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Ventilator-Associated Pneumonia: Bridging the Gap Between Protocols and Practice

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ABSTRACT

None

Ventilator-Associated Pneumonia (VAP) remains a major complication within critical care settings, significantly contributing to patient morbidity, prolonged Intensive Care Unit (ICU) and hospital stays, and increased healthcare costs. [1, 2] It reflects infection of the pulmonary parenchyma occurring after at least 48 hours of mechanical ventilation and is recognised radiologically by new or progressive infiltrates accompanied by clinical features of infection. [1, 2] Clinically, VAP is categorised as early-onset when it develops within the first four days of ventilation, and late-onset when it occurs beyond day five. Late-onset VAP is particularly concerning due to its strong association with multidrug-resistant (MDR) pathogens. [3].

The burden of VAP is significant. A recent systematic review reported an incidence of nearly 30%, identifying female sex, smoking history, and high APACHE II scores as major predictors [4]. Patients who develop VAP experience substantially longer ICU stays, although mortality differences compared with non-VAP patients are inconsistent. Across Asia, the reported burden is considerably higher, ranging from 3.5 to 46 episodes per 1,000 ventilator-days, based on regional variability in ICU environments, antimicrobial resistance, and infection-control practices [6].

Multiple clinical and organisational factors modulate VAP risk. These include recent surgical interventions, trauma, preceding sepsis, re-intubation, inter-facility transfer, comorbid illnesses, tracheostomy, older age, chronic respiratory conditions, contaminated ventilatory circuits, suboptimal ICU hygiene, and inadequate adherence to sterile intubation protocols [2, 4-6]. Such findings emphasise the interplay between patient vulnerability and structural quality of care.

Diagnosis remains a challenge, often utilizing Modified Clinical Pulmonary Infection Score (CPIS), which integrates physiological parameters, oxygenation indices, secretions, radiographic progression, and microbiological data. [7] Microbiological profiles in Asian ICUs show a predominance of Gram-negative bacteria. A Nepalese study reported pathogen isolation in 92% of VAP cases, with *Klebsiella pneumoniae*, *Acinetobacter spp.*, *Pseudomonas aeruginosa*, and *Escherichia coli* as leading agents. MDR strains were observed even in early-onset cases. [7] Similarly, an Indian trauma centre documented VAP incidences of 9.25 per 1,000 ventilator-days, with *Acinetobacter baumannii*, *Klebsiella pneumoniae*, and *Staphylococcus aureus* frequently isolated. [8]

Globally pooled ICU data reveal the substantial clinical burden of hospital-acquired infections, where VAP contributes to prolonged hospitalisation and increased mortality, particularly in settings challenged by antimicrobial resistance. While non-infected patients had a length of stay (LOS) of approximately 6.57 days and a mortality of 14.06%, those with infections saw LOS extend to 22.54 days and mortality rise to 36.89% [5]. The global estimate of 4.71 million deaths attributable to antimicrobial resistance in 2021 further highlights the urgency of addressing VAP within the broader AMR crisis.

Strengthening Prevention Strategies

The occurrence of VAP often highlights gaps in infection control and environmental hygiene. Preventing VAP requires a structured, system-level approach. Hospitals must ensure adequately staffed infection-prevention units and maintain strong collaboration with microbiology laboratories to ensure timely culture reporting and antimicrobial stewardship.

The implementation of "Care Bundles" is non-negotiable.

Essential components must include:

- Strict hand hygiene compliance.
- Daily assessment of readiness for extubation.
- Maintenance of endotracheal cuff pressure.
- Head-of-bed elevation (30°–45°).
- Oral care with chlorhexidine.
- Sedation minimization protocols.
- Sterile suctioning and proper circuit management.

Strict adherence to these protocols, combined with internal reporting and antibiogram evaluation, has been shown to decrease mortality rates [9]. While establishing protocols is the first step, the rigorous adherence to them by all stakeholders is the only way to drastically reduce the incidence of VAP.

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