EDITORIAL

Ventilator-associated Pneumonia: A Persistent Menace in the ICU

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All over the world, in intensive care units (ICUs), invasive mechanical ventilation (MV) is initiated for numerous causes, including central nervous system (CNS) disease, neuromuscular disease, respiratory pathology, cardiovascular system involvement, and many other situations, depending on the extent of disease and the purpose for need of mechanical support in breathing. However, MV has its own complications, which can lead to increase in morbidity and mortality, and ventilator-associated pneumonia (VAP) is one such major and common complication.[1] Ventilator-associated pneumonia is defined as pneumonia that develops ≥48 h after the initiation of invasive MV.[2] There is a variation in incidence of VAP depending on the geographical region, type of patients admitted to a particular ICU, and methods used for diagnosis. For European Centers, the European Union – ventilator-associated pneumonia/community-acquired pneumonia (EU-VAP/CAP) study has reported an incidence of 18.3 per thousand ventilator-days, whereas it is much lower in North American hospitals, i.e., around 1–2.5 per thousand ventilator days.[3] In lower-middle income countries, the incidence of VAP is reported to be as high as 43.7 per thousand ventilator days.[4]

The incidence rate varies significantly depending on the studied population. It has been reported that the incidence of VAP drastically increases in trauma patients (nearly 4 times) compared to non-trauma patients.[5] Chronic obstructive pulmonary disease and acute respiratory distress syndrome patients also have a predisposition for higher VAP incidence. However, age does not seem to affect the rate of incidence of VAP. Male gender is considered an independent risk factor for VAP.[3]

The list of risk factors for VAP includes pre-existing pulmonary disease, multiorgan involvement, and supine position. Some of additional risk factors are use of sedation and paralytic agents, prolonged mechanical ventilation and ICU stay, aspiration, reintubation, and immunosuppression.[6]

The microbiological organisms associated with VAP depend on multiple factors, including the duration of mechanical ventilation and ICU stay, exposure to antimicrobials, and local epidemiology. The most common gram-positive microorganism is *Staphylococcus aureus*, while the most common gram-negative microorganisms are *Acinetobacter* species, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Escherichia coli*.[3] The predominant pathogens causing VAP in Asian countries are gram-negative organisms. One of the Indian studies reported 95.7% of bacterial isolates to be gram-negative bacilli of which 34.28% were *Acinetobacter* spp. and *P. aeruginosa* comprised 25.71% of the isolates.[7] A systematic review on VAP among adults in Asia suggested that most commonly identified organism was *Acinetobacter baumannii* (26%), followed by *P. aeruginosa* (22%) and then *K. pneumoniae* (14%).[4] A report presented by panel of experts from 10 Asian countries had warned about the increasing prevalence of multidrug-resistant (MDR) pathogens which was in alignment with the findings of a study conducted in an Indian ICU. Mathai et al. reported around 27.3% isolates to be MDR organisms. All *Acinetobacter* isolates were MDR, and nearly half (43.1%) of them were resistant to carbapenems. Nearly 70% of *Klebsiella* isolates were also resistant to carbapenems.[8] Papazian et al. reported that nearly two-thirds of *A. baumannii* strains were carbapenem-resistant.[3] These MDR organisms pose a major challenge in the treatment of VAP and subsequently increase mortality.

Since VAP increases the length of stay (LOS) in the ICU, it also increases the burden of cost on public healthcare system or private individuals. A recent study in a trauma ICU suggested that the LOS for VAP patients was almost thrice compared to that of a non-VAP patient. The total expenditure for a VAP patient was nearly 2.5 times that of a non-VAP patient.[5]

Neurocritical care (NCC) units present a unique set of challenges compared to medical and surgical ICUs. There is a mixed set of patients including cerebrovascular accidents, traumatic brain injury (TBI), post-neurosurgical patients to name a few. Many of them require prolonged mechanical ventilation eventually leading to tracheostomy, have higher chances of aspiration, require sedative agents, and all of these lead to a prolonged ICU stay. The extubation strategies in neurointensive care unit patients and associations with outcomes (ENIO) study were conducted on acute brain injured (ABI) patients which

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included cases like TBI, CNS infections, and cerebrovascular accidents, including ischemic stroke, intracranial hemorrhage, and subarachnoid aneurysmal hemorrhage, and the incidence of VAP was 39.5% (33.7 cases per thousand ventilator days). However, among the various types of ABI patients, TBI patients had the highest incidence of VAP, i.e., 49.5%.[9]

There are limited studies which address the incidence of VAP in NCC units, especially in Asian countries. A study of 457 NCC unit patients revealed a VAP incidence of 39.43 per thousand ventilatory days, and about 30% patients developed VAP. Multidrug-resistant *A. baumannii* and *K. pneumoniae* were the most common causative organisms. Male sex, diabetes mellitus, and a low Glasgow coma scale (GCS) score (3–8) were identified as risk factors in this study. Mechanical ventilation more than 7 days was added risk for VAP.[10]

As with most healthcare-associated infections, VAP increases both morbidity and mortality. Increased morbidity, in turn, prolongs the ICU and hospital stays, which poses financial burden to the patient—party or healthcare system. Prevention is the most effective way to deal with this menace. Generous adoption and strict implementation of general infection control practices and specific VAP prevention strategies are the way forward to aim minimal, if not zero, incidence of VAP. Specific VAP prevention strategies include implementation of bundle, education surveillance, monitoring of compliance with VAP prevention recommendations, consistent reporting of VAP rate and performance feedback.[11]

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