CHAPTER 12

Prevention of hospital-acquired pneumonia (strategies for prevention of hospital-acquired infections)

The committee for The Japanese Respiratory Society guidelines in management of respiratory infections

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Prevention of hospital-acquired pneumonia (HAP) requires a full understanding of the mechanisms and aetiology of this disease. Successful prevention of HAP will depend upon reducing the risks of acquiring infection.

The mechanisms underlying HAP are multifactorial. Pathogens (mostly resistant bacteria) adhere to the mucous membranes of the upper respiratory tract (including the nasopharynx) of inpatients and proliferate topically. The usual source of the pathogens is the hospital environment or infected individuals and/or carriers. Patients who have significant risk factors such as systemic immunosuppression, or susceptibility to infection locally in the lower respiratory tract are likely to develop HAP. Pathogens in the mucous membranes of the upper respiratory tract are able to descend into the lower respiratory tract, where they adhere and proliferate. From here pathogens can invade the alveoli, ultimately causing pneumonia. This is the most common sequelae leading to infection. Other routes of infection include the gastrointestinal tract, urinary tract, bedsores and intravenous hyper alimentation (IVH). In these situations inpatients with underlying disease states are invaded by pathogens via the gastrointestinal tract, urinary tract, bedsores and IVH catheters following bacteremia. As a consequence, the basic strategies for prevention of HAP are primarily as follows: (a) individual defence strategies for each inpatient, (b) strategies for prevention of transmission of infection from health care workers, and (c) improvement of the hospital environment (Fig. 1).

STRATEGIES FOR THE PREVENTION OF INFECTION OF INPATIENTS

The most effective way to prevent HAP is to implement thorough preventive measures for each individual patient. The key methods are as follows.

Cleaning the upper respiratory tract

The upper respiratory tract serves as a gateway to the lower respiratory tract for pathogenic bacteria, and ultimately, it is impossible to prevent HAP without proper cleaning of the upper respiratory tract. From the standpoint of mouth care (oral hygiene), rinsing the mucous membranes of the upper respiratory tract (including periodontal region, pharynx and nose) has been demonstrated to be effective in preventing lower respiratory tract infection. Gargling with povidone-iodine approximately four times a day (in the morning, between meals and at bedtime) is also effective in preventing hospital-acquired infection, taking the rates of proliferation of bacteria and other microorganisms into consideration.

Strategies for prevention of aspiration pneumonia

Since ‘aspiration’ is one of the factors leading to severe/intractable HAP, it is advisable to take measures to prevent aspiration pneumonia as appropriate in each individual. For example, appropriate body posture must be maintained during and after meals. Other preventive measures include drug therapy and gastrostomy. (Refer to Chapter 8.)
Nutritional control

It is particularly important for systemic management to keep patients well nourished. It has been reported that low serum albumin levels are associated with an increased susceptibility to infection.

Control of underlying disorders directly linked to susceptibility to infection

1. Sputum drainage and respiratory rehabilitation for patients with chronic lower respiratory tract infection
2. Prevention of congestive heart failure in patients with chronic heart disease
3. Adequate control of factors contributing to susceptibility to infection, such as diabetes mellitus and other metabolic disorders

Strategies for the management of diseases other than respiratory disorders that may lead to invasion by pathological microorganisms

It is very important to prevent bedsores, because they often serve as a gateway to microbial invasion. It is also necessary to handle IV catheters appropriately. Try to maintain bowel movements as normal as possible to prevent bacterial invasion through the intestinal tract or biliary tract (to prevent autoinfection).

Vaccination

Influenza vaccine and *Streptococcus pneumoniae* vaccines are often effective in preventing HAP.

**BASIC STRATEGIES FOR THE PREVENTION OF HOSPITAL-ACQUIRED INFECTIONS TO BE IMPLEMENTED BY HEALTHCARE WORKERS**

Washing and disinfecting the hands and fingers thoroughly

All healthcare workers (physicians, nurses and assistants, in particular) must wash and disinfect their hands and fingers thoroughly before every medical procedure. Disposable gloves should be worn as needed. All healthcare workers must be trained and educated properly in this respect, and they must be re-educated as needed. In addition, all healthcare workers should break bad habits, including the habit of touching their face with the fingers. Safety re-training programmes must be offered on a regular basis (e.g. once a year).

Thorough gargling

Healthcare workers are continually placed in environments where they are exposed to pathogens (respiratory pathogens readily adhere to the mucous membranes in the oral cavity), whether inside or out-
side of hospitals. Healthcare workers must ‘gargle’ between medical procedures, because they are always at a risk of becoming carriers of pathogens via the airborne mode of infection (droplet nucleus infection) or droplet infection. Povidone-iodine (isodine®) is adequately bactericidal even at very dilute concentration (the stock-solution may be diluted approximately 300 fold). If healthcare workers have no past history of allergic reaction to iodine, povidone-iodine (isodine®) is useful in preventing hospital-acquired infections.

**Prevention of hospital-acquired infection(s) through vaccination of healthcare workers**

Vaccination against influenza is recommended for healthcare workers. In addition to influenza vaccine, healthcare workers, primarily interns, residents and nurses should be vaccinated with measles vaccine and chickenpox vaccine, because measles and chickenpox are often serious when contracted by adults. To prevent measles and chickenpox, the measles antibody titres and chickenpox antibody titres of healthcare workers, primarily interns, residents and nurses should be determined.

**Offering adequate educational programmes for prevention of hospital-acquired infections**

Educational programmes or courses should be offered on a regular basis so that healthcare workers recognise the importance of their role in preventing hospital-acquired infections as a whole.

**BASIC STRATEGIES FOR PREVENTION OF HOSPITAL-ACQUIRED INFECTIONS TO BE IMPLEMENTED BY MEDICAL INSTITUTIONS**

The medical institution (the founder or director) is responsible for providing the proper hospital environments listed below (physical aspects) for the prevention of hospital-acquired infections. These efforts must be functionally linked to strategies for the prevention of hospital-acquired infections to be implemented by all healthcare workers (physicians, nurses and their assistants) as mentioned earlier.

**Environmental strategies for the hospital and hospital units**

All rooms in the hospital must be cleaned adequately, and contamination by pathogenic bacteria (as a result of a variety of procedures in the hospital) must be eliminated as quickly as possible. Contaminated materials must be disposed of by following strict procedures. Instruments and linen supplies (used for patient care) must be disinfected as appropriate.

**Ventilation of hospital rooms, and related issues**

Whenever possible, hospital rooms should be maintained under negative pressure, and if that is impossible, an attempt should be made to ventilate them as appropriate (ventilation to the outside). Contaminated rooms must be equipped with high-quality filters and adequate ventilation should be performed.

**Maintaining clean beds and providing adequate space between beds (in large rooms accommodating several patients)**

Transmission of pathogens between patients must be minimized by providing adequate space between beds.

**Arrangement of rooms for patients with infections (it is preferable to accommodate patients with infections in separate rooms.)**

Patients with MRSA infection should be accommodated in rooms specially designated for MRSA infection alone, and a special toilet, bath and ventilation equipment should be installed (keeping the hospital room under negative pressure and using ventilation filters) in special rooms for ambulatory patients. Designated white clothes and a mask (an N95 particulate mask, etc. if needed) must be worn at all times and doors must be closed tightly.