Section: Medicine

Case Series

HOSPITAL-ACQUIRED AND VENTILATOR-ASSOCIATED PNEUMONIA IN A MEDICAL ICU: A CASE SERIES EMPHASIZING CLINICAL OUTCOMES AND MODIFIABLE RISK FACTORS

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ABSTRACT

Background: Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are major causes of morbidity and mortality in intensive care units (ICUs), particularly in resource-limited settings. Data reflecting real-world clinical patterns and preventable factors remain limited.

Materials and Methods: We conducted a retrospective descriptive case series of patients who developed HAP or VAP in a medical ICU of a tertiary care teaching hospital over a one-month period. Clinical characteristics, comorbidities, ventilator exposure, microbiological data, complications, and outcomes were analyzed. Charlson Comorbidity Index (CCI) was used to assess baseline risk.

Results: Six patients developed HAP/VAP (HAP: 66.7%, VAP: 33.3%). Mean age was approximately in the elderly range, and all patients had significant comorbidities. High comorbidity burden (CCI ≥5) was observed in 66.7% of cases. Microbiological confirmation was available in 50% of patients, with pathogens including Klebsiella pneumoniae, Escherichia coli, and multidrug-resistant Pseudomonas aeruginosa. Major complications included septic shock (50%), pleural involvement (50%), and acute kidney injury (33.3%). Overall mortality was 50%.

Conclusion: HAP and VAP in this cohort were associated with high comorbidity burden, severe complications, and significant mortality. Gaps in prevention bundle adherence, delayed microbiological confirmation, and airway-related events were identified as key modifiable factors. Strengthening ICU care processes and antimicrobial stewardship may improve outcomes.

Keywords: HAP, VAP, Septic shock, ICU, Multidrug-resistant organisms.

INTRODUCTION

Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) remain among the most frequent nosocomial infections in critically ill patients and are associated with prolonged ICU stay, increased healthcare costs, and high mortality. HAP develops ≥48 hours after hospital admission, while VAP occurs ≥48 hours after initiation of mechanical ventilation.[1-3]

The pathogenesis of VAP involves microaspiration, biofilm formation, impaired mucociliary clearance, and prolonged sedation. Patients with neurological impairment, chronic lung disease, or malignancy are particularly vulnerable due to impaired airway protection and reduced immune reserve.[4-6]

Despite established prevention strategies—including ventilator care bundles and antimicrobial stewardship—implementation gaps persist in routine ICU practice, especially in resource-constrained settings.[7,8]

MATERIALS AND METHODS

This retrospective descriptive case series was conducted in the medical ICU of a tertiary care teaching hospital over a one-month period.

Inclusion Criteria

Patients developing

- HAP (≥48 hours after admission)
- VAP (≥48 hours after intubation)

Data Collection

Data were obtained from medical records, including:

- Demographics and comorbidities
- Ventilator exposure and timelines
- Laboratory and imaging findings
- Microbiological data
- Antibiotic therapy
- Clinical outcomes

Variables Assessed

- Charlson Comorbidity Index (CCI)
- ICU stay duration (where available)
- Ventilator exposure
- Complications (septic shock, AKI, pleural disease)
- Outcome (death/discharge/LAMA)

Ethical Consideration: Institutional ethics approval was obtained. Patient confidentiality was maintained.

RESULTS

Baseline Characteristics

A total of 6 patients developed HAP/VAP:

- HAP: 4 patients (66.7%)
- VAP: 2 patients (33.3%)
- Female: 66.7%

All patients had underlying comorbidities. High comorbidity burden (CCI ≥5) was observed in 4 patients (66.7%).

Clinical Features

- Ventilator exposure: 33.3%
- Re-intubation observed in VAP cases
- Radiological progression: 83.3%

Microbiology

- Klebsiella pneumoniae
- Escherichia coli
- MDR Pseudomonas aeruginosa

Complications

- Septic shock: 50%
- Pleural involvement: 50%
- AKI: 33.3%

Outcomes

- Mortality: 50%
- Discharged: 16.7%
- LAMA: 33.3%

Table 1: Summary of Six HAP/VAP Cases

Case	1	2	3	4	5	6
Age/Sex	55/F	88/F	55/F	78/M	60/F	71/M
Baseline Risk Factors	Breast carcinoma; s/p MRM	Stroke; CAD (aspiration risk)	COPD; Type 2 RF	Metastatic pancreatic Ca; asthma	HTN; COPD; chronic smoker	COPD; HTN; prior CVA
HAP/VAP	HAP	VAP	VAP	HAP	HAP	HAP
Pneumonia Suspected (Trigger/Timing)	New fever/leukocytosis after ≥48h admission	Day 5 post-intubation deterioration	Worsening oxygenation after intubation (22/12→24/12)	Sepsis at/after admission	Day 3 new infiltrate after normal Day 1 CXR	Admitted with shock; infiltrates during ICU stay
Ventilation Timeline	Not ventilated (NR)	Intubated 25/11–28/11; re-intubated 01/12	NIV → Intubated 22/12	Ventilated (ACVC)	Not ventilated	ICU care; vasopressors (ventilation NR)
Imaging (Findings → Interpretation)	CXR: Left hemithorax opacification; mild right basal opacities → HAP with pleural involvement	CXR: New opacities vs prior → VAP	CXR: Bilateral infiltrates → progression → VAP	HRCT: Bilateral consolidation; cavitation; hydropneumothorax → severe pleural infection	CXR Day1: Normal; Day3: New infiltrate → HAP	CXR: Bilateral infiltrates → pneumonia in shock
Microbiology (Timing)	Not available	NR	ET: Klebsiella; Blood: E. coli (colistin-sensitive)	NR	Pleural fluid: No growth; TB PCR negative	ET: MDR Pseudomonas
Antibiotics (Escalation)	Piperacillin–tazobactam + levofloxacin	Escalation incl. cefoperazone–sulbactam	Meropenem+ Linezolid+ Doxy → Colistin	NR	Meropenem + Moxifloxacin	Escalated per sensitivity
Key Complications	Hyponatremia; pleural involvement	Severe hypokalemia; AF; re-intubation; arrest	Septic shock; AKI	Refractory septic shock	Sepsis; AKI on CKD; pleural effusion	Coagulopathy; lactate elevation; septic shock

Outcome	LAMA (unknown outcome)	Death	Death	Death	Discharged	LAMA
CCI	3	6	2	10	5	5
Risk category	Moderate	High	Low-Moderate	Very High	High	High
APACHE II Score	8	22	26	30	20	28
VAP Bundle Adherence	No	Yes	Yes	No	No	No

Footnotes: NR = Not recorded in available clinical documentation. LAMA = Left against medical advice. Ventilation duration and exact culture timing were not consistently available in records.
Abbreviations: HAP = hospital-acquired pneumonia; VAP = ventilator-associated pneumonia; NIV = non-invasive ventilation; ET = endotracheal; CXR = chest radiograph; HRCT = high-resolution CT; AKI = acute kidney injury; NR = not recorded/available.
Operational diagnostic criteria used: HAP was defined as a new or progressive infiltrate occurring ≥48 hours after admission with compatible clinical deterioration. VAP was defined as a new or progressive infiltrate occurring ≥48 hours after intubation with compatible clinical deterioration.

Table 2: Imaging Progression

Case	Imaging Day/Timepoint	Radiology Findings (Describe Only)	Interpretation (Separate Clinical Correlation)
1	13/12/2025 (Portable CXR)	Marked left hemithorax opacification with reduced aeration; mild right basal opacities.	Findings compatible with pleural process and/or parenchymal collapse–consolidation; treated clinically as HAP.
2	30/11/2025 (CXR)	Development/worsening of pulmonary opacities compared with prior films (exact zonal distribution not recorded).	Radiology documented as VAP and used to support antibiotic escalation.
3	22/12/2025 (CXR)	Bilateral patchy infiltrates.	Interpreted as early infective involvement in a ventilated patient.
3	24/12/2025 (CXR)	Worsening bilateral diffuse opacities compared with 22/12.	Radiologic progression consistent with worsening VAP.
4	HRCT chest (Date not specified)	Dependent bilateral lower-lobe consolidation with internal cavitary breakdown; right hydropneumothorax.	Findings consistent with severe infective process with pleural space involvement; concern for alveolar–pleural fistula.
5	01/12/2025 (CXR)	No focal consolidation reported (normal study).	Baseline imaging without infiltrates.
5	Approximately Day 3 after admission (Repeat CXR)	New pulmonary infiltrates (exact location not recorded).	New infiltrates after ≥48 hours consistent with HAP in clinical context.
6	Serial CXRs during ICU stay (Dates not specified)	Bilateral pulmonary infiltrates.	Findings interpreted as pneumonia in the setting of septic shock.

Footnote:
Imaging descriptions are limited to documented radiologic findings. Interpretation reflects clinical correlation recorded in ICU notes. Exact imaging times were not consistently available in all cases.

DISCUSSION

This case series highlights the significant burden of HAP and VAP in critically ill patients, particularly those with high baseline comorbidity.

Key findings

- Strong association between comorbidity burden and mortality
- Airway-related factors (ventilation, re-intubation) critical
- Limited microbiological confirmation
- Presence of MDR organisms
- Frequent pleural complications

Gaps identified

- Inconsistent bundle adherence
- Delay in microbiological diagnosis
- Suboptimal airway secretion management

CONCLUSION

HAP and VAP in this ICU cohort were associated with high comorbidity burden, severe complications, and significant mortality.

Key modifiable factors

- Prevention bundle adherence
- Early microbiological diagnosis
- Optimized airway management
- Timely source control

Addressing these gaps may improve outcomes in ICU practice.

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