

NOSOCOMIAL INFECTIONS IN AN INTENSIVE CARE UNIT

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Summary

A total of 676 patients were admitted to the intensive care unit, University Hospital, Kuala Lumpur between January 1989 and March 1990. Fifty-one hospital-acquired infections were recorded, giving a rate of 7.6%. The most frequent site of infection was the respiratory tract (41.2%), followed by the urinary tract (27.5%). Most of the pathogens were gram-negative bacilli (71%). The three most common pathogens were *Klebsiella* species, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Key words: Intensive care unit, nosocomial infection.

INTRODUCTION

Critically ill patients in the intensive care unit (ICU) are especially susceptible to many types of infections as these patients undergo more invasive procedures and instrumentation, for example mechanical ventilation, tracheostomy, urinary tract catheterisation and intravenous infusions. Furthermore, they tend to stay-for longer periods of time in the hospital and receive multiple antibiotic therapy, making them more susceptible to colonisation and subsequent infection by hospital strains of pathogens. These bacterial strains are characteristically multiply-antibiotic resistant. The urinary tract, wounds and respiratory tract are important sites of nosocomial infections. Gram-negative bacilli are the main pathogens, especially *Pseudomonas aeruginosa*, which is particularly associated with respiratory tract infections.^{1,2,3}

This article describes the pattern of nosocomial infections and their major causative pathogens occurring in the ICU, University Hospital, Kuala Lumpur, during the period of January 1989 to March 1990. The criteria for infection was determined from clinical surveillance and laboratory data.

MATERIALS AND METHODS

A. Method of surveillance

This was done by reviewing all bacteriological culture reports for the ICU, selecting those which indicate possible infections and reviewing the patients' clinical information to confirm hospital-acquired infections.

A nosocomial infection is considered to be any clinical infection manifested in a patient 48 hours or more after admission into hospital. Culture negative infections, fungal, viral and parasitic infections were excluded from the survey.

B. Definitions of various infections

1. Respiratory tract infection:
The presence of purulent respiratory secretions, fever and suggestive chest x-ray.
2. Urinary tract infection:
The presence of significant bacteriuria (at least 10^5 organisms/ml urine) with or without symptomatology.
3. Surgical wound infection:
The presence of inflammation, with or without purulent discharge.
4. Septicaemia:
The presence of pathogens in blood culture specimens, excluding possible contaminants, associated with clinical manifestations.

RESULTS AND DISCUSSION

Out of a total of 676 patients admitted into the ICU during the study period, 51 hospital-acquired infections were recorded. This gives an infection rate of 7.6%, which compares favourably with other hospitals, which had reported infection rates of up to 18%.^{4,5} Such high rates may reflect the type of patients admitted to the ICU. Furthermore, this infection rate in the ICU may be higher if

culture negative infections, fungal, viral and parasitic infections had been included in this study.

The nosocomial infection rate for the whole University Hospital in 1989 was 3.8%, which compares well with rates of 5–10% from other hospitals.⁶ A higher infection rate is to be expected in the ICU as it is a high risk unit consisting of seriously ill and immunocompromised patients requiring intensive critical care management. The main infection occurred in the respiratory tract, accounting for 41.2% of all nosocomial infections in the ICU, followed by urinary tract infection (27.5%) and surgical wound infection (11.8%) as shown in Table 1. It should be noted that

TABLE 1
HOSPITALACQUIRED INFECTIONS IN
ICU, BY SITE OF INFECTION

Site	Number of infections (%)
Respiratory tract	21 (41.2)
Urinary tract	14 (27.5)
Surgical wound	6 (11.8)
Blood	3 (5.9)
Others	7 (13.7)
Total	51 (100)

in the whole University Hospital, respiratory tract infection was the third commonest nosocomial infection, after urinary tract and surgical wound infection. However, in the ICU, since more than 70% of patients admitted required assisted ventilation, the commonest nosocomial infection seen was in the respiratory tract. Prolonged assisted ventilation and the need for frequent bronchial suctioning to clear off secretions would lead to an increased risk of contamination and infection in such patients, usually from exogenous sources. A series of clinical reports have also indicated that respiratory tract infections may be acquired from respiratory therapy equipment, which can harbour gram-negative contaminants.^{2,3} Contamination of reservoir humidifiers and the external circuits of ventilators can lead to direct aerosolisation of these gram-negative organisms into the respiratory tract of ventilated patients. Such equipment should be changed and decontaminated by thermal disinfection daily, if

single-use disposable units are not available.

Septicaemia occurred in 3 patients. The low rate of septicaemia may be due to vigorous treatment of infections in the ICU, and it is comparable to other studies.⁴ Urinary tract infection accounted for 27.5% of all nosocomial infections in ICU. This is most likely associated with urinary catheterisation. *Streptococcus faecalis* was the most frequently isolated organism, followed by *Klebsiella* species. Other organisms responsible for urinary tract infection was *Escherichia coli*, *Proteus* species and *Pseudomonas aeruginosa*. Other infections were mainly superficial skin infections, examples being infected intravenous indwelling catheter sites and septic spots.

The majority of the pathogens were found to be gram-negative bacilli (71%) of which the two most common were *Klebsiella* species and *Pseudomonas aeruginosa* (Table 2). This

TABLE 2
BACTERIA ISOLATED FROM ICU
NOSOCOMIAL INFECTIONS

Bacteria	Number of isolates (%)
<i>Klebsiella species</i>	14 (21.7)
<i>Pseudomonas aeruginosa</i>	12 (18.5)
<i>Staphylococcus aureus</i>	11 (16.9)
<i>Acinetobacter calcoaceticus</i>	6 (9.2)
<i>Streptococcus faecalis</i>	6 (9.2)
<i>Escherichia coli</i>	5 (7.7)
<i>Proteus</i> species	5 (7.7)
<i>Citrobacter</i> species	2 (3.1)
<i>Enterobacter</i> species	2 (3.1)
<i>Streptococcus</i> species	2 (3.1)
Total	65 (100)

is comparable with studies from other hospitals.^{4,7} *Klebsiella* species and *Pseudomonas aeruginosa* were frequently isolated from the tracheal secretions of patients with pneumonia. Routine bacteriological cultures on tracheal secretions of ventilated patients in the ICU revealed that the commonest organism isolated was *Pseudomonas aeruginosa* (41%), followed by *Acinetobacter* species (21.5%) and *Klebsiella* species (13%).

TABLE 3
ANTIBIOTIC SENSITIVITY OF GRAM-NEGATIVE BACILLI ASSOCIATED
WITH NOSOCOMIAL INFECTIONS IN ICU

Antibiotic	No. tested	Sensitive (%)	Resistant (%)
Ampicillin	24	4 (16.7)	20 (83.3)
Co-trimoxazole	24	19 (79.0)	5 (21.0)
Gentamicin	24	22 (91.7)	2 (8.3)
Cefoperazone	20	19 (95.0)	1 (5.0)

Staphylococcus aureus was also commonly isolated from the respiratory tract. Of the 11 *Staphylococcus aureus* isolates, 7 (64%) were methicillin-resistant strains, of which 4 isolates were from the respiratory tract and 3 from surgical wound infections.

Among the gram-negative bacilli, gentamicin resistance was still low at 8.3%, as compared to a high resistance of 83% towards ampicillin, making this antibiotic virtually useless in the ICU. Co-trimoxazole resistance was noted in 21% of gram-negative isolates (Table 3). Ceftazidime resistance occurred in about 5% of all *Pseudomonas aeruginosa* isolated in the University Hospital. During this period in the ICU, 2 (18%) of eleven *Pseudomonas aeruginosa* isolates tested for ceftazidime were resistant.

In conclusion, nosocomial infections contribute significantly to morbidity and mortality of patients in a high risk unit like the ICU although high infection rates can be prevented. Most infections are either endogenous or transferred by contact. Proper antibiotic usage, good nursing practices, aseptic techniques and careful hand hygiene are of paramount importance in infection control in the ICU. Continuous surveillance is necessary to note the type of pathogens and their antibiotic resistance patterns so that proper antibiotic treatment is provided, and to determine that a high standard of patient care is maintained at all times.

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