Hospital Acquired Pneumonia – Preventive Strategies

Number of Contact Hours – 1

Audience RN

Pharmacology Hr : 1

CERP : A

Goals and Objectives

Goals

The goal of this article is to discuss the various preventive strategies for hospital acquired pneumonia

Objectives

Discuss the etiology of hospital acquired pneumonia

Identify any three preventive strategies of hospital acquired pneumonia

Describe other preventive interventions in HAP

Discuss the safety priority in prevention of HAP

Describe the clinical prevention strategies of HAP

Introduction

Hospital-acquired pneumonia (HAP) is the second most common nosocomial infection, and is characterized by high morbidity and mortality. HAP is frequently caused by either multidrug-resistant nosocomial bacteria or by opportunistic pathogens, i.e., microorganisms that usually do not cause an infection in healthy individuals but can typically colonize and infect critically ill patients. HAP is especially a serious threat to patients hospitalized in the intensive care unit (ICU) and receiving mechanical ventilation. This so called ventilator-associated pneumonia (VAP) is defined as a pneumonia that typically develops more than 48 hours after endotracheal intubation and initiation of mechanical ventilation. Mechanical ventilation significantly increases the risk for infections resulting in a 20-fold increased risk for developing pneumonia as compared to non-ventilated patients in the ICU. VAP is the most common nosocomial infection in ICU settings, and after controlling for other variables, patients developing VAP have a considerably higher mortality, reaching up to 50% in some studies, compared to non-VAP pneumonia patients. [1, Rank 5]

Etiology of Hospital-Acquired Pneumonia

HAP is mostly caused by opportunistic pathogens such as Pseudomonas aeruginosa, methicillin-resistant Staphylococcus aureus (MRSA), Acinetobacter baumannii and Enterobacteriaceae that tend to colonize patients very quickly once admitted to the hospital. In particular, infections caused by Gram-negative multidrug-resistant organisms, including *P*. aeruginosa and extended-spectrum β-lactamase-producing or carbapenemase-producing Enterobacteriaceae, are increasingly being reported worldwide. Especially in VAP, P. aeruginosa is one of the main etiologic agents responsible for a global prevalence rate of >25% and is associated with development of other serious complications such as septic shock and multiple organ dysfunction.

Researchers consider animal cystic fibrosis (CF) models as highly relevant to understand the pathophysiology of HAP because of their shared etiology. P. aeruginosa is, as in VAP, a major cause of pulmonary infection in CF patients, along with other pathogens known for their biofilm producing capacity such as Staphylococcus aureus *and* Burkholderia cepacia. Cystic fibrosis is the most common and fatal autosomal-recessive disease in the Caucasian population affecting ≈70,000 individuals worldwide and is caused by a dysfunctional CF transmembrane conductance regulator (CFTR) resulting in increased mucous secretion in the alveolar spaces that provide an ideal environment for bacterial colonization and biofilm formation. This biofilm protects bacteria from host immune cells and antibiotics by encapsulation and sequestration and thus co-induces the typically persistent type of lung inflammation observed in CF patients. Moreover, VAP pathogenesis is also closely linked to biofilm forming organisms colonizing the endotracheal tube (ETT) such as *P. aeruginosa,* and the presence of *P. aeruginosa* in the biofilm on the ETT microbiome negatively correlates with patient prognosis. [2, Rank 5]

Prevention Strategies of Hospital Acquired Pneumonia

The heterogeneity of the interventions investigated (hand hygiene, oral care, prevention of aspiration and dysphagia, bed position, mobilization, prevention of viral infections, antibioprophylaxis and stress-bleeding prophylaxis) did not permit a meta-analysis.

<u>Hand Hygiene</u>

Hand hygiene is an effective measure to prevent HAP. Nevertheless, no clinical trial has demonstrated its efficacy for decreasing specifically pneumonia outside the ICU. Studies showed that access to bedside antiseptic handrubs contributed to an increase in hand hygiene compliance leading to an overall significant reduction in nosocomial infection prevalence (from 16.9 to 9.9%). Hence, the implementation of programmes to enhance hand hygiene adherence by health care workers (HCWs) and use of alcohol-based disinfectants could potentially contribute to HAP reduction, but further studies are needed to demonstrate its preventive effectiveness, independent of other measures. [10, Rank 3]

<u>Oral Care</u>

Aspiration of oropharyngeal secretions is an important pathogenic event preceding HAP. Silent aspiration into the intrathoracic airway occurs in normal subjects and is more pronounced in elderly and neurologically impaired patients. The impact of oral care in reducing respiratory tract infections, HAP and mortality has been documented in several clinical trials and has been subject to systematic reviews and meta-analysis.

Researchers conducted a systematic review to examine the evidence for a possible etiological association between oral health and pneumonia. The review found that presence of cariogenic and periodontal pathogens in saliva and dental plaque, dental decay and poor oral hygiene were potential risk factors for HAP. Ten studies analysing the impact of oral care interventions in the incidence or progression of pneumonia were analysed; three of them were not randomized. The interventions included in the studies were: professional dental care, mouthrinse with 0.12% chlorhexidine (CHX), application of 0.2% CHX gel, 1% povidone-iodine (PVI) scrubbing of pharynx, topical application of a non-absorbable antibiotic solution and topical antimicrobial prophylaxis. Studies were performed in ICUs (*n* = 6), nursing homes (*n* = 3) and in a general hospital (*n* = 1). Except for 1 study, all studies showed that interventions reduced the incidence of pneumonia and/or the length of mechanical ventilation. Overall, this review found a relative risk reduction in pneumonia incidence between 34 and 83% following oral decontamination techniques.

Another group of researchers conducted a systematic review focusing on the preventive attributes of oral hygiene (0.12% CHX oral rinse, tooth-brushing, 1% PVI scrubbing of pharynx or professional mechanical oral health care weekly) on pneumonia and respiratory tract infection among hospitalized elderly people and elderly nursing home residents. It included five RCTs and 10 non-randomized intervention studies, all suggesting an association between poor oral hygiene and pneumonia in dependent elderly people. Data from the included RCTs were not considered for meta-analysis because of the heterogeneity in primary endpoints, methodological quality and study design. The analysis revealed an absolute risk reduction between 6.6 and 11.7% for pneumonia, respiratory tract infection and death from pneumonia.

A meta-analysis investigating the effect of oral care on pneumonia among non-ventilated patients was conducted and included five RCTs, two of which assessed the use of CHX in hospitalized patients and the remaining three the impact of mechanical oral cleaning among nursing home residents. A significant risk reduction for pneumonia (relative risk (RR) 0.61, 95% CI 0.40–0.91) as well as a risk reduction for fatal pneumonia (RR 0.41, 95% CI 0.23–0.71) was observed. However, these results should be interpreted with caution. The majority of the RCTs were at high risk of selection bias in that they did not include participants with risk factors for pneumonia, such as patients with nasogastric tubes or severe dementia. Furthermore, a precise and reproducible definition of pneumonia was not provided in two RCTs.

Twenty-eight RCTs were selected for analysis and addressed the following interventions: 1) professional dental care, 2) sodium bicarbonate mouthrinse, 3) toothbrushing, 4) 0.12 and 0.2% CHX, 5) topical application of a non-absorbable antibiotic solution and 6) PVI swab. Although all included trials had a randomized controlled design, the risk-of-bias evaluation revealed that the majority of the included studies presented with a moderate to high risk of bias. Overall, the use of oropharyngeal decontamination using various antimicrobial interventions was suggested to be associated with a reduction in both VAP and HAP. Twelve of the 17 studies reviewing the efficacy of CHX failed to demonstrate a significant effect. The effectiveness of other measures such as tooth brushing or iodine swab remained uncertain. [11, Rank 4]

Prevention of Aspiration and Dysphagia

Dysphagia is the most important risk factor for aspiration pneumonia, especially in elderly and acute stroke patients. It is estimated that 43–54% of stroke patients with dysphagia aspirate and 37% of the later will develop pneumonia.

A systematic review including 1808 studies analysed dysphagia programmes and prevention of pneumonia among post-stroke patients, mainly focusing on the methodology used for the diagnosis of dysphagia. The diagnostic methods analysed were: 1) patients'reports of swallowing difficulty, 2) bedside program evaluation, 3) videofluoroscopic study of swallowing and 4) fiberoptic endoscopic examination of swallowing. Although no RCTs were found in the search, the implementation of a systematic programme for diagnosis and treatment of dysphagia in acute stroke patients seemed to substantially reduce pneumonia rates compared with historical controls in 4 different case series. The small size of available studies did not allow determination of the relative efficacy of different diagnostic methods.

Researchers conducted a systematic review including 15 RCTs that analysed the treatment of dysphagia in post-stroke patients in respect of death, return to functional swallowing and pneumonia. The treatments analysed in the review were: 1) texture-modified diets, 2) swallowing therapy programmes, 3) non-oral feeding, 4) use of medications (nifedipine) and 5) physical stimulation (aromatherapy, cold stimulus of the faucial pillars). According to the authors, the methodological quality of the trials was only fair. Due to the small number of trials found in the search as well as the heterogeneity of treatments and outcomes evaluated, limited evidence was found to support a specific treatment for dysphagia. Nevertheless, the analysis performed suggested that nasogastric tubes do not appear to increase the risk of death when compared with percutaneous endoscopic gastrostomy feeding tubes. Furthermore, general swallowing programs were associated with a pneumonia risk reduction in acute stroke patients. [12, Rank 3]

Bed Position

The positioning of mechanically ventilated patients in a semi-recumbent position for preventing pneumonia has been advocated for more than a decade. However, the possible

impact of semi-recumbent position in HAP prevention among non-ventilated patients has not been extensively studied.

A RCT including 45 dependent patients admitted to a geriatric hospital analysed the impact of bed elevation for at least two hours after each meal and daily cleaning of the oropharynx (gargling for a few minutes with PVI) compared to standard care in the prevention of respiratory tract infections. Febrile days were significantly decreased (up to 4 days) in the intervention group compared to the control group. However, which measure (oral hygiene or bed elevation) contributed more to the reduction in febrile days could not be assessed in this study.

Researchers conducted a RCT including 229 adults and children with tetanus admitted to a Vietnamese hospital. The intervention group was assigned to a semi-recumbent position of 30°. The study included ventilated and non-ventilated patients as well as tracheostomized subjects. Development of pneumonia and mortality did not differ between the intervention (semi-recumbent position) and control group (supine position). In fact, an increase in the overall complication rate (65.0% versus 50.9%, $p = 0.03$) and a need for tracheostomy (58.9% versus 45.5%, $p = 0.04$) were observed in the intervention group. Thus, clinicians should be aware of the risk that non-ventilated patients may often change their positioning and may even increase the likelihood of microaspirations and further complications. [13, Rank 5]

Mobilization

Development of HAP is associated with a reduction in respiratory secretions' clearance, which in turn is related to physical inactivity. Some recommendations for VAP prevention include physiotherapy and early mobility programmes but sparse data is available for HAP prevention.

Researchers conducted a RCT evaluating the preventive effect of a "turn-mob" program for HAP. The study included 223 non-ventilated patients with acute ischemic stroke. The intervention group ($n = 111$) was submitted to the "turn-mob" program, the later consisting of modifying the patient from supine to right and left lateral recumbent position every two hours and passive mobilization of the limbs every 6 h. The intervention was carried out by previously trained relatives of the patient. The control group ($n = 112$) was submitted to change of position by the nursing staff 3 times per day. Performing passive mobilization and postural changes was associated with a 61% relative decrease in the incidence of HAP (intervention group- 12.6% versus control group- 26.8%; RR 0.39, 95% CI 0.19–0.79). Of note, the high HAP incidence (19.7%) observed in this study is twice the rate usually reported for acute stroke patients. Furthermore, the turn-mob program was performed every two hours; thus, wide implementation of this strategy, carried out by patient family members or by HCWs, seems to be too cumbersome and time-consuming to be applied broadly.

A prospective cluster study including 1179 subjects from elderly and respiratory care compared the effect of an early mobility bundle programme in one hospital to usual care in a second one. The primary outcome was incidence of HAP. The intervention consisted of enhancing measures and equipment (availability of walking aids, of mobility charts, education…) in order to maximize patients'mobility. After adjustement on admission condition, age and patient comorbidity, the intervention remained associated with lower incidence of HAP with a hazard ratio of 0.39 (95% CI 0.22–0.68). But these results should be interpreted with caution: patients were not randomized and there were some significant differences between the groups in terms of demographics and comorbidities; falls were significantly higher in the intervention group in comparison with the control group (29.2% versus 18.4%). Randomized studies are warranted to prove clinical effectiveness and lack of adverse events of this kind of intervention for elderly patients. [14, Rank 4]

Other Preventive Interventions

Viral Infections

Among patients with HAP, approximately 20% are due to viral pathogens and are associated with increased morbidity and mortality. Respiratory viral infections, especially influenza and respiratory syncytial virus, affect mainly immunocompromised patients and nosocomial transmission is common. Multimodal interventions including 1) contact and droplet precautions, 2) cohort nursing, 3) influenza vaccination of HCW and high risk populations, 4) chemoprophylaxis to residents in long term care facilities during an influenza outbreak and 5) generalized use of masks irrespective of vaccination status have shown to be effective in prevention of nosocomial spread of influenza and other respiratory viruses. [15, Rank 3]

Antibioprophylaxis

Acute stroke patients are especially vulnerable to infections due to diverse factors: swallowing disturbances, altered mental status, use of invasive procedures (urinary catheterisation; mechanical ventilation) and immunodepression. Considering the higher risk of infection among these patients, a possible benefit by preemptive antibiotic therapy has been considered. A Cochrane systematic review found six RCTs including 506 acute ischemic or haemorrhagic stroke patients. Of these, five were included in a meta-analysis and identified a significant reduction in the general infection rate from 36 to 22% with antibiotic prophylaxis. A recent multicentre RCT included 2538 patients with acute stroke to investigate the effect of intravenous ceftriaxone (2 g daily for 4 days) in the functional outcome at 3 months (modified Rankin Scale), infection rates, death, antimicrobial use and LOS. Although the intervention group had a significant reduction in the rates of overall infection (odds ratio (OR) 0.44, 95% CI 0.30–0.65), the same effect was not observed for pneumonia (OR 0.67, 95% CI 0.39–1.15). Neither functional outcome, nor mortality or LOS was reduced with the intervention, and therefore, there is currently not enough evidence of benefit from the use of prophylactic antibiotics in acute stroke patients. [16, Rank 4]

Stress-Bleeding Prophylaxis

Increase in gastric pH can lead to an increase in bacterial colonization. Researchers have performed a meta-analysis to examine the association between proton pump inhibitors (PPIs) treatment and respiratory infections. They included 7 RCTs and showed a trend towards an association between PPIs and respiratory infections, although it failed to reach statistical significance (OR 1.42, 95% CI 0.86–2.35; *P* = 0.17). They have studied the association between the use of acid-suppressive drugs and the risk of pneumonia. Meta-analysis of 23 RCTs examining risk of HAP in association with use of histamine-2 receptor antagonists showed a higher risk of HAP among subjects receiving those drugs (RR 1.22, 95% CI 1.01–1.48). Of note, few RCTs have been performed outside the ICU setting. [17, Rank 5]

Guidelines for Prevention of Hospital-Acquired Pneumonia

Hospital-acquired infections (HAIs) are a common, costly, and potentially lethal patient safety problem in United States hospitals and world-wide. HAIs affect between 5 and 10 percent of hospitalized patients in the U.S. annually, resulted in approximately 99,000 deaths in 2002, and may account for nearly $45 billion in direct annual hospital costs. While perhaps unavoidable in some patients, at least 20% of all HAIs can be prevented, and approximately 70% of central line-associated bloodstream infections (CLABSIs) appear preventable.

Despite published guidelines and evidence-based recommendations supporting several practices to prevent HAI, research conducted in 2015 identified substantial variability in the use of these recommendations by U.S. hospitals. For example, to prevent CLABSI about 70% of non-federal U.S. hospitals and 80% of Department of Veterans Affairs (VA) hospitals reported regular use of maximum barrier precautions and chlorhexidine gluconate during catheter insertion. To prevent ventilator-associated pneumonia (VAP), over 80% of hospitals regularly used semi-recumbent positioning but only 21% used subglottic secretion drainage. Finally, catheter-associated urinary tract infection (CAUTI) prevention practices were regularly used only by a minority of hospitals.

Since 2015 there have been several initiatives related to infection prevention. Most notable, perhaps, is the change in the Centers for Medicare and Medicaid Services (CMS) payment system, which no longer pays hospitals for the additional costs incurred for certain hospital-acquired infections, including CAUTI and CLABSI, as of 1 October 2008. Other initiatives include the rising number of hospitals participating in infection prevention collaboratives, the use of practice bundles, and the increase in mandated reporting of hospital infection rates by individual states. Whether there has been any increase in the use of practices to prevent HAI by U.S. hospitals, however, is not known. Therefore, they examined the use of infection prevention practices by non-federal U.S. acute care hospitals and VA Medical Centers, and assessed trends in practice use between 2005 and 2009. Because CMS does not pay for services provided in VA hospitals, they are not subject to the non-payment rule

and serve as a comparison group to provide insights about temporal changes as well as the impact of the CMS payment policy. [3, Rank 2]

Safety Priority in Prevention of Hospital-Acquired Pneumonia

Preventing HAP is a patient safety priority in the U.S. and world-wide. Along with a continuing need to develop new practices to reduce infection, we must also understand the extent to which recommended practices are being used to identify potential gaps and opportunities for enhancing infection prevention activities to protect hospitalized patients. This study shows a significant increase in the percentage of U.S. hospitals, both non-federal and VA, reporting use of several key practices to prevent CLABSI, VAP, and CAUTI between 2005 and 2009. The majority of non-federal hospitals report that the CMS policy to no longer pay for the additional cost of some HAIs had a moderate to large increase on the priority of preventing CLABSI, VAP and CAUTI at their facility. Not surprisingly, a majority of VA hospitals report no change in priority related to the CMS rule since they are not directly subject to the payment change. Despite the increased use of many practices, however, there is much variability and the use of practices to prevent CAUTI remains relatively low compared to those for CLABSI and VAP among both groups of hospitals.

Of the 12 practices included in this analysis, reported use increased for 11 of the practices among non-federal hospitals and for 11 of the practices among VA hospitals. Although not all increases were statistically significant, the patterns observed for many of the practices appeared to be similar between the non-federal and VA hospitals particularly those for preventing CLABSI and VAP. Reported use of all of the practices for preventing CLABSI, except antimicrobial central venous catheters, and all of the practices for preventing VAP increased among both non-federal and VA hospitals. Interestingly, more than half of the non-federal hospitals identified a moderate or large increase in the importance of preventing VAP as a result of the CMS payment change. Yet, while VAP was one of the conditions considered when the initial list was established and remains among the conditions discussed for subsequent inclusion, it is not currently affected by the CMS payment rule.[27] Perceived importance notwithstanding, the actual direct impact of the reimbursement rule on prevention efforts to date appears to be limited. [4, Rank 3]

Clinical Prevention Strategies

The clinical strategy combines clinical suspicion with semi-quantitative cultures of sputum and/or tracheal aspirates. Clinical parameters include fever, pulmonary manifestations (e.g. purulent sputum or endotracheal secretions, abnormal respiratory system examination, worsening gas exchange), and basic investigations (e.g. leukocytosis, abnormal chest radiograph). Advanced radiologic investigations such as CT scanning are neither feasible in most patients nor recommended. Clinical data are supplemented by microbiological workup.

Sputum or endotracheal aspirates (ETAs) are easily obtained in most patients and should be sent for culture before initiation of antibiotics. It is important to ensure that a representative sample of the lower respiratory tract is collected. Despite its numerous limitations, sputum appears to be the only representative lower respiratory tract sample in non-intubated patients. Routine culture reporting as either positive or negative is not useful since it cannot discriminate at all between the wide spectrum of light contamination and heavy infection. Semi-quantitative cultures overcome this problem to some extent, and are still technically simple enough to be feasible in most standard microbiology laboratories. Culture growths are reported semi-quantitatively as light, moderate, or heavy. Semi-quantitative tracheal aspirate cultures are highly sensitive, but have low specificity and cannot differentiate colonization from infection. However, their specificity increases when combined with clinical criteria. The semi-quantitative cultures, however, have a high negative predictive value. In fact, a sterile ETA culture is strong evidence against pneumonia in the absence of a recent change in antibiotic therapy. In addition, blood cultures, as well as cultures of other clinical specimens (such as pleural fluid) should also be submitted. These additional investigations help in identifying possible extrapulmonary sites of infection, and a concordant isolate from both respiratory and other samples virtually clinches the microbial etiology. [5, Rank 4]

It must be emphasized that a combination of clinical and radiologic features alone has low specificity for diagnosing HAP/VAP due to substantial overlap with non-infectious conditions like congestive heart failure, pulmonary edema, pulmonary hemorrhage, atelectasis, and others. Therefore, supplementary microbiological data are extremely important. No single constellation of clinicoradiological findings is a perfect diagnostic marker of HAP/VAP. There have been several efforts to formulate objective bedside criteria to assist the clinician in diagnosing HAP/VAP. One widely used clinical approach is the CDC algorithm for “clinically defined pneumonia,” which attempts diagnosis based on the presence of two of three radiologic criteria, plus at least one systemic and two pulmonary signs clinically suggestive of pneumonia

In order to increase the specificity of clinical diagnosis, the clinical pulmonary infection score (CPIS) is utilized, which combines clinical, radiographic, physiological (PaO_2/FiO_2), and microbiological data into a single numerical result. When the CPIS exceeded 6, good correlation was found with pneumonia diagnosed by quantitative cultures of bronchoscopic and non-bronchoscopic bronchoalveolar lavage (BAL) specimens. Researchers also proposed a modified CPIS that does not rely on culture data to guide clinical management. Not all recent studies have corroborated the high accuracy initially reported for the CPIS. The accuracy of the CPIS is not high without microbiological data, but can be improved if a reliable lower respiratory tract sample is obtained and studied carefully using Gram staining. Although CPIS may not be a good tool for diagnosis of HAP/VAP, it may still help the clinician to evaluate the clinical response to therapy and determine its appropriate duration. The duration of therapy was directly correlated with the CPIS at the time of pneumonia

diagnosis. In one study, the CPIS when calculated prospectively and used serially throughout the course of VAP management, decreased in patients who survived, but not in those who did not, thus reflecting the clinical evolution of pneumonia. It is therefore also important that if clinical/microbiological features do not objectively support infection but the clinical suspicion of HAP/VAP is high, patient may be reevaluated after 48–72 h. [6, Rank 5]

Bacteriological Strategy

The bacteriological strategy depends upon "quantitative" cultures of lower respiratory secretions {ETA [10^5 or 10^6 colony forming units (CFU)/mL], bronchoalveolar lavage [BAL, 10^4 CFU/mL] or protected-specimen brush [PSB, 10^3 CFU/mL] specimens, collected with or without a bronchoscope} to establish both the presence of pneumonia and the etiological pathogen. Growth above a threshold concentration is necessary to determine the causative microorganism. The threshold is obtained through cultures of serial dilutions of the clinical material, and is described in terms of CFU per unit volume of the undiluted sample. Bacteriological approach gives importance to separating colonizers from infecting pathogens. However, such an approach is technically demanding, both in terms of equipment/accessories needed for sample collection and the infrastructure required for microbiological standardization. There is hardly any microbiology laboratory in India that routinely performs quantitative cultures, and quantitative cultures are considered more of a research tool. The bacteriological strategy is considerably more expensive in terms of sampling and diagnostics, but may reduce the overall cost of treatment as fewer patients (only microbiologically confirmed pneumonia) are treated with targeted antibiotic therapy.

In several studies, the sensitivity of quantitative tracheal aspirate samples has been >80% for identifying an etiological pathogen, results that were often comparable to bronchoscopic findings in the same patients. The quality of the PSB sample is difficult to measure and the reproducibility is not exact, with as many as 25% of results on different sides of the diagnostic threshold when comparing two samples collected from the same site in the same patient. [7, Rank 4]

Combined Clinicobacteriological Strategy

Beyond issues with the sensitivity and specificity of the CPIS, inter-observer variability in noting clinical parameters remains a major concern, as different clinicians may not absolutely concur with the clinical features in a given patient. Adding microbiological results improves this situation by providing objective evidence of infection. A predominantly clinical approach involves empiric antibiotic therapy in those clinically diagnosed as having pneumonia and can thus result in overtreatment. A bacteriological approach, on the other hand, recommends antibiotics only to those in whom pneumonia is microbiologically confirmed. However, quantitative cultures are not routinely available, and the strategy can result in denying treatment to those with false-negative cultures. A combined approach is logically attractive, with a primary goal of using appropriate therapy in a timely manner, without overusing antibiotics.

In a combined approach, patients strongly suspected to have HAP/VAP undergo lower respiratory tract sampling. Empiric antibiotics may be started after specimens have been submitted for culture. For patients highly suspected to have pneumonia but not fulfilling the essential clinical criteria for the same, regular monitoring is advocated. Some of these patients may actually have ventilator-associated tracheobronchitis (VAT), which is defined by the presence of fever, increased volume and purulence of respiratory secretions, a positive culture of a respiratory sample, and the absence of a new or an evolving pulmonary infiltrate in the chest X-ray in a patient on mechanical ventilation for >48 h. In either situation, the decision to continue/modify/stop antibiotics can be taken once culture results are available, taking into account the overall clinical features and response to treatment. Several guidelines advocate the use of a combined clinical and bacteriological strategy for better outcomes in diagnosing and treating HAP/VAP. [8, Rank 3]

Infection Prevention and Control

Infection prevention and control (IPC) is a universally relevant component of all health systems and affects the health and safety of both people who use health services and those who provide them. Health care-associated infections (HAI) are one of the most common adverse events in care delivery and both the endemic burden and epidemics are a major public health problem. The burden of HAI is significantly higher in LMICs and affects especially high-risk populations, such as patients admitted to neonatal and intensive care units where the frequency of HAI is two to 20 times higher compared to high-income countries, notably for device-associated infections.

HAI has a significant and largely avoidable economic impact at both the patient and population levels, including out-of-pocket costs to patients and costs incurred through lost productivity due to morbidity and mortality. Although the evidence related to the economic burden of HAI is limited, particularly in LMICs, available data from the USA and Europe suggest costs estimated at several billions. According to the US Centers for Disease Control and Prevention, the overall annual direct medical costs of HAI to hospitals in the USA alone ranges from US$ 35.7 to 45 billion, while the annual economic impact in Europe is as high as $ 70 billion

Although significant progress has been made to reduce HAI in many parts of the world, a number of emerging events have underlined the need to support countries in the development and strengthening of IPC with the objective to achieve resilient health systems, both at the national and facility levels. In recent years, global public health emergencies of international concern, such as the Middle East respiratory syndrome coronavirus and the Ebola virus disease outbreaks, revealed gaps in IPC measures applied by the countries concerned. Furthermore, the current review of the International Health Regulations and the Global Action Plan to combat antimicrobial resistance (AMR) called for strengthening IPC across nations. This will also contribute to achieve strategic goal 5 of the WHO Framework on integrated people-centred health services and the United Nations

Sustainable Development Goals - in particular, those related to universal access to water and sanitation and hygiene (WASH), quality health service delivery in the context of universal health coverage, and the reduction of neonatal and maternal mortality.

In consideration of these factors, WHO decided to prioritize the development of evidence-based recommendations on the essential elements ("core components") of IPC programmes at the national and facility level. With the exception of a set of IPC core components previously identified by experts during a WHO meeting, there is a major gap in international evidence-based recommendations as to what should constitute the key elements of effective IPC programmes at the national and facility level. A first step was made by a project initiated by the European Centre for Disease Prevention and Control, which identified key components for hospital organization, management and structure for the prevention of HAI based on evidence and expert consensus. [9, Rank 4]

Conclusion

Hospital Acquired Pneumonia (HAP) is a major public health problem with a significant impact on morbidity, mortality and quality of life. They represent also an important economic burden to health systems worldwide. However, a large proportion of HAI are preventable through effective infection prevention and control (IPC) measures. Improvements in IPC at the national and facility level are critical for the successful containment of antimicrobial resistance and the prevention of HAI, including outbreaks of highly transmissible diseases through high quality care within the context of universal health coverage. Given the limited availability of IPC evidence-based guidance and standards, the World Health Organization (WHO) decided to prioritize the development of global recommendations on the core components of effective IPC programmes both at the national and acute health care facility level, based on systematic literature reviews and expert consensus. The aim of the guideline development process was to identify the evidence and evaluate its quality, consider patient values and preferences, resource implications, and the feasibility and acceptability of the recommendations. [10, Rank 5]

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