk factors were identified that could represent targets for preventive interventions.

Introduction

The syndrome of hospital-acquired pneumonia (HAP) is defined as pneumonia occurring in non-intubated patients

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Table I
Patient characteristics

Characteristics	All patients ($N = 166$)	Radiologically confirmed HAP ($N = 108$)	Radiology inconsistent with HAP ($N = 54$)	*P*-value[a]
Male	99 (59.6%)	67 (62.0%)	31 (57.4%)	0.6
Age				
Median years (IQR)	79.5 (69–87)	77 (68–86)	81 (71–88)	
≥65 years	138 (83.1%)	88 (81.5%)	46 (85.2%)	0.7
≥75 years	104 (62.7%)	63 (58.3%)	38 (70.4%)	0.2
Admitted by medicine	125 (75.3%)	75 (69.4%)	46 (85.2%)	0.04
Admitted by surgery	41 (24.7%)	33 (30.6%)	8 (14.8%)	
Emergency surgery	24	19	5	1.0
Elective surgery	17	14	3	
Nursing home resident	5 (3.0%)	2 (1.9%)	3 (5.6%)	0.3
Medical history				
COPD	45 (27.1%)	32 (29.6%)	12 (22.2%)	0.4
Asthma	11 (6.6%)	10 (9.3%)	1 (1.9%)	0.1
Bronchiectasis	4 (2.4%)	3 (2.8%)	1 (1.9%)	1.0
Pulmonary fibrosis	2 (1.2%)	2 (1.9%)	0	0.6
Other lung disease	4 (2.4%)	3 (2.8%)	1 (1.9%)	1.0
IHD	36 (21.7%)	22 (20.4%)	13 (24.1%)	0.7
Heart failure	34 (20.5%)	22 (20.4%)	11 (20.4%)	1.0
Stroke/TIA	43 (25.9%)	26 (24.1%)	17 (31.5%)	0.3
Other neurological disease	10 (6.0%)	7 (6.5%)	2 (3.7%)	0.7
Cognitive impairment	32 (19.3%)	17 (15.7%)	13 (24.1%)	0.2
Chronic liver disease	3 (1.8%)	3 (2.8%)	0	0.6
Chronic kidney disease	15 (9.0%)	6 (5.6%)	9 (16.7%)	0.04
Solid malignancy	23 (13.9%)	11 (10.2%)	11 (20.4%)	0.09
Haematological malignancy	5 (3.0%)	3 (2.8%)	2 (3.7%)	1.0
Type 1 DM	3 (1.8%)	1 (0.9%)	3 (5.6%)	0.1
Type 2 DM	29 (17.5%)	19 (17.6%)	9 (16.7%)	1.0
Immunosuppressive drugs	1 (0.6%)	1 (0.9%)	0	1.0
Dysphagia/GI dysmotility/NG tube fed (new or old)	33 (19.9%)	25 (23.1%)	8 (14.8%)	0.3

HAP, hospital-acquired pneumonia; IQR, interquartile range; COPD, chronic obstructive pulmonary disease; IHD, ischaemic heart disease; TIA, transient ischaemic attack; DM, diabetes mellitus; GI, gastrointestinal; NG, nasogastric.

[a] Comparing patients with radiologically confirmed HAP and patients with radiology inconsistent with HAP; chi-square test or Fisher's exact test depending on number of subjects.

≥48 h after hospitalization, and therefore not incubating at the time of admission.[1] This is distinct from ventilator-associated pneumonia (VAP), which is defined as pneumonia occurring after 48–72 h of mechanical ventilation in an intubated patient. HAP may be suspected if a patient develops new symptoms and signs consistent with respiratory tract infection (fever, abnormal chest examination, purulent sputum, tachypnoea, impaired oxygenation) and laboratory results consistent with inflammation (raised white cell count and C-reactive protein). However, the diagnosis of HAP also requires radiological demonstration of a new or progressive lung infiltrate.[1] American Thoracic Society/Infectious Diseases Society of America (ATS/IDSA) guidelines for the management of HAP highlight Gram-negative bacilli as frequently occurring pathogens in HAP and *Staphylococcus aureus* as an emerging cause. Much of the literature that has been used to describe the aetiology of HAP relates to VAP, nosocomial pneumonia occurring specifically in the intensive care unit (ICU) or nursing-home-acquired pneumonia.[1–6] Overall, more is known about the pathogenesis and microbiology of VAP, facilitated by the ease of obtaining deep respiratory samples by bronchoalveolar lavage in intubated patients. Importantly, there are evidence-based 'care bundles' to prevent VAP, but not HAP.[7]

Empirical treatment of HAP aims to include cover for nosocomial pathogens, especially Gram negative bacteria, therefore it necessitates using broad-spectrum agents such as co-amoxiclav and piperacillin–tazobactam, with the attendant risks of antibiotic-associated diarrhoea, *C. difficile* infection, selection for antimicrobial resistance in patient and environmental flora and also high costs. An accurate diagnosis of HAP is therefore essential to ensure appropriate use of these antimicrobials.

The aim of this study was to retrospectively evaluate the accuracy of the diagnosis of HAP in inpatients on acute internal medicine and general surgical wards receiving intravenous antimicrobials for a clinical diagnosis of HAP made by the patient's team. The demographic and microbiological features of patients with radiologically confirmed HAP will be described.