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FACTORS INFLUENCING PROLONGED HOSPITALIZATION IN SKIN AND SOFT TISSUE INFECTIONS: A SINGLE-CENTRE RETROSPECTIVE COHORT STUDY

Hülya Çaşkurlu[1], Merve Sarı[1], Sevim Güngören Ocak[1], Halenur Vural Akbal[1], Ahmet Naci Emecen[2], Kadriye Savurmuş[1], Yasemin Çağ[1], Pınar Ergen[1], Özlem Aydın[1]

[1]*Istanbul Medeniyet University, Faculty of Medicine, Department of Infectious Diseases and Clinical Microbiology, Istanbul, Türkiye*

[2]*Dokuz Eylul University, Faculty of Medicine, Department of Public Health, Epidemiology Subsection, Izmir, Türkiye*

ABSTRACT

Objective: *This study aimed to characterize the clinical, laboratory, radiological, and treatment features of patients hospitalized with skin and soft tissue infections (SSTIs) and to evaluate factors associated with prolonged hospitalization.*

Material and Method: *This retrospective single-center cohort study was conducted on 105 patients who followed up for Skin Soft Tissue Infections (SSTIs) at Prof. Dr. Süleyman Yalçın Göztepe City Hospital between 2021 and 2022. Demographic, clinical, laboratory, imaging, and treatment data were collected. Patients were grouped by hospital stay length: <14 days and ≥14 days. Group comparison was made using chi-square and Student's t-test or Mann–Whitney U test. Univariable and multivariable logistic regression analyses were conducted.*

Results: *The mean age was 61.3±16.2 years old (48.6% female). Comorbidities were present in 87.6%, especially diabetes (50.5%) and hypertension (40%). SSTIs mainly affected the lower extremities (71.4%). Erythema (87.6%), fever (43.8%), and warmth (42.9%) were the most common symptoms. Cellulitis (66.7%) and diabetic foot infections (22.9%) were the main diagnoses. Prior antibiotic use was reported in 62.9%. Tissue cultures were positive in 72.2% of the 54 cases, frequently identifying Enterococcus faecalis and Staphylococcus aureus. Empirical treatments included piperacillin-tazobactam and clindamycin; 38.1% required antibiotic changes. Median hospital stay was 8 days; 24.8% stayed ≥14 days. Longer stays were significantly associated with diabetes (39.6% vs. 9.6%, p=0.001), abnormal Doppler ultrasound (38.7% vs. 10.0%, p=0.01), and need for surgery (85.7% vs. 20.4%, p=0.001). CRP values were significantly higher in patients hospitalized for long periods. Culture positivity and pathogen type did not affect length of stay.*

Conclusion: *Identifying high-risk patients early, using imaging and culture-guided therapy, and timely surgical intervention can help reduce hospital stays and improve outcomes in SSTI cases.*

Keywords: *Soft tissue infections, risk factors, duration of therapy, length of stay.*

CORRESPONDING AUTHOR: **Hülya Çaşkurlu** İstanbul Medeniyet Üniversitesi Prof. Dr. Süleyman Yalçın Şehir Hastanesi Klinik Mikrobiyoloji ve Enfeksiyon Hastalıkları Anabilim Dalı, Istanbul, Türkiye **hcaskurlu@hotmail.com**

HÇ https://orcid.org/0000-0002-6760-2052 | **MS** https://orcid.org/0000-0002-5103-3406 | **SGO** https://orcid.org/0009-0006-1890-830X

HVA https://orcid.org/0009-0000-8947-6758 | **ANE** https://orcid.org/0000-0003-3995-0591 | **KS** https://orcid.org/0009-0005-1137-9620

KÇ https://orcid.org/0000-0002-9983-0308 | **PE** https://orcid.org/0000-0003-3990-7056 | **ÖA** https://orcid.org/0000-0003-0398-9216

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DERİ VE YUMUŞAK DOKU ENFEKSİYONLARINDA HASTANE YATIŞ SÜRESİNİ ETKİLEYEN FAKTÖRLER: TEK MERKEZLİ RETROSPEKTİF KOHORT ÇALIŞMA

ÖZET

Amaç: Bu çalışmada, deri ve yumuşak doku enfeksiyonu (DYDE) nedeniyle hastaneye yatan hastaların klinik, laboratuvar, radyolojik ve tedavi özelliklerinin incelenmesi ve uzun hastanede yatışla ilişkili faktörlerin değerlendirilmesi amaçlanmıştır.

Materyal ve Metot: 2021-2022 yılları arasında Prof. Dr. Süleyman Yalçın Göztepe Şehir Hastanesi'nde DYDE nedeniyle hastaneye yatırılan 105 hasta, retrospektif tek merkezli kohort çalışma ile değerlendirildi. Demografik, klinik, laboratuvar, görüntüleme ve tedavi verileri toplandı. Hastalar yatış sürelerine göre <14 gün ve ≥14 gün olmak üzere iki gruba ayrıldı. Grup karşılaştırmalarında ki-kare, t-testi ve Mann–Whitney U testi kullanıldı. Tek değişkenli ve çok değişkenli lojistik regresyon modelleri oluşturuldu.

Bulgular: Ortalama yaş 61,3±16,2 olup, %48,6'sı kadın idi.Hastaların %87,6'sında komorbidite vardı; en sık diyabet (%50,5) ve hipertansiyon (%40) görüldü. Enfeksiyonların çoğu alt ekstremitedeydi (%71,4). Sık görülen klinik bulgular eritem (%87,6), ateş (%43,8) ve lokal ısı artışı (%42,9) idi. Selülit (%66,7) ve diyabetik ayak enfeksiyonu (%22,9) ön plandaydı. %62,9'u hastaneye yatmadan önce antibiyotik kullanmıştı. Doku kültürü alınmış 54 hastanın %72,2'sinde üreme vardı; en sık Enterococcus faecalis ve Staphylococcus aureus saptandı. Ampirik tedaviler genellikle piperasilin-tazobaktam ve klindamisin içeriyordu; %38,1'inde antibiyotik değişikliği yapıldı. Ortalama hastanede kalış süresi 8 gündü; %24,8'i ≥14 gün yattı. Uzun yatış diyabet, (39,6% vs. 9,6%, p=0,001), Doppler USG anormallikleri (38,7% ve 10,0%, p=0,01) ve cerrahi müdahalelerle (85,7% ve 20,4%, p=0,001) ile ilişkiliydi. Uzun süre yatan hastaların CRP değerleri anlamlı olarak yüksekti. Kültür pozitifliği ve mikroorganizma türü yatış süresini etkilemedi.

Sonuç: Risk faktörlerinin erken tanınması, uygun görüntüleme ve kültüre dayalı tedavi, hastanede kalış süresini kısaltmada ve sonuçları iyileştirmede önemlidir. Zamanında cerrahi müdahale de prognozu olumlu etkilemektedir.

Anahtar kelimeler: Yumuşak doku enfeksiyonları, risk faktörleri, tedavi süresi, yatış süresi.

INTRODUCTION

Skin and soft tissue infections (SSTIs) are significant infectious diseases that encompass a wide spectrum of clinical conditions, ranging from mild superficial infections to severe, life-threatening presentations requiring hospitalization.[1] These infections are most commonly caused by Gram-positive bacteria, particularly *Staphylococcus, Streptococcus pyogenes, and Enterococcus species*. Nevertheless, Gram-negative bacilli and other microorganisms may also play a role in certain patient populations, particularly in nosocomial or immunocompromised settings.[2]

The management of SSTIs depends on whether the infection is purulent or non-purulent. In some cases, systemic antibiotic therapy alone may be sufficient, whereas in others, a combination of antimicrobial therapy and surgical intervention, such as incision and drainage or extensive debridement, becomes necessary.[3-5]

Despite advances in antimicrobial therapy, several factors may contribute to prolonged hospitalization in patients with SSTIs. These include advanced age, diabetes mellitus, peripheral vascular disease, obesity, chronic kidney disease, immunosuppression, delayed initiation of appropriate antibiotic treatment, infection with multidrug-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), and the necessity for repeated surgical procedures. Each of these factors can significantly increase both morbidity and mortality, as well as extend the length of inpatient care.[6,7]

When SSTI is not treated early and appropriately, hospital stays are prolonged and the use of broad-spectrum antibiotics increases. This, in turn, creates an economic burden and leads to the development of antibiotic resistance due to prolonged antibiotic use.

Extended hospital stays, frequent use of broad-spectrum antibiotics, surgical interventions, and the management of complications substantially increase direct healthcare costs. Moreover, indirect costs, including prolonged recovery periods, loss of workforce productivity, and reduced quality of life, contribute to the overall socioeconomic impact.[7,8]

Table 1. Demographic and clinical characteristics of patients with soft tissue infections, and comparison according to length of hospital stay

	All, n=105	Length of Stay		*p*
		<14 days, n=79	≥14 days, n=26	
Age (years), mean ± SD	61.3 ±16.2	62.6 ±16.8	57.5 ±13.8	0.130
Sex				0.336
Male	54 (51.4%)	38 (70.4%)	16 (29.6%)	
Female	51 (48.6%)	41 (80.4%)	10 (19.6%)	
Comorbidity				0.035*
No	13 (12.4%)	13 (100%)	0 (0.00%)	
Yes	92 (87.6%)	66 (71.7%)	26 (28.3%)	
Diabetes mellitus				0.001*
No	52 (49.5%)	47 (90.4%)	5 (9.62%)	
Yes	53 (50.5%)	32 (60.4%)	21 (39.6%)	
Hypertension				0.612
No	63 (60.0%)	49 (77.8%)	14 (22.2%)	
Yes	42 (40.0%)	30 (71.4%)	12 (28.6%)	
Hyperlipidemia				0.764
No	81 (77.1%)	62 (76.5%)	19 (23.5%)	
Yes	24 (22.9%)	17 (70.8%)	7 (29.2%)	
Congestive heart failure				0.726
No	93 (88.6%)	69 (74.2%)	24 (25.8%)	
Yes	12 (11.4%)	10 (83.3%)	2 (16.7%)	
Malignancy				0.445
No	95 (90.5%)	70 (73.7%)	25 (26.3%)	
Yes	10 (9.52%)	9 (90.0%)	1 (10.0%)	
Chronic kidney disease				0.686
No	96 (91.4%)	73 (76.0%)	23 (24.0%)	
Yes	9 (8.57%)	6 (66.7%)	3 (33.3%)	
Peripheral artery disease				0.406
No	97 (92.4%)	74 (76.3%)	23 (23.7%)	
Yes	8 (7.62%)	5 (62.5%)	3 (37.5%)	
Cerebrovascular Disease/Alzheimer				0.595
No	100 (95.2%)	76 (76.0%)	24 (24.0%)	
Yes	5 (4.76%)	3 (60.0%)	2 (40.0%)	
Predisposing Factors				0.450
Yok	36 (34.3%)	25 (69.4%)	11 (30.6%)	
Var	69 (65.7%)	54 (78.3%)	15 (21.7%)	
Tinea pedis and/or onychomycosis				0.844
No	69 (65.7%)	51 (73.9%)	18 (26.1%)	
Yes	36 (34.3%)	28 (77.8%)	8 (22.2%)	
Trauma				>0.999
No	82 (78.1%)	62 (75.6%)	20 (24.4%)	
Yes	23 (21.9%)	17 (73.9%)	6 (26.1%)	
Prior surgical or invasive procedures				0.759
No	88 (83.8%)	67 (76.1%)	21 (23.9%)	
Yes	17 (16.2%)	12 (70.6%)	5 (29.4%)	
Venous insufficiency				0.757
No	90 (85.7%)	67 (74.4%)	23 (25.6%)	
Yes	15 (14.3%)	12 (80.0%)	3 (20.0%)	
Prosthetic material or foreign bodies				>0.999
No	99 (94.3%)	74 (74.7%)	25 (25.3%)	
Yes	6 (5.71%)	5 (83.3%)	1 (16.7%)	
Cellulitis				0.001*
No	35 (33.3%)	19 (54.3%)	16 (45.7%)	
Yes	70 (66.7%)	60 (85.7%)	10 (14.3%)	

	All, n=105	Length of Stay		*p*
		<14 days, n=79	≥14 days, n=26	
Diabetic foot infection				0.055
No	81 (77.1%)	81 (77.1%)	16 (19.8%)	
Yes	24 (22.9%)	24 (22.9%)	10 (41.7%)	
Abscess				0.301
No	92 (87.6%)	92 (87.6%)	21 (22.8%)	
Yes	13 (12.4%)	13 (12.4%)	5 (38.5%)	
Other SSTIs				0.003*
No	89 (84.8%)	89 (84.8%)	17 (19.1%)	
Yes	16 (15.2%)	16 (15.2%)	9 (56.2%)	
Lower extremity				0.592
No	30 (28.6%)	30 (28.6%)	9 (30.0%)	
Yes	75 (71.4%)	75 (71.4%)	17 (22.7%)	
Upper extremity				0.511
No	92 (87.6%)	92 (87.6%)	24 (26.1%)	
Yes	13 (12.4%)	13 (12.4%)	2 (15.4%)	
Trunk				0.686
No	96 (91.4%)	96 (91.4%)	23 (24.0%)	
Yes	9 (8.57%)	9 (8.57%)	3 (33.3%)	
Perineal-gluteal region				0.102
No	97 (92.4%)	97 (92.4%)	22 (22.7%)	
Yes	8 (7.62%)	8 (7.62%)	4 (50.0%)	
Face and neck				>0.999
No	103 (98.1%)	103 (98.1%)	26 (25.2%)	
Yes	2 (1.90%)	2 (1.90%)	0 (0.00%)	
Erythema				0.003*
No	13 (12.4%)	13 (12.4%)	8 (61.5%)	
Yes	92 (87.6%)	92 (87.6%)	18 (19.6%)	
Fever (≥37,5°C)				0.960
No	59 (56.2%)	59 (56.2%)	14 (23.7%)	
Yes	46 (43.8%)	46 (43.8%)	12 (26.1%)	
Localized warmth				0.034*
No	60 (57.1%)	60 (57.1%)	20 (33.3%)	
Yes	45 (42.9%)	45 (42.9%)	6 (13.3%)	
Edema				0.079
No	77 (73.3%)	77 (73.3%)	23 (29.9%)	
Yes	28 (26.7%)	28 (26.7%)	3 (10.7%)	
Discharge				0.145
No	78 (74.3%)	78 (74.3%)	16 (20.5%)	
Yes	27 (25.7%)	27 (25.7%)	10 (37.0%)	
Pain				>0.999
No	95 (90.5%)	95 (90.5%)	24 (25.3%)	
Yes	10 (9.52%)	10 (9.52%)	2 (20.0%)	

Other SSTIs include necrotizing fasciitis, decubitus ulcer, and catheter-related SSTIs. **SD:** Standard deviation, **SSTIs:** skin and soft tissue infections, ***:** unable to calculate

In our country, SSTIs continue to represent a major clinical problem. The high prevalence of diabetes mellitus, peripheral arterial disease, malignancy, hypertension, and the inappropriate or uncontrolled use of antibiotics has been shown to increase both the incidence and severity of these infections.[9,10]

Therefore, the aim of this study is to contribute to national data on SSTIs by investigating risk factors in a larger patient group over the past two years. Specifically, this study aims to examine the variables affecting length of hospital stay, the effects of timely initiation of appropriate antibiotic therapy, appropriate imaging studies, and early surgical interventions on hospitalization outcomes, and ultimately contribute to addressing a gap in our country.

Table 2. Laboratory and radiological findings of patients with soft tissue infections, and comparison according to length of hospital stay

	All, n=105	Length of Stay		*p*
		<14 days, n=79	≥14 days, n=26	
Leukocyte count (cells/μL), median (25^{th}-75^{th})	12600 [8800;18000]	11800 [8100;17900]	13600 [10325;19050]	0.311
Neutrophil count (cells/μL), median (25^{th}-75^{th})	9580 [6680;15530]	8900 [6010;14960]	10425 [8420;17478]	0.314
Neutrophil percentage (%), median (25^{th}-75^{th})	83.0 [72.0;89.8]	82.7 [71.5;89.9]	84.3 [75.5;89.2]	0.761
Lymphocyte count (cells/μL), median (25^{th}-75^{th})	1200 [900;1700]	1200 [900;1600]	1200 [925;1700]	0.829
CRP level (mg/L), median (25^{th}-75^{th})	103 [26.0;190]	67.0 [20.5;159]	150 [92.0;226]	0.003*
USG finding, n=78				0.487
No	2 (2.56%)	1 (50.0%)	1 (50.0%)	
Yes	76 (97.4%)	55 (72.4%)	21 (27.6%)	
Inflammation, n=78				0.315
No	4 (5.13%)	2 (50.0%)	2 (50.0%)	
Yes	74 (94.9%)	54 (73.0%)	20 (27.0%)	
Abscess or fluid collection, n=78				0.148
No	60 (76.9%)	46 (76.7%)	14 (23.3%)	
Yes	18 (23.1%)	10 (55.6%)	8 (44.4%)	
Air image, n=78				0.001*
No	73 (93.6%)	56 (76.7%)	17 (23.3%)	
Yes	5 (6.41%)	0 (0.00%)	5 (100%)	
Doppler USG finding, n=71				0.010*
No	40 (56.3%)	36 (90.0%)	4 (10.0%)	
Yes	31 (43.7%)	19 (61.3%)	12 (38.7%)	
Monophasic/Biphasic flow, n=71				0.006*
No	55 (77.5%)	47 (85.5%)	8 (14.5%)	
Yes	16 (22.5%)	8 (50.0%)	8 (50.0%)	
Atheromatous plaques, n=71				0.217
No	61 (85.9%)	49 (80.3%)	12 (19.7%)	
Yes	10 (14.1%)	6 (60.0%)	4 (40.0%)	
Osteomyelitis, n=42				0.066
No	31 (73.8%)	24 (77.4%)	7 (22.6%)	
Yes	11 (26.2%)	5 (45.5%)	6 (54.5%)	
Abscess, n=42				0.695
No	33 (78.6%)	22 (66.7%)	11 (33.3%)	
Yes	9 (21.4%)	7 (77.8%)	2 (22.2%)	

CRP: C-reactive protein, **USG:** ultrasonography, ***:** unable to calculate.

MATERIAL and METHOD

In this single-center, retrospective cohort study, patients those diagnosed with SSTIs and hospitalized for inpatient treatment in the Infectious Diseases Clinic of Prof. Dr. Süleyman Yalçın Göztepe City Hospital between January 1, 2021, and November 1, 2022, were reviewed using the hospital information system.

Inclusion criteria for the study were as follows: patients aged 18 years or older and those diagnosed with a SSTIs, including cellulitis, diabetic foot infection, abscesses, or other clinically confirmed soft tissue infections. Exclusion criteria comprised patients younger than 18 years of age, those with infections not primarily involving skin or soft tissue, such as surgical site infections, and patients with incomplete documentation or missing key clinical data. Pregnant or breastfeeding women were also excluded (Table 1).

The patients' demographic characteristics and clinical, laboratory, and radiological findings were recorded. In addition, details regarding prior antibiotic use, empirical treatment at admission, surgical interventions, and length of hospital stay were collected. For comparative analysis, patients were categorized into two groups according to hospitalization duration (<14 days and ≥14 days) (Figure).

This study was reviewed and approved by the Clinical Research Ethics Committee of Prof. Dr. Süleyman Yalçın Göztepe City Hospital (Approval number: 2022/0667. date: 23.11.2022).

Table 3. Comparison of treatment characteristics and clinical interventions by length of hospital stay

	All, n=105	Length of Stay		*p*
		<14 days, n=79	≥14 days, n=26	
History of antibiotic use prior to hospitalization				0.183
No	39 (37.1%)	26 (66.7%)	13 (33.3%)	
Yes	66 (62.9%)	53 (80.3%)	13 (19.7%)	
Culture positivity in tissue biopsy, n=54				0.585
No	15 (27.8%)	10 (66.7%)	5 (33.3%)	
Yes	39 (72.2%)	21 (53.8%)	18 (46.2%)	
Empirical antibiotic susceptibility, n=39				>0.999
No	10 (25.6%)	5 (50.0%)	5 (50.0%)	
Yes	29 (74.4%)	16 (55.2%)	13 (44.8%)	
IV antibiotic change:				<0.001*
Yok	65 (61.9%)	58 (89.2%)	7 (10.8%)	
Var	40 (38.1%)	21 (52.5%)	19 (47.5%)	
IV antibiotic change (clinical indication):				0.002*
Yok	75 (71.4%)	63 (84.0%)	12 (16.0%)	
Var	30 (28.6%)	16 (53.3%)	14 (46.7%)	
IV antibiotic change (culture-guided):				<0.001*
Yok	87 (82.9%)	73 (83.9%)	14 (16.1%)	
Var	18 (17.1%)	6 (33.3%)	12 (66.7%)	
Additional Interventions				<0.001*
No	74 (70.5%)	65 (87.8%)	9 (12.2%)	
Yes	31 (29.5%)	14 (45.2%)	17 (54.8%)	
Drainage				0.356
No	88 (83.8%)	68 (77.3%)	20 (22.7%)	
Yes	17 (16.2%)	11 (64.7%)	6 (35.3%)	
Debridement				<0.001*
No	93 (88.6%)	76 (81.7%)	17 (18.3%)	
Yes	12 (11.4%)	3 (25.0%)	9 (75.0%)	
Amputation or VAC therapy				0.001*
No	98 (93.3%)	78 (79.6%)	20 (20.4%)	
Yes	7 (6.67%)	1 (14.3%)	6 (85.7%)	

IV: Intravenous; **VAC:** vacuum-assisted closure, ***:** unable to calculate

Statistical Analysis

Categorical variables were summarized as numbers and percentages, while continuous variables were presented as mean ± standard deviation (mean± SD) or median with 25th–75th percentile (25th-75th), as appropriate. The normality of distribution for continuous variables was assessed using histograms and the Shapiro–Wilk test. The independent samples t-test was used for normally distributed variables to compare groups, while the Mann–Whitney U test was applied for non-normally distributed variables. Categorical variables were compared using the chi-square test. Univariable and multivariable logistic regression analyses were conducted to identify factors associated with prolonged hospital stay. Variables with $p \leq 0.10$ in univariable analysis were considered for inclusion in the multivariable model. Variables with missing data (e.g., radiological parameters), highly correlated variables (e.g., erythema, localized warmth, and edema- overlapping signs of cellulitis), and variables reflecting the same clinical outcome or disease severity rather than predictors of prolonged hospitalization (e.g., intravenous antibiotic change, additional interventions such as debridement, amputation, or VAC therapy) were excluded from the multivariable analysis to avoid conceptual overlap with the outcome. A two-tailed p-value of less than 0.05 was considered statistically significant. All analyses were performed using R software version 4.3.3 (R Foundation for Statistical Computing, Vienna, Austria; https://www.R-project.org/).

RESULTS

Demographic and Clinical Characteristics of Patients

This study included 105 patients diagnosed with soft tissue infections. The mean age of the patients was 61.3±16.2 years, and 48.6% (n=51) were female. Comorbidities were present in 87.6% (n=92) of the patients. The most common comorbidities were diabetes mellitus (DM)(50.5%), hypertension (40.0%), and hyperlipidemia (22.9%). At least one predisposing factor was identified in 65.7% (n=69) of the patients, most frequently tinea pedis and/or onychomycosis (34.3%), a history of trauma (21.9%), and prior surgical or invasive procedures (16.2%) (Table 2).

The infection site was located in the lower extremities in 71.4% of the patients and in the upper extremities in 12.4%. The most commonly documented clinical findings were erythema (87.6%), fever (≥37.5°C) (43.8%), and localized warmth (42.9%). The most frequent clinical diagnoses were cellulitis (66.7%) and diabetic foot infection (22.9%), followed by abscesses (12.4%) and other soft tissue infections (15.2%). The recurrence rate was found to be 30.5%.

Laboratory and Radiological Findings

The median CRP level was 103 mg/L [25th-75th: 26.0–190.0]. Ultrasonography (USG) was performed in 78 of the 105 patients (74.3%), and at least one radiological finding was identified in 97.4% of these cases. The most common finding was inflammation (n=74, 94.9%), followed by abscess or fluid collection (n=18, 23.1%) and the presence of air images (n=5, 6.4%). Doppler USG was performed in 71 patients (67.6%), with radiological findings observed in 43.7% (n=31). The most frequent findings were monophasic or biphasic arterial flow (22.5%) and atheromatous plaques (14.1%). Magnetic resonance imaging (MRI) was performed in 42 patients (40.0%), revealing osteomyelitis in 26.2% (n=11) and abscess formation in 21.4% (n=9) (Table 3).

Tissue Biopsy Results, Treatment Characteristics, and Outcome

In this study, 66 of the 105 patients (62.9%) had a history of antibiotic use prior to hospitalization. The median duration of antibiotic use was 7 days [IQR: 3–9.5 days]. The most commonly used antibiotics

Table 4. Univariable and multivariable logistic regression analyses of factors associated with prolonged hospital stay

	Univariable, OR (95% CI)	Univariable, OR (95% CI)
Comorbidity	- *	-
Diabetes mellitus	5.94 (2.15-19.7)	5.70 (1.87-20.92)
Cellulitis	0.20 (0.08-0.52)	-
Diabetic foot infection	2.87 (1.05-7.76)	-
Other SSTIs	5.30 (1.72-17.2)	6.32 (1.78-25.22)
Erythema	0.16 (0.04-0.54)	-
Localized warmth	0.32 (0.10-0.84)	-
Edema	0.30 (0.06-0.96)	-
Baseline CRP level (mg/L), median (25th-75th)	1.01 (1.00-1.01)	1.00 (1.00-1.01)
Air image, n=75	- *	-
Doppler USG finding, n=71	5.42 (1.62-22.3)	-
Monophasic/Biphasic flow, n=71	5.65 (1.63-20.6)	-
Osteomyelitis, n=42	3.93 (0.90-18.4)	-
IV antibiotic change	7.24 (2.75-21.2)	-
IV antibiotic change (clinical indication)	4.50 (1.74-12.0)	-
IV antibiotic change (culture-guided)	9.98 (3.28-33.8)	-
Additional Interventions	8.46 (3.19-24.1)	-
Debridement	12.6 (3.29-64.8)	-
Amputation or VAC therapy	20.3 (3.11 - 547)	-

OR: odds ratio, **CI:** confidence interval; **SSTIs:** Skin and soft tissue infections, **USG:** ultrasonography, **CRP:** C-reactive protein, **VAC:** vacuum-assisted closure, ***:** unable to calculate.

Hosmer–Lemeshow test: χ^2=105, df=8, p<0.001, AUC=0.82 (95% CI: 0.74–0.90), Nagelkerke R^2=0.31.

Variables with missing data (e.g., radiological findings), highly correlated variables (erythema, localized warmth, edema - overlapping signs of cellulitis), and variables reflecting the same clinical outcome or disease severity rather than predictors of prolonged hospitalization (e.g., intravenous antibiotic change, surgical interventions) were excluded from the multivariable model to avoid conceptual overlap with the outcome. Other SSTI was analyzed instead of cellulitis as it represented more severe infections associated with prolonged hospitalization.

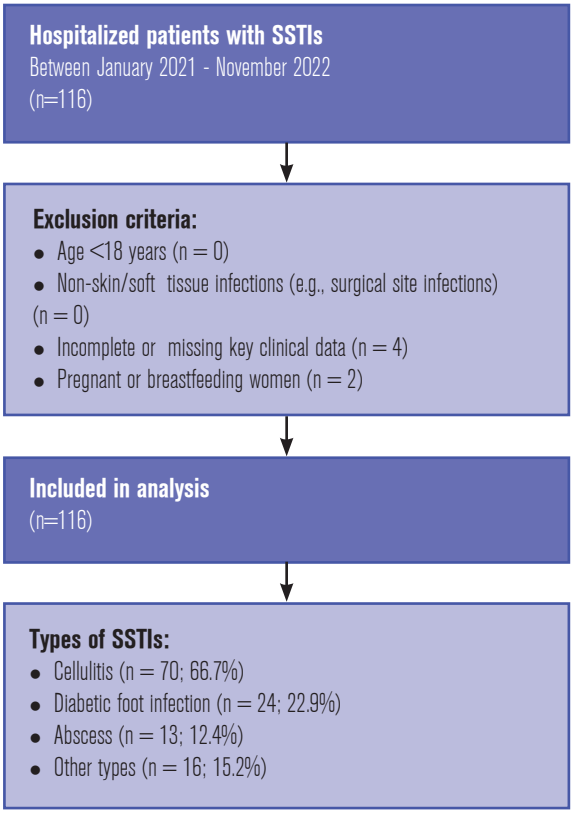

Figure Flow Diagram of the Study
SSTIs: Skin and soft tissue infections

were amoxicillin-clavulanate (n=36, 34.3%), fluoroquinolones (n=30, 28.6%), clindamycin (n=24, 22.9%), and third-generation cephalosporins (n=21, 20.0%).

Tissue biopsy samples were obtained from 54 patients (51.4%), with culture positivity observed in 39 of them (72.2%). The predominant species were *Enterococcus faecalis* (18.5%), *Staphylococcus aureus* (14.8%), *Enterobacter spp*. (11.1%) and *Staphylococcus epidermidis* (coagulase-negative staphylococci) (9.3%). Empirical antibiotic regimens at hospital admission most commonly included piperacillin-tazobactam (n=54, 51.4%), clindamycin (n=41, 39.0%), daptomycin (n=24, 22.9%), teicoplanin (n=22, 21.0%), and carbapenems (n=20, 19.0%). Among the 39 culture-positive patients, the isolated microorganisms were susceptible to the empirical antibiotic therapy in 29 cases (74.4%). IV antibiotic therapy was modified during hospitalization in 38.1% of patients (n=40). The modification was based on clinical indications in 28.6% (n=30) of the total cohort. Culture-guided changes in IV antibiotics were observed in 17.1% of patients (n=18).

Additional therapeutic procedures were performed in 31 patients (29.5%). Surgical interventions included drainage in 16.2% of cases, debridement in 11.4%, and amputation or vacuum-assisted closure (VAC) therapy in 6.7% (Table 4).

The median length of hospital stay was 8 days [25th-75th ,6.0–13.0]. Seventy-two percent of patients (n=79) were hospitalized for fewer than 14 days, while 24.8% (n=26) stayed for 14 days or more.

Comparison of Patients by Length of Hospital Stay

When patients were compared according to the length of hospital stay, the presence of comorbidities was significantly associated with prolonged hospitalization. Among patients with comorbidities, 28.3% (n=26) stayed in the hospital for ≥14 days, whereas none of the patients without comorbidities had a hospital stay of ≥14 days (p=0.035). Similarly, 39.6% (n=21) of patients with DM were hospitalized for ≥14 days, compared to only 9.6% (n=5) of those without DM (p=0.001). Patients diagnosed with cellulitis were less likely to experience prolonged hospitalization; 14.3% (n=10) of those with cellulitis had a hospital stay of ≥14 days, compared to 45.7% (n=16) of patients without this diagnosis (p=0.001). Supporting this finding, erythema and localized warmth—clinical signs commonly associated with cellulitis—were also more frequent among patients with shorter hospital stays. In contrast, patients with other types of soft tissue infections, including necrotizing fasciitis, decubitus ulcers, and catheter-related infections, were more likely to have prolonged hospitalizations (Table 2).

CRP levels were higher among patients with prolonged hospitalizations; the median CRP value was 150 mg/L [25th-75th: 92.0–226.0] in the ≥14-day group and 67.0 mg/L [25th-75th : 20.5–159.0] in the <14-day group (p=0.003). Air images on USG were only observed in patients with longer hospital stays. All five patients with air images (n=5, 100%) were in the ≥14-day group, while none of the patients in the <14-day group had this finding (p=0.001). Doppler USG findings were also associated with prolonged hospitalization. Among patients with abnormal doppler findings, 38.7% (n=12) stayed ≥14 days, compared to 10.0% (n=4) among those without such findings (p=0.010). Similarly, monophasic or biphasic arterial flow patterns were more common in patients with longer stays; 50.0% (n=8) of those with this finding were hospitalized for ≥14 days, compared to 14.5% (n=8) of those without it (p=0.006) (Table 3).

Among those with a change in IV antibiotics, 47.5% (n=19) stayed in the hospital for ≥14 days, compared to only 10.8% (n=7) among those without such a change (p<0.001). Additionally, both IV antibiotic modifications based on clinical indications and those guided by culture results were significantly associated with prolonged hospitalization (p=0.002 and p<0.001, respectively). Among patients who underwent additional interventions, 54.8% (n=17) stayed in the hospital for ≥14 days, compared to only 12.2% (n=9) of those who did not receive such interventions (p<0.001). Debridement procedures and amputation or vacuum-assisted closure (VAC) therapy was also significantly more common among patients with prolonged hospitalizations (p<0.001 and p=0.001, respectively) (Table 4).

A multivariable logistic regression model revealed that the presence of diabetes mellitus (OR = 5.70, 95% CI = 1.87–20.92) and other SSTI types (OR=6.32, 95% CI=1.78–25.22) were independently associated with prolonged hospital stays. In addition, higher baseline CRP levels were also related to an increased likelihood of prolonged hospitalization (OR=1.00, 95% CI=1.00–1.01 per mg/L), (Table 4)..

DISCUSSION

One hundred and five patients diagnosed with SSTIs were examined in this retrospective study. The mean age of the participants was found to be 61.3 ± 16.2 years, a finding that aligns with data in the literature suggesting that elderly individuals are more susceptible to such infections.[11] An examination of gender distribution revealed that males (51.4%) and females (48.6%) were represented in nearly equal proportions. This finding is consistent with general trends in the literature, indicating that both genders may be similarly affected by SSTIs.[10]

In this study, the most common types of infections were identified as cellulitis (66.7%), diabetic foot infection (22.9%), and abscess (12.4%). The predominance of cellulitis, particularly among elderly individuals, is consistent with findings reported in the literature, including Suaya's study, which identified cellulitis and abscess as the most frequent SSTIs regardless of diabetic status.[12]

Diabetic foot infection was also observed at a considerable rate, reflecting the burden of diabetes in the study population. Notably, 87.6% of patients had at least one comorbidity, most commonly DM, hypertension, hyperlipidemia, congestive heart failure, and malignancy. Previous studies have also highlighted trauma, vascular and cardiovascular diseases, intravenous drug use, immunosuppression, prior surgical interventions, vasculopathy, neuropathy,tinea pedis and/or onychomycosis, the presence of foreign bodies and impaired lymphatic drainage as additional predisposing factors for SSTIs.[6,10,13,14] These findings indicate that disruption of skin integrity plays a crucial role in the development of skin infections.[13]

In this study, comorbidities were found to have a significant impact on the clinical course of SSTIs. All patients without comorbidities had shorter hospital stays, while the presence of comorbid conditions, particularly diabetes mellitus, was significantly those reported by Suaya et al., indicating that diabetic patients tend to experience longer hospital stays compared to non-diabetic individuals.[12]

Furthermore, the recurrence rate of SSTIs in this cohort was 30.5%, which falls within the range (7–45%) reported in the literature, again highlighting the burden of comorbidities on disease progression and outcomes.[7]

Previous studies have demonstrated that local clinical signs such as erythema, warmth, pain, and edema are common in SSTIs, whereas systemic manifestations including fever, tachycardia, hypotension are usually associated with more severe infections.[8] However, it is known that these findings may present atypically in older adults.[11]

In our study, erythema, fever, localized warmth, and edema were the most frequently observed clinical findings. Notably, erythema and localized warmth were significantly associated with shorter hospital stays, suggesting that patients without systemic involvement tend to experience a more favorable disease course. Similarly, cellulitis was significantly associated with shorter hospitalization, a finding consistent with reports by Jenkins et al., who showed that cellulitis cases generally resolve more rapidly than complicated soft tissue infections.[9]

Among laboratory parameters, only CRP was significantly associated with prolonged hospitalization, with higher levels correlating with longer hospital stays. This underscores the potential role of CRP as a prognostic biomarker in predicting disease severity and recovery duration.

The most common anatomical site of infection was the lower extremities, accounting for 71.4% of cases. This distribution may be attributed to the increased susceptibility of the lower limbs to trauma, as well as the relatively poor circulation in these regions, which predisposes them to infection. This finding is also consistent with previously published data in the literature.[8]

High-risk SSTIs include infections such as those affecting the face, orbital cellulitis, postvenectomy cellulitis, and hand cellulitis resulting from human or animal bites.[15]

Microbiological analysis revealed Gram-positive bacteria, especially Enterococcus faecalis and Staphylococcus aureus, as the most frequently isolated pathogens, in line with national and international data.[4,16,17]

Although MRSA was not found at a high rate, the presence of methicillin-resistant coagulase-negative staphylococci highlights the need for careful antibiotic stewardship. Gram-negative organisms, including Enterobacter spp., Klebsiella pneumoniae, Escherichia coli, and Pseudomonas aeruginosa, were also isolated, particularly in patients with comorbidities and complicated infections.

In the randomized controlled trial conducted by Lause et al., it was reported that tissue culture did not directly prolong the length of hospital stay but was beneficial for guiding treatment decisions.[18,19] In this study, it was determined that patients with positive tissue cultures had hospital stays longer than 14 days. On the other hand, no statistically significant association was found between the length of hospital stay and either the presence of growth in culture, the type of isolated microorganisms, or their antibiotic resistance profiles ($p > 0.05$).

Imaging modalities such as plain radiography, ultrasonography (USG), computed tomography (CT), and magnetic resonance imaging (MRI) are recommended in the diagnosis of SSTIs. Plain radiography is useful in evaluating the presence of osteomyelitis; USG plays a key role in detecting abscesses and inflammation; while CT and MRI are crucial for identifying deep tissue infections.[6]

In this study, patients' imaging findings were evaluated using various modalities. In USG, signs of inflammation were more commonly detected, whereas abscesses were observed less frequently. This may be attributed to the predominance of cellulitis-type infections in patient population. Doppler USG revealed vascular circulatory disorders, which may be associated with comorbidities such as DM and peripheral arterial disease. The identification of abscess and osteomyelitis in MRI was consistent with findings reported in the literature.[17]

An analysis of the empiric antibiotic regimens administered to patients during hospitalization revealed that piperacillin-tazobactam, clindamycin, and daptomycin were the most frequently prescribed agents. These were followed by teicoplanin, linezolid, and carbapenems. Less commonly used antibiotics included ampicillin-sulbactam, trimethoprim-sulfamethoxazole, fluconazole, and metronidazole. The preference for broad-spectrum antibiotics in SSTI cases is consistent with findings reported in other studies in the literature.[9]

A statistically significant association was not observed between empiric antibiotic susceptibility and the duration of hospital stay. In patients whose antibiotic regimens were adjusted based on culture results, a shorter hospital stay (<14 days) was significantly more common. Similarly, among those whose antibiotics were modified according to clinical findings, the rate of hospitalization under 14 days was also significantly higher. These findings highlight the importance of obtaining tissue cultures and promptly guiding treatment based on culture results for early and effective management.

In patients who exhibited subcutaneous gas on USG and circulatory disorders on doppler USG, the length of hospital stay was found to be significantly longer. Additionally, prolonged hospitalization was observed in those who received adjunctive treatments such as debridement and drainage alongside antibiotic therapy. These findings underscore the importance of early imaging and the timely implementation of surgical interventions when necessary.

Limitations

The main limitation of this study is its retrospective and single-center design, which may restrict the generalizability of the findings. Furthermore, the lack of long-term follow-up data prevented the evaluation of recurrence rates beyond hospitalization.

CONCLUSION

In conclusion, this study highlights that cellulitis, diabetic foot infections, and abscesses are the most common forms of SSTIs, with comorbidities such as diabetes mellitus playing a significant role in prolonging hospitalization. Our findings emphasize the importance of timely initiation of appropriate empiric antibiotics, early culture sampling, and adjustment of treatment based on microbiological or clinical findings to shorten hospital stays. Moreover, the use of imaging modalities contributes not only to accurate diagnosis but also to guiding early surgical interventions, which are crucial for reducing complications and improving outcomes.

By addressing both clinical and microbiological aspects, this study provides valuable data that may contribute to optimizing SSTI management strategies in our country. Future multicenter and prospective studies with larger populations are warranted to validate these findings and to develop standardized approaches for diagnosis and treatment.

*The authors declare that there are no conflicts of interest.

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