

Incidence and characteristics of health care-associated infection in hospitalized patients with rheumatic diseases in Alexandria Main University Hospital

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Introduction

Health care-associated infection (HCAI) is an important cause of morbidity and mortality in patients with autoimmune diseases. Most previous reports investigated HCAI in the setting of systemic lupus erythematosus but lacked reports on other connective tissue diseases.

Objectives

We aimed to determine the incidence and characteristics of HCAI in patients with rheumatic diseases admitted to the Rheumatology Unit in Alexandria Main University Hospital in 2017.

Patients and methods

A 1-year duration prospective observational study was done to elucidate the incidence and characteristics of HCAI in patients with underlying rheumatic diseases who were admitted to our Rheumatology Unit between January 1 and December 31, 2017. Statistical analysis was performed using IBM SPSS Statistics 20. Data are presented as numbers and percentages for categorical variables and means and SDs for continuous variables.

Results

A total of 516 patients [423 (82%) female and 93 (18%) male] with underlying rheumatic diseases and disease duration of 6.03±4.18 years were admitted during the study period. The mean age was 32.18±9.54 years, and the mean length of hospitalization was 10.04±5.76 days. HCAI occurred in 14.9% ($n=77$) of patients, with 81 (15.69%) infection cases (four cases had more than one episode of infection in more than one site with a different organism during the same admission). Gram-negative bacilli were the most commonly isolated organisms (46.3%; $n=38$), and the urinary tract was the most commonly documented site of infection (39.5%; $n=32$). *Klebsiella* spp. (17.9%; $n=15$) was the most frequently identified infectious agent. Of the total cases with HCAI ($n=77$), 85.7% ($n=66$) were cured, 7.8% ($n=6$) deteriorated, 5.2% ($n=4$) died, and 1.3% ($n=1$) referred to another specialized hospital.

Conclusion

Despite the improvement in health care services, the incidence of HCAI infection in our inpatient population is still high and represents a burden on our resources. Although most cases were treated with appropriate antimicrobials, HCAI is still the cause of deterioration, and death occurred in a considerable percentage of patients with rheumatic diseases.

Keywords:

health care-associated infection, incidence, rheumatic diseases

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Introduction

Despite a significant increase in the survival of patients with rheumatic disorders over the past five decades, infection continues to be a major cause of mortality and morbidity among those patients, and deaths owing to infection are observed all through the disease course [1]. The increased susceptibility to infections in such patients may be explained by abnormalities of the cellular and humoral immune responses, the use of immunosuppressive drugs, as well as comorbidities [2,3].

Health care-associated infections (HCAI) are an important cause of morbidity and mortality during

hospitalization. The estimated number of HCAI cases in hospitals in the USA was 1.7 million, with almost 99 000 deaths directly resulting from HCAs in a study conducted in 2002 [4].

Rapid medical, surgical, and pharmaceutical advances in the past 30 years have resulted in a rapid growth of a population of patients with suppressed immune

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function. The incidence of infections in this group has risen rapidly as their numbers grow due to increased survival. Overall, the incidence of serious infections and severe sepsis has clearly increased over time [5].

Infections are an important cause of morbidity in patients with autoimmune diseases [6]. Infections in patients with underlying autoimmune diseases can involve unusual organisms requiring atypical pharmacological therapy. In addition to having increased susceptibility to common community-acquired and nosocomial pathogens, immunocompromised patients are vulnerable to opportunistic pathogens and to reactivation of endogenous but latent organisms [7]. Infection with these pathogens can present with minimal signs and symptoms or with atypical features in unusual locations. This can considerably delay the diagnosis if the presence of immunocompromise is not appreciated. Although the risk of mortality is high in these patients given the underlying immunosuppression and the unusual nature of the involved organisms, the outcome can be optimized by early diagnosis and aggressive treatments with specific therapy [8,9].

It is extremely important to prevent HCAI in medical care generally and in the setting of rheumatic diseases particularly owing to the immunosuppressive state associated with these disorders. There are few detailed systematic reports on HCAI in rheumatology locally and internationally; most previous reports investigated infection as a whole in rheumatic patients or HCAI in the setting of systemic lupus erythematosus (SLE) but lack other connective tissue diseases (CTDs), and reviewing the literatures revealed few studies in this context.

We aimed to determine and characterize the annual incidence of HCAs in patients with underlying rheumatic diseases admitted to the Rheumatology Unit of the Internal Medicine Department in Alexandria Main University Hospital (AMUH).

Patients and methods

A 1-year duration prospective observational study was performed to elucidate the incidence and characteristics of HCAs in patients with underlying rheumatic diseases admitted to the rheumatology ward of the Internal Medicine Department in AMUH, between January 1 and December 31, 2017. Informed consent was obtained from patients who participated in this study and confidentiality of data was assured. Data were

collected on demographic and clinical characteristics and also on previous and current clinical history. Infection acquired at any time before admission or detected within 48 h of hospital admission in patients without previous contact with health care services was classified as community-acquired infection [10,11]. HCAI was determined according to the criteria proposed by Cardoso *et al.* [12] as infection detected within 48 h of hospital admission in patients who had previous contact with health care service within 1 year. Patients who fulfilled these criteria were counted as patients with HCAI, whereas other patients who did not fulfill these criteria were counted in the non-HCAI group. The diagnosis of infection was based on clinical findings, positive cultures, gram-stain results, specific serological assays, and/or response to antimicrobial treatment. The type of identified organisms, site, and outcome of all HCAI were recorded for each case.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics 20 (Armonk, NY: IBM Corp.) [13]. Data are presented as numbers and percentages for categorical variables and means and SD for continuous variables (age, length of stay, and disease duration). Regarding ethical considerations, official approvals for the study were obtained from the ethical committee of the Faculty of Medicine, University of Alexandria, and the Director of the AMUH. Confidentiality of data was assured.

Results

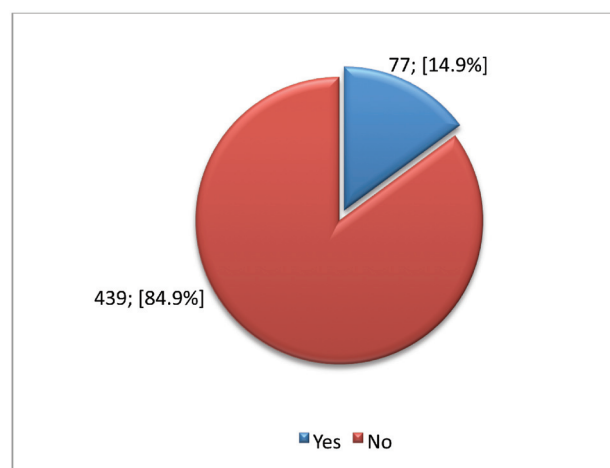
During the aforementioned period, a total of 516 admissions were recorded. Their demographic data and clinical characteristics are summarized in Table 1. In 14.9% ($n=77$) of the total admissions, at least one HCAI was documented (Fig. 1). Five cases showed mixed infection with more than one type of organism (total $n=82$), seven developed a mixed infection with more than one microorganism isolated from the same site (total $n=84$), and four patients developed more than one infection in more than one site per admission (total $n=81$). Gram-negative bacilli were the most commonly isolated organism in 46.3% ($n=38$) followed by gram-positive cocci in 25.6% ($n=21$) and fungal infection in 11% ($n=9$). Gram-positive diplococci, gram-negative cocci, and gram-negative diplococci were identified in (6.1%; $n=5$), (4.9%; $n=4$), and (2.5%; $n=2$), respectively. Gram-positive bacilli, gram-negative coccobacilli, and viral infection were documented in 1.2% ($n=1$) for each one of them (Table 2).

Table 1 Demographic and clinical characteristics of the studied cases

Demographic and clinical characteristics	n (%)
Sex	
Male	93 (18.0)
Female	423 (82.0)
Place of admission	
Male Medical Ward	73 (14.2)
Female Medical Ward	336 (65.1)
Intermediate Care Unit	107 (20.7)
Age (years)	
Mean±SD	32.18±9.54
Minimum–maximum	15–54
Length of stay (days)	
Mean±SD	10.04±5.76
Minimum–maximum	4–67
Diagnosis	
Systemic lupus erythematosus	191 (37.0)
Rheumatoid arthritis	170 (32.9)
Seronegative spondyloarthritis	32 (6.2)
Primary vasculitis	28 (5.4)
Inflammatory myositis	21 (4.1)
Juvenile idiopathic arthritis	20 (3.9)
Behçet's disease	11 (2.1)
Primary antiphospholipid syndrome	10 (1.9)
Systemic sclerosis	9 (1.7)
Adult-onset still's disease	7 (1.4)
Overlap syndrome	7 (1.4)
Mixed connective tissue disease	5 (1.0)
Primary Sjogren's syndrome	5 (1.0)
Disease duration (years)	
Mean±SD	6.03±4.18
Minimum–maximum	1–27
Disease activity	
Yes	373 (72.3)
No	143 (27.7)
Comorbidities	
Yes	30 (5.8)
No	486 (94.2)
Total	516 (100.0)

Klebsiella spp. was the most commonly isolated organism in 17.9% ($n=15$) followed by methicillin-resistant *Staphylococcus aureus* (MRSA) in 14.3% ($n=12$) and *Pseudomonas aeruginosa* in 11.9% ($n=10$), whereas, *Pneumocystis jirovecii*, *Clostridium difficile*, *Enterovirus* spp., and *Aspergillus* spp. were the least isolated organisms in 1.2% ($n=1$) of HCAI cases, for each one of them (Table 3).

Urinary tract infection (UTI) was the most common identified infection in 39.5% ($n=32$) followed by blood stream infection (BSI) in 18.5% ($n=15$), lower respiratory tract infection in 16.1% ($n=13$), and upper respiratory tract infection in 7.4% ($n=6$), whereas pseudomembranous colitis, infective endocarditis, oropharyngeal infection, and empyema were the least documented infection in only

Figure 1

Distribution of studied cases according to the presence of HCAI. HCAI, health care-associated infection.

Table 2 Types of organisms in cases with health care-associated infection

Type of organisms	n (%)
Gram-negative bacilli	38 (46.3)
Gram-positive cocci	21 (25.6)
Fungus	9 (11.0)
Gram-positive diplococci	5 (6.1)
Gram-negative cocci	4 (4.9)
Gram-negative diplococci	2 (2.5)
Gram-positive bacilli	1 (1.2)
Gram-negative coccobacilli	1 (1.2)
Viral	1 (1.2)
Total ^a	82 (100.0)

^aFive cases had mixed infection with more than one type of organisms.

1.2% ($n=1$) of HCAI cases for each one of them (Table 4).

Regarding the outcome of HCAI cases, 85.7% ($n=66$) improved, 7.8% ($n=6$) died on the same admission, 5.2% ($n=4$) deteriorated and developed multiorgan failure and were shifted to the ICU, and one case with meningitis was transferred to another specialized center for further management (Fig. 2).

Discussion

Patients with rheumatic diseases have an increased risk of infections owing to their condition and immunosuppressive therapies. To date, reviewing the literature did not reveal any documented data regarding the incidence of overall infection in rheumatic diseases, and HCAI in particular, in Egypt. To decrease the incidence rate of HCAs, we prospectively surveyed the incidence and characteristics of HCAI in our hospital.

Table 3 Organisms in cases with health care-associated infection

Organisms	n (%)
<i>Klebsiella</i> spp.	15 (17.9)
MRSA	12 (14.3)
<i>Pseudomonas aeruginosa</i>	10 (11.9)
<i>Candida albicans</i>	7 (8.3)
<i>Acinetobacter baumannii</i>	6 (7.1)
<i>Staphylococcus aureus</i>	5 (5.9)
<i>Enterococcus</i> species	5 (5.9)
<i>Escherichia coli</i>	4 (4.7)
<i>Staphylococcus epidermidis</i>	3 (3.6)
<i>Legionella pneumophila</i>	3 (3.6)
Vancomycin-resistant <i>Enterococcus</i> spp.	2 (2.4)
<i>Providencia</i> spp.	2 (2.4)
<i>Neisseria meningitidis</i>	2 (2.4)
<i>Morganella morganii</i>	2 (2.4)
<i>Chlamydia trachomatis</i>	2 (2.4)
<i>Pneumocystis jirovecii</i>	1 (1.2)
<i>Clostridium difficile</i>	1 (1.2)
<i>Enterovirus</i> spp.	1 (1.2)
<i>Aspergillus</i> spp.	1 (1.2)
Total ^a	84 (100.0)

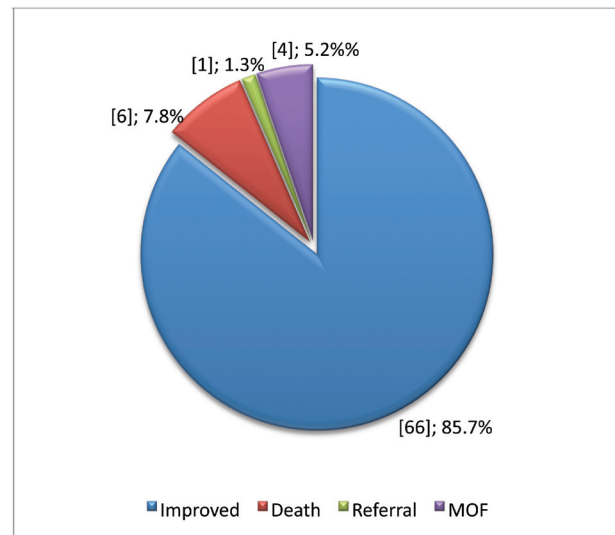
^aSeven cases had mixed infection with more than one organism. MRSA, methicillin-resistant *Staphylococcus aureus*.

Table 4 Distribution of cases with health care-associated infection according to site of infection

Site of infections	n (%)
Urinary tract infection	32 (39.5)
Blood stream infection	15 (18.5)
Lower respiratory tract infection	12 (14.8)
Upper respiratory tract infection	6 (7.4)
Decubitus ulcer infection	4 (5.0)
Meningitis	3 (3.7)
Vasculitic ulcer infection	2 (2.5)
Gastrointestinal tract infection	2 (2.5)
Septic bursitis	1 (1.2)
Pseudomembranous colitis	1 (1.2)
Infective endocarditis	1 (1.2)
Oropharyngeal infection	1 (1.2)
Empyema	1 (1.2)
Total ^a	81 (100.0)

^aFour cases had infection in more than one site.

HCAI occurred in 14.9% of patients per year in our study period. UTI was the most common infection in 39.5% followed by BSI in 18.5% and RTI in 23.5% (lower respiratory tract infection in 16.1% and upper respiratory tract infection in 7.4%). In a similar study, Masahiro *et al.* [14], prospectively investigated the incidence of HCAI in a rheumatology care university hospital. They reported an incidence rate of 18.3% per year in their study period. In their study, the incidence rate of RTI was the highest, and MRSA was the causative organism in 21% of cases. In contrast to our result, UTI was reported in only 1.0% of HCAI

Figure 2

Distribution of cases with HCAI according to their outcome. HCAI, health care-associated infection; MOF, multiorgan failure.

cases, and they concluded that RTI, BSI, and opportunistic infection were the most common causes of HCAI in patients with CTDs.

Vieira *et al.* [15] investigated the prevalence of overall infections in their inpatient population at rheumatology unit, and they reported hospital-acquired infection in 19.0%, whereas infections were the admission reason in 17.6% of the cases, with an overall of 31.7% period prevalence of infection. In concordance with our results, the urinary tract was the most commonly affected site (32.0%). However, *Escherichia coli* was the most frequently identified infectious agent in their study (17.5%), whereas in the present study, *Klebsiella* spp. was the most commonly isolated organism in 17.9% followed by MRSA in 14.3% of cases with HCAI.

In another two studies, Li *et al.* [16] and Duffy *et al.* [17] reported that the major sites of HCAI were the urinary tract, the blood stream, and the respiratory tract. These findings were consistent with our findings. Moreover, in retrospective studies on patients with SLE, HCAI was reported to occur in ~10 patients per year [18]. However, there are some differences between their studies and our study regarding study designs (retrospective vs. prospective) or study patients (SLE vs. patients with all rheumatic diseases). Previous studies of infection among patients with rheumatic diseases revealed that patients with CTD and infection do poorly compared with those who do not have an infection and that infections contribute to death both early and late in the course of the disease. In

a study conducted by Abu-Shakra *et al.* [19], infection was the primary cause of death in 32% of a cohort of 665 patients with SLE. In the present study, although 85.7% of HCAI cases had improved on antimicrobial therapy with complete elimination of infection, 7.8% died from infection on the same admission, whereas 5.2% deteriorated and developed multiorgan failure and were shifted to the ICU, and one case with meningitis was transferred to another specialized center for further management.

Falagas *et al.* [20] conducted a systematic review on 39 studies focusing on infection-related morbidity and mortality in patients with CTD; however, most reviewed studies focused on infection incidence and/or outcome in patients with SLE, and none of the studies focused on HCAI in particular. The mortality attributed to infection was 5.2%. They concluded that infections were a major cause of mortality in patients with CTD.

Conclusion

In conclusion, identifying the characteristics of HCAI in our patient population will guide us, in the future, in applying preventive measures, anticipation of the nature of infection and proper selection of empirical antimicrobial therapy for early management.

However, the incidence of HCAI in our hospital, site of infections, as well as the causative microorganisms were comparable to the results reported previously in different studies conducted in specialized centers for rheumatology care. UTI, BSI, and RTI were the most common causes of HCAI in our hospital. Despite the improvement in health care services, the incidence of HCAI infection in our inpatient population is still high and represents a burden on our resources, and contributes to the morbidity and mortality in patients with rheumatic diseases.

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Conflicts of interest

There are no conflicts of interest.

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