




Hospital-acquired infections in autoimmune patients: A 5-year retrospective study from a referral hospital in northern Iran

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ABSTRACT

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Nosocomial infections (NIs) represent a major healthcare challenge, particularly in immunocompromised populations such as patients with autoimmune diseases (AIDs). This study aimed to investigate the prevalence and bacterial etiology of NIs in hospitalized AID patients in northern Iran. In this retrospective cross-sectional over a six-year period (2018–2024) a total of 37 patients diagnosed with both autoimmune conditions and hospital-acquired infections were included. The mean age of patients was 54.3 ± 16.9 years, with rheumatoid arthritis being the most common underlying disease. Urinary tract infections (UTIs) were the predominant NI (54.1%), followed by bloodstream (21.6%), respiratory (18.9%), and skin/soft tissue infections (5.4%). Gram-negative bacteria were the leading pathogens, with *Klebsiella* spp. (40.5%) most frequently isolated. These findings highlight the high prevalence of UTIs and Gram-negative bacterial infections in hospitalized AID patients. The predominance of multidrug-resistant organisms underscores the need for targeted infection prevention strategies and robust antimicrobial stewardship.

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1. Introduction

Nosocomial infections (NIs) remain a significant cause of morbidity, mortality, and prolonged hospitalization, particularly in immunocompromised populations [1]. Patients with autoimmune diseases (AIDs) represent a uniquely vulnerable group due to both their underlying immune dysregulation and the frequent use of immunosuppressive therapies, including corticosteroids, biologics, and disease-modifying antirheumatic drugs. This immunosuppressed state predisposes them to a higher risk of hospital-acquired infections compared to the general population [2, 3].

Previous studies have reported that bacterial pathogens are the predominant cause of NIs in patients with autoimmune conditions, frequently involving the respiratory tract, urinary tract, bloodstream, and surgical sites [4, 5]. Gram-negative bacteria, such as *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*, as well as Gram-positive pathogens like *Staphylococcus aureus* and *Enterococcus spp.*, are commonly implicated. The widespread emergence of multidrug-resistant (MDR) organisms further complicates management and outcomes in this population [6].

Despite the recognized susceptibility of AID patients to infections, limited data are available regarding the prevalence and bacterial etiology of nosocomial infections specifically within this group. Understanding the epidemiological patterns and microbial profiles is crucial for developing targeted infection prevention strategies and optimizing antimicrobial stewardship in hospitalized AID patients. This study aims to investigate the prevalence and bacterial etiology of nosocomial infections in hospitalized patients with autoimmune diseases, providing evidence to inform clinical decision-making and infection control policies.

2. Materials and Methods

2.1 Study Design

This retrospective cross-sectional study was conducted at Razi hospital, a tertiary care center in Rasht, the North of Iran, between March 2018 and March 2024. The study focused on hospitalized patients diagnosed with autoimmune diseases who developed nosocomial infections during their admission. The study was approved by the Ethics Committee of Guilan University of Medical Sciences (Approval No. IR.GUMS.REC.1403.260). Given the retrospective nature of the study, the use of existing records, the absence of any patient interaction, and no additional risk to participants, the requirement for obtaining individual informed consent was waived. Patient confidentiality was maintained by anonymizing personal identifiers, and the study adhered to the principles of the Declaration of Helsinki. Data were retrieved from electronic medical records using a standardized data

collection form. Variables included demographic information (age, sex), type of autoimmune disease, comorbidities, duration of hospital stay, type of infection, and bacterial etiology of infections.

2.2 Statistical analysis

Descriptive statistics were used to summarize the data. Categorical variables were expressed as frequencies and percentages, while continuous variables were reported as means \pm standard deviations (SD). Statistical analyses were performed using SPSS version 24 (IBM Corp., Armonk, NY), with a significance level set at $p < 0.05$.

3. Results

A total of 37 hospitalized patients with autoimmune diseases and nosocomial infections were included in this study. The mean age of the patients was 54.32 ± 16.93 years (range: 25–88 years), with a median of 56 years. Of the total patients, 25 (67.6%) were female and 12 (32.4%) were male. The most common underlying autoimmune disease was rheumatoid arthritis (RA) in 15 patients (40.5%), followed by pemphigus in 5 patients (13.5%), vasculitis in 4 patients (10.8%), psoriasis in 4 patients (10.8%), and systemic lupus erythematosus (SLE) in 3 patients (8.1%). Other autoimmune diseases included inflammatory bowel disease (5.4%), Wegener's granulomatosis (2.7%), Guillain-Barré syndrome (2.7%), dermatomyositis (2.7%), and autoimmune thrombocytopenic purpura (2.7%).

The most frequent site of nosocomial infection was the urinary tract, observed in 20 patients (54.1%), followed by bloodstream infections (BSIs) in 8 patients (21.6%), respiratory infections in 7 patients (18.9%), and skin and soft tissue infections (SSTIs) in 2 patients (5.4%). In patients younger than 56 years, urinary tract infections (UTIs) were the most prevalent (61.1%), followed by respiratory (22.2%), bloodstream (11.1%), and SSTIs (5.6%).

Among patients aged 56 years or older, UTIs accounted for 47.4%, BSIs for 31.6%, respiratory infections for 15.7%, and SSTIs for 5.3%. Among male patients, UTIs were observed in 50%, respiratory infections in 25%, BSIs in 16.7%, and SSTIs in 8.3%. Among females, UTIs were more common (56%), followed by bloodstream (24%), respiratory (16%), and SSTIs (4%). Distribution of infections by autoimmune diseases presented in Table 1. Among rheumatoid arthritis patients as the most prevalent autoimmune diseases, UTIs (73.3%) and BSIs (26.7%) were the predominant infections. Also, in pemphigus UTIs 80% and BSIs 20% was recorded.

The mean hospital stay was 21.89 ± 24.34 days (range: 1–98 days), with a median of 13 days. Patients hospitalized for ≤ 13 days had UTIs (52.5%), respiratory infections (21.1%), BSIs (21.1%), and SSTIs (5.3%). Patients with > 13 days of hospitalization had UTIs

(55.5%), bloodstream (22.2%), respiratory (16.7%), and soft tissue infections (5.6%). At the end of hospitalization, 29 patients (78.4%) were discharged, while 8 patients (21.6%) died. Regarding bacterial etiology, *Klebsiella* spp. was the most commonly isolated organism (40.5%), followed by *Acinetobacter* spp. (18.9%), *Citrobacter* spp. (16.2%), *E. coli* (10.8%), Gram-positive cocci (8.1%), and *P. aeruginosa* (5.4%). The full results of bacterial etiology by autoimmune diseases was shown in Table 2.

4. Discussion

This retrospective study provides valuable insights into the prevalence, clinical characteristics, and bacterial etiology of NIs in hospitalized patients with AIDs over a five-year period in a tertiary care hospital in northern Iran. The results underscore the heightened vulnerability of this patient population to hospital-acquired infections. Our findings indicate that UTIs were the most common nosocomial infections across all age groups and autoimmune disease categories, consistent with previous studies reporting high UTI prevalence in immunosuppressed and catheterized patients [7-9]. The predominance of UTIs was especially pronounced among patients with rheumatoid arthritis and pemphigus, likely reflecting the frequency of long-term corticosteroid use and hospitalization-related urinary catheterization. Notably, bloodstream infections (BSIs) and respiratory infections were the second and third most prevalent types, respectively. The proportion of BSIs was relatively higher in patients older than 56 years, aligning with evidence that aging contributes to immunosenescence and increases susceptibility to systemic infections [10]. Additionally, the longer hospital stay observed in patients with BSIs and respiratory tract infections suggests a potential association between infection severity, prolonged admission, and increased mortality risk. Microbiologically, Gram-negative bacteria were the predominant pathogens, with *Klebsiella* spp. emerging as the most frequent isolate, followed by *Acinetobacter* spp. and *Citrobacter* spp. These findings are in line with regional surveillance studies indicating a rise in multidrug-resistant Gram-negative bacilli (MDR-GNB)

as the leading cause of hospital-acquired infections in immunocompromised patients [11-15]. The high prevalence of *Klebsiella* spp. in autoimmune patients, especially among those with vasculitis and rheumatoid arthritis raises concerns regarding colonization and nosocomial transmission in high-risk wards.

Interestingly, *Acinetobacter* spp. was found predominantly in patients with lupus erythematosus and other less frequent autoimmune disorders. This pathogen is particularly associated with ventilator-associated pneumonia and BSIs in ICU settings and is recognized for its ability to acquire resistance rapidly, complicating therapeutic options [16].

While *E. coli*, a classic uropathogen, was present in only 10.8% of cases, its comparatively lower frequency may reflect increasing displacement by more resistant organisms in nosocomial settings. The presence of *P. aeruginosa* and Gram-positive cocci, although limited, still warrants attention due to their inherent or acquired resistance profiles and association with poor outcomes in hospitalized patients [17].

Our study also reported a 21.6% mortality rate, which, although based on a small sample, reflects the clinical burden of nosocomial infections in autoimmune patients. This mortality rate is comparable to prior studies in immunocompromised populations, emphasizing the need for enhanced infection control measures and early diagnostic interventions [18].

A key strength of this study is its focus on a highly specific and clinically vulnerable population, providing a clearer picture of infection patterns in AID patients. However, limitations include the relatively small sample size, retrospective design, and lack of antimicrobial susceptibility data, which could have added depth to our understanding of resistance trends and therapeutic challenges.

This study highlights the significant burden of nosocomial infections among hospitalized autoimmune patients, with UTIs and Gram-negative bacteria being most prevalent. Given the increasing threat of multidrug resistance, routine surveillance, strict infection control practices, and tailored antimicrobial stewardship programs are essential to improving outcomes in this high-risk population.

Table 1. The frequency of infections by autoimmune diseases. Results presented as No. (%).

Type of infection	Rheumatoid arthritis	Pemphigus	Vasculitis	Psoriasis	Lupus erythematosus	Other
UTIs	11 (73.3)	4 (80)	1 (25)	0	1 (33.3)	3 (50)
BSIs	4 (26.7)	1 (20)	1 (25)	2 (50)	0	0
RIs	0	0	1 (25)	1 (25)	2 (66.7)	3 (50)
SSTIs	0	0	1 (25)	1 (25)	0	0

Table 2. The frequency of bacterial etiology by autoimmune diseases. Results presented as No. (%).

Type of infection	Rheumatoid arthritis	Pemphigus	Vasculitis	Psoriasis	Lupus erythematosus	Other
<i>Klebsiella</i> spp.	5 (33.3)	2 (40)	4 (100)	1 (25)	0	3 (50)
<i>Acinetobacter</i> spp.	4 (26.7)	0	0	0	2 (66.7)	1 (16.7)
<i>Citrobacter</i> spp.	2 (13.3)	2 (40)	0	0	1 (33.3)	1 (16.7)
<i>Escherichia coli</i>	2 (13.3)	1 (20)	0	0	0	1 (16.7)
Gram-positive cocci	1 (6.7)	0	0	2 (50)	0	0
<i>Pseudomonas aeruginosa</i>	1 (6.7)	0	0	1 (25)	0	0

Authors' contributions

Conceptualization, study design, and supervision: AP, TY. Data collection, analysis and interpretation: SS, AP. Original draft preparation: SS. Critical revision and editing: AP, TY. All authors read and approved the final version of article.

Conflict of interest

No potential conflict of interest was reported by the authors.

Ethical declarations

The study design was approved by the Ethics Committee of Guilan University of Medical Sciences (Approval No. IR.GUMS.REC.1403.260). Given the retrospective nature of the study, the use of existing records, the absence of any patient interaction, and no additional risk to participants, the requirement for obtaining individual informed consent was waived. Patient confidentiality was maintained by anonymizing personal identifiers, and the study adhered to the principles of the Declaration of Helsinki.

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References

- Aiesh BM, Qashou R, Shemmessian G, Swaileh MW, Abutaha SA, Sabateen A, et al. Nosocomial infections in the surgical intensive care unit: an observational retrospective study from a large tertiary hospital in Palestine. *BMC Infect Dis.* 2023;23(1):686. DOI: [10.1186/s12879-023-08677-z](https://doi.org/10.1186/s12879-023-08677-z) PMID: [37833675](https://pubmed.ncbi.nlm.nih.gov/37833675/)
- Dropulic LK, Lederman HM. Overview of Infections in the Immunocompromised Host. *Microbiol Spectr.* 2016;4(4):DMIH2-0026-2016. DOI: [10.1128/microbiolspec.DMIH2-0026-2016](https://doi.org/10.1128/microbiolspec.DMIH2-0026-2016) PMID: [27726779](https://pubmed.ncbi.nlm.nih.gov/27726779/)
- Morales-Tisnés T, Quintero-Ortiz L, Quintero-Muñoz E, Sierra-Matamoros F, Arias-Aponte J, Rojas-Villarraga A. Prevalence of hospital readmissions and related factors in patients with autoimmune diseases. *J Transl Autoimmun.* 2021;4:100121. DOI: [10.1016/j.jtauto.2021.100121](https://doi.org/10.1016/j.jtauto.2021.100121) PMID: [34585131](https://pubmed.ncbi.nlm.nih.gov/34585131/)
- Nicastro L, Tükel Ç. Bacterial Amyloids: The Link between Bacterial Infections and Autoimmunity. *Trends Microbiol.* 2019;27(11):954-963. DOI: [10.1016/j.tim.2019.07.002](https://doi.org/10.1016/j.tim.2019.07.002) PMID: [31422877](https://pubmed.ncbi.nlm.nih.gov/31422877/)
- Xie WL, Li ZL, Xu Z, Qu HR, Xue L, Su X, et al. The risk factors for nosocomial infection in chinese patients with active rheumatoid arthritis in shanghai. *ISRN Rheumatol.* 2012;2012:215692. DOI: [10.5402/2012/215692](https://doi.org/10.5402/2012/215692) PMID: [22548187](https://pubmed.ncbi.nlm.nih.gov/22548187/)
- Banawas SS, Alobaidi AS, Dawoud TM, AlDehaimi A, Alsubaie FM, Abdel-Hadi A, et al. Prevalence of Multidrug-Resistant Bacteria in Healthcare-Associated Bloodstream Infections at Hospitals in Riyadh, Saudi Arabia. *Pathogens.* 2023;12(9):1075. DOI: [10.3390/pathogens12091075](https://doi.org/10.3390/pathogens12091075) PMID: [37764883](https://pubmed.ncbi.nlm.nih.gov/37764883/)
- Jepsen OB, Larsen SO, Dankert J, Daschner F, Grönroos P, Meers PD, et al. Urinary-tract infection and bacteraemia in hospitalized medical patients—a European multicentre prevalence survey on nosocomial infection. *J Hosp Infect.* 1982;3(3):241-52. DOI: [10.1016/0195-6701\(82\)90043-3](https://doi.org/10.1016/0195-6701(82)90043-3) PMID: [6183317](https://pubmed.ncbi.nlm.nih.gov/6183317/)
- Hosseinpour M, Pezeshgi A, Mahdiabadi MZ, Sabzghabaei F, Hajjishah H, Mahdavyinia S. Prevalence and risk factors of urinary tract infection in kidney recipients: a meta-analysis study. *BMC Nephrol.* 2023;24(1):284. DOI: [10.1186/s12882-023-03338-4](https://doi.org/10.1186/s12882-023-03338-4) PMID: [37759155](https://pubmed.ncbi.nlm.nih.gov/37759155/)
- Zhu C, Liu H, Wang Y, Jiao J, Li Z, Cao J, et al. Prevalence, incidence, and risk factors of urinary tract infection among immobile inpatients in China: a prospective, multi-centre study. *J Hosp Infect.* 2020;104(4):538-544. DOI: [10.1016/j.jhin.2019.11.018](https://doi.org/10.1016/j.jhin.2019.11.018) PMID: [31790744](https://pubmed.ncbi.nlm.nih.gov/31790744/)
- Gavazzi G, Krause KH. Ageing and infection. *Lancet Infect Dis.* 2002;2(11):659-66. DOI: [10.1016/s1473-3099\(02\)00437-1](https://doi.org/10.1016/s1473-3099(02)00437-1) PMID: [12409046](https://pubmed.ncbi.nlm.nih.gov/12409046/)
- Mahmoudi S, Mahzari M, Banar M, Pourakbari B, Haghi Ashtiani MT, Mohammadi M, et al. Antimicrobial resistance patterns of Gram-negative bacteria isolated from bloodstream infections in an Iranian referral paediatric hospital: A 5.5-year study. *J Glob Antimicrob Resist.* 2017;11:17-22. DOI: [10.1016/j.jgar.2017.04.013](https://doi.org/10.1016/j.jgar.2017.04.013) PMID: [28729206](https://pubmed.ncbi.nlm.nih.gov/28729206/)
- Mousavi SJ, Nezhadrahim R, Abdulzadeh F. The Most Common Multi-Drug Resistant Bacteria Associated with Hospital Infections, in Urmia, Iran. *Iran J Pathol.* 2024;19(3):283-291. DOI: [10.30699/IJP.2024.2014294.3195](https://doi.org/10.30699/IJP.2024.2014294.3195) PMID: [39687456](https://pubmed.ncbi.nlm.nih.gov/39687456/)
- Hemmati H, Hasannejad-Bibalan M, Khoshdoz S, Khoshdoz P, Yaghubi Kalurazi T, Sedigh Ebrahim-Saraie H, et al. Two years study of prevalence and antibiotic resistance pattern of Gram-negative bacteria isolated from surgical site infections in the North of Iran. *BMC Res Notes.* 2020;13(1):383. DOI: [10.1186/s13104-020-05223-x](https://doi.org/10.1186/s13104-020-05223-x) PMID: [32795378](https://pubmed.ncbi.nlm.nih.gov/32795378/)
- Javanmardi F, Emami A, Pirbonyeh N, Rajaei M, Hatam G, Keshavarzi A. Study of multidrug resistance in prevalent Gram-negative bacteria in burn patients in Iran: A systematic review and meta-analysis. *J Glob Antimicrob Resist.* 2019;19:64-72. DOI: [10.1016/j.jgar.2019.04.017](https://doi.org/10.1016/j.jgar.2019.04.017) PMID: [31063845](https://pubmed.ncbi.nlm.nih.gov/31063845/)
- Ahmadkhosravi N, Khosravi AD, Asareh Zadehan Dezfuli A, Hashemzadeh M, Saki M, Mehr FJ, et al. Study of aerobic and anaerobic bacterial profile of nosocomial infections and their antibiotic resistance in a referral center, Southwest Iran: A three year cross-sectional study. *PLoS One.* 2021;16(11):e0259512. DOI: [10.1371/journal.pone.0259512](https://doi.org/10.1371/journal.pone.0259512) PMID: [34752474](https://pubmed.ncbi.nlm.nih.gov/34752474/)
- Peleg AY, Seifert H, Paterson DL. *Acinetobacter baumannii*: emergence of a successful pathogen. *Clin Microbiol Rev.* 2008;21(3):538-82. DOI: [10.1128/CMR.00058-07](https://doi.org/10.1128/CMR.00058-07) PMID: [18625687](https://pubmed.ncbi.nlm.nih.gov/18625687/)
- Bassetti M, Righi E. Multidrug-resistant bacteria: what is the threat? *Hematology Am Soc Hematol Educ Program.* 2013;2013:428-32. DOI: [10.1182/asheducation-2013.1.428](https://doi.org/10.1182/asheducation-2013.1.428) PMID: [24319215](https://pubmed.ncbi.nlm.nih.gov/24319215/)
- Singh N, Limaye AP. Infections in Solid-Organ Transplant Recipients. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases.* 2015:3440-52. DOI: [10.1016/B978-1-4557-4801-3.00313-1](https://doi.org/10.1016/B978-1-4557-4801-3.00313-1)