

The frequency of hospital-acquired infections in Mousavi Hospital Zanjan, Iran

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Abstract

Hospital-acquired infections occur in 5 to 10% of admitted patients in hospital. It is one of the main reasons for death of many hospitalized patients especially in developing countries. Therefore, finding ways to control these infections should be a priority and certainly the first step in achieving this goal. The aim of this study was to determine the frequency of hospital-acquired infections and related factors in Mousavi Hospital in Zanjan, Iran.

The demographic data and data about the kind of infection, admission, duration and the ward of admission were reviewed. Statistical analysis was performed by SPSS version 16.0. Among 34102 admitted patients from 21st March 2013 to 21st March 2014 in Mousavi hospital in Zanjan, Iran, 206 (0.6%) patients, 141 (68.4%) male and 65 (31.6%) female, met the criteria of hospital-acquired infections. The highest frequency was in the burn ward with 82 (20.55%) patients. The most common type of infections were surgical site infections, pneumonia, urinary tract infection, sepsis and eye infection respectively. There was a significant correlation between the type of hospital-acquired infections and hospital wards ($P=0.0001$).

The rate of hospital-acquired infections in this study is lower than other studies, which can be due to an effective way of infection control with continuous surveillance and health education for hospital staffs. However, poor diagnostic methods and failure in the reporting system of infections should be considered.

Keywords: hospital-acquired infection, epidemiology, infection control, Iran

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Introduction

Hospital-acquired infections (HAI) are defined as infections acquired after 48 hours of hospital admission, 3 days after discharge or 30 days after an operation.^{1,2} Infectious agents are transmitted in different ways, but the most common and important way is through contaminated hands. Hospital-acquired infections occur in 5 to 10% of patients admitted to hospitals.^{1,3} Hospital-acquired infection is one of the main reasons for death of many hospitalised patients, especially in developing countries.^{2,4-6} It can also increase the patient's hospitalisation and expenses.⁷ The treatment of HAIs is expensive. More than half of these HAIs can be controlled and prevented. Despite the improvement in treatment processes, the risk of HAI has increased due to prolonged hospitalisations and the increased use of invasive medical devices for patient diagnosis and treatment.⁸ The frequency of HAIs could be reduced with a shorter hospital stay and the prudent use of antibiotics. Therefore, hospital costs may be decreased, resistant organisms may be prevented and the mortality rate in admitted patients may be reduced. Finding ways to prevent or control these infections should be a priority.

The first step in achieving this goal is to assess the current status of the hospital and its different wards. This information is used to define the priorities for allocating resources and for further training of hospital staff in areas with higher risk. The aim of this study was to determine the frequency of HAIs and their related factors in Mousavi Hospital, affiliated with Zanjan University of Medical Sciences in Zanjan, Iran.

Methods

A retrospective case record review was conducted on patients with a diagnosis of HAI in Mousavi hospital, Zanjan, Iran from 21st March 2013 to 21st March 2014. Zanjan province is located in northwest Iran with more than 1,000,000 population. The Mousavi Hospital is a referral and teaching general Hospital of Zanjan University of Medical Sciences with 500 beds and more than 30,000 admissions per year. This hospital has paediatrics, obstetrics and gynaecology, surgery, orthopaedic surgery, urology, cardiology, neurosurgery, a coronary care unit, adult and neonatal intensive care units (AICU and NICU, respectively), with special services in burn and trauma.

A questionnaire was designed to collect information based on the Iranian Nosocomial Infection Surveillance System (NISS) definition.⁹ The patients who met the criteria for an HAI using these definitions were enrolled in this study. The data reviewed for each patient included demographic information, the type of infection and the ward/s where the patient received care. The local Ethical Committee approved the study (Ethical code: ZUMS.Rec.1393.51).

Statistical analysis was performed by SPSS version 16.0. Continuous data were expressed as mean \pm standard deviation (SD). The Student's t-test and Mann Whitney test were applied for comparison of mean values wherever appropriate. The relationship of type and cause of infection with ward of admission was determined by Mann Whitney regression test. The Spearman correlation coefficient was used to find a correlation between them, and a P value ≤ 0.05 was considered significant.

Results

Among 34,102 admitted patients from 21st March 2013 to 21st March 2014, 206 (0.6%) patients, 141 (68.4%) male and 65 (31.6%) female, met the criteria for an HAI. The demographic characteristics of these patients are shown in Table I.

Infection was most common in patients who were older than 50 years (34.4%). Hospital wide, the most common types of HAIs identified were surgical site infections (SSIs), pneumonia and urinary tract infections (UTIs), respectively.

As shown in Table II, of the 399 patients admitted to the burn ward, 82 (20.55%) developed an HAI. In the adult ICU ward, HAIs occurred in 91 (12.76%) of the 713 admitted patients. Considering all 206 HAIs detected in the hospital, 44.17% of the infections occurred in the AICU (91 of 206).

Of the 206 patients who developed HAIs, they were as follows: SSI, 101 (49%); pneumonia, 51 (24.8%); UTI, 38 (18.4%); sepsis, 13 (6.3%) and eye infections, 3 (1.5%). Pneumonia was the most common HAI in the AICU and NICU (45.1% and 66.7% respectively). Surgical site infections were the most common HAI in the burn and orthopaedic wards (92.7% and 71.4%

Table I. Demographic characteristics of patients

| Variables | | |
|-------------------|--------|-------------|
| Gender | Male | 141 (68.4%) |
| | Female | 65 (31.6%) |
| Age | | |
| <1 month | | 11 (5.3%) |
| 1 month -10 years | | 34 (16.5%) |
| 10-30 years | | 50 (24.2%) |
| 30-50 years | | 40 (19.4%) |
| >50 years | | 71 (34.4%) |

respectively). In the other wards, the distribution of HAIs was as follows: SSI, 58.8%; pneumonia, 23.5%; and UTI, 17.6%. Eye infections were found only in 3 NICU patients. There was a significant correlation between the type of HAI hospital wards ($P=0.0001$).

Discussion

Hospital acquired infections are a leading cause of morbidity and mortality. In 2002 in the United States, a comparatively well resourced country, it was estimated that a total of 1.7 million HAIs (4.5 per 100 admissions) occurred and these resulted in almost 99,000 deaths, making HAIs the sixth leading cause of death in the United States.¹⁰ Many of these HAIs are potentially preventable.

Table II. The frequency of hospital-acquired infections (HAI) in the different hospital wards

| | Burn ward | AICU | NICU | Orthopaedic ward | Other wards* | Total |
|---|-----------|-------|------|------------------|--------------|-------|
| Total number of admissions | 399 | 713 | 1121 | 3564 | 28305 | 34102 |
| Total number of hospital-acquired infections | 82 | 91 | 9 | 7 | 17 | 206 |
| The frequency of hospital-acquired infections | 20.6% | 12.8% | 0.8% | 0.2% | 0.1% | 0.6% |

AICU = Adult Intensive Care Unit;

NICU = Neonatal Intensive Care Unit;

* Other wards = Paediatrics, Surgery, Obstetric and Gynaecology, Orthopaedic, Urology, Cardiology, Neurosurgery, Coronary care unit

In the present study of patients admitted to Mousavi Hospital in Zanzan Province, Iran, 206 of 34,102 patients (0.6%) developed an HAI. The HAI rate in the present study is similar to that identified in a much larger Iranian study by Zahraei *et al.* who found 10,557 HAIs among 1,879,356 patients admitted to selected hospitals (0.57%).⁴ In 2006, Askarian *et al.* conducted a six month prospective hospital wide study at a 374 bed educational university hospital in Shiraz, Iran, and determined an overall HAI rate of 4.1 per 1,000 patient days.⁵ Notably, the length of stay was four days for non-infected patients and 17.5 days for infected patients ($P<0.001$).

Other investigators have studied HAI rates in different regions and settings. Razine *et al.* conducted a point-

prevalence study of HAIs on all wards of eight hospitals of the Rabat University Medical Centre, Rabat, Morocco and found that HAIs were present in 10.3% of patients.¹¹ Ding *et al.* conducted a retrospective review of HAIs in the ICU of a tertiary hospital in East China between 2003 and 2007 and calculated an HAI rate of 26.8% or 51.0 per 1,000 patient days.³ Maa *et al.* conducted a 5 year retrospective study of HAIs at Linkou Chang Gung, Taiwan's only children's hospital (495 beds), and determined the incidence of HAIs to be 4.06 episodes per 1,000 patient days.¹² Ghotbi *et al.* found the overall prevalence of HAIs in the NICU of Besat Hospital, Sanandaj, Iran was 15.96%.¹³ Finally, in a five year retrospective study of HAIs at Bahrami Children Hospital, Tehran, Iran, Salamati *et al.* identified 52 of 5,990 (0.87%) patients with an HAI.¹⁴

Askarian *et al.* found that among their 4,013 patients, the most common HAI overall was UTI (1.07%), followed by SSI (0.72%), bloodstream infection (0.32%), and pneumonia (0.32%).⁵ Zahraei *et al.* also identified UTI as the most prevalent infections (32.2%) and bloodstream infections as the least (16.3%) prevalent.⁴ Among the 206 patients in the present study, surgical site infection and pneumonia were the two most frequent HAIs, but frequency varied depending on the specific patient population. In the present study, pneumonia was the most common HAI in the adult ICU (45.1%) and NICU (66.7%), in keeping with other studies which have found respiratory infections to be most common in ICUs. Farzianpour *et al.* identified pneumonia and UTIs as their most common HAIs.⁷ Ding *et al.* reported that lower respiratory tract infections accounted for most of the infections (68.4%) in their ICU, followed by UTIs (15.9%), bloodstream infection (5.9%), and gastrointestinal tract infection (2.5%).³ Hajibagheri *et al.* determined that 30 to 50% of HAIs were pneumonia related to mechanical ventilation in the ICU of Tohid Hospital in Sanandaj, Iran.¹⁵ However, Askarian *et al.* identified the most frequent infection in ICU to be UTI.⁵

In contrast to ICU settings, in our study SSIs were the most common in the burn ward (92.7%) and the orthopaedic ward (71.4%). Differences among study findings may reflect different patient populations and inpatient services provided. In a 2011 prevalence survey of HAIs in 183 hospitals in the United States, the rate of HAI was 4.0%.¹⁶ The most frequent infections were pneumonia (21.8%), SSIs (21.8%), and gastrointestinal infections (17.1%).

There was also a correlation between the frequency of HAI and hospital ward in the present study. Patients admitted to ICUs have a higher risk of developing an HAI. For example, 44.2% of the total HAI detected in our study were identified in adult ICU patients, similar to Zahraei *et al.* who found 26.7% of HAI in ICUs, followed by 12.8% in the surgery ward.⁴ Farzianpour *et al.* also identified that the majority of HAIs in their study in three teaching hospitals in Qazvin Province, Iran, developed among ICU patients.⁷ Salamati *et al.* found that the highest proportion of paediatric HAIs occurred in the NICU (40%), followed by the neonatal surgery ward (35%) and the neonatal ward (25%).¹²

The low rate of HAIs observed in this study could be due to good infection control practices with continuous surveillance, and the health education program provided for the hospital staff. However, suboptimal diagnostic methods and the failure in full reporting of infections should be considered as reasons for our low HAI rates. In spite of our low reported overall HAI rates, ongoing efforts are needed to reduce HAIs in our hospital, in particular SSI and pneumonia.

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