Research Article

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Title: Assessment of wound cultures in an oncology hospital.

Short title: Wound cultures in an oncology hospital.

Abstract

Purpose: The aim of this study is to evaluate the patient's demographic, clinical and laboratory data to determine whether the bacteria isolated from wound cultures are causative agents or colonization, and to determine their antimicrobial susceptibilities. This study aims to assess the demographic, clinical, and laboratory data of patients to distinguish between pathogenic bacteria and colonization in wound cultures, while also determining their antimicrobial susceptibilities.

Materials and methods: This retrospective research was conducted in Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital between January 1, 2021 and December 31, 2022. Two hundred thirty six isolates from 186 patients wound cultures were included in the study. Demographic data, clinical data and laboratory results of the patients were evaluated. The isolated bacteria and their antimicrobial susceptibilities were determined. The Q score system was used to evaluate the microbiological quality of wound samples.

Results: One hundred fifty nine cases (85%) were inpatients. Totally 119 (63.9%) patients were diagnosed with infection. The Q score for 136 samples (85.5%) was assessed as Q3. The most common isolated microorganisms were coagulase negative-staphylococci (CoNS) (19%), *Escherichia coli* (14.8%), and *Staphylococcus aureus* (13.1%), respectively in wound bacterial cultures. The methicillin resistance rate was 55.5% in CoNS and 54.1% in *Staphylococcus aureus*. Gram-negative bacteria were isolated in 81 (59.9%) infected patients.

Among patients with infected wounds, 39 (32.7%) patients had surgical site infections, 25 (21%) prosthesis infections, and diabetic foot infections 3 (2.5%). Infection rates were statistically significantly higher in patients with surgery, prosthesis, and diabetic foot

(*p*=0.054).
Conclusion: The Q score serves as a strong indicator for identifying the causative agent in wound infection and distinguishing it from colonization, thus aiding in the prevention of unnecessary antibiotic use. Regular review of local antibiotic susceptibility data is crucial in the clinical treatment of specific patient groups with oncological conditions.
Keywords: Wound culture, Q score, oncology patient, antimicrobial susceptibility.

Makale başlığı: Onkoloji hastanesindeki hastaların yara kültürlerinin değerlendirilmesi.

Kısa başlık: Onkoloji hastanesinde yara kültürleri.

Öz

Amaç: Bu çalışmanın amacı, yara kültürlerinden izole edilen bakterilerin etken/kolonizasyon ayrımının yapılmasında; hastaya ait demografik, klinik ve laboratuvar verilerinin değerlendirilmesi ve etken bakterilerin antimikrobiyal duyarlılıklarının belirlenmesidir.

Gereç ve yöntem: Bu retrospektif araştırma, 1 Ocak 2021-31 Aralık 2022 tarihleri arasında Dr. Abdurrahman Yurtaslan Ankara Onkoloji Eğitim ve Araştırma Hastanesi'nde gerçekleştirildi. Çalışmaya, 186 hastaya ait 236 yara kültürü dahil edildi. Hastalara ait demografik veriler, klinik veriler ve laboratuvar sonuçları değerlendirildi. İzole edilen bakteriler ve antimikrobiyal duyarlılıkları belirlendi. Yara örneklerinin mikrobiyolojik kalitesini değerlendirmek için Q skor sistemi kullanıldı.

Bulgular: Vakaların 159'u (%85) yatan hastalardı. Toplam 119 (%63,9) hastada etken olarak kabul edildi. Q puanı 136 örnek için (%85,5) Q3 olarak değerlendirildi. Yara bakteri kültürlerinde en sık izole edilen mikroorganizmalar sırasıyla koagülaz negatif stafilokoklar (KNS) (%19), *E. coli* (%14,8) ve *S. aureus* (%13,1) oldu. Metisilin direnci oranı KNS'lerde %55,5; *S. aureus*'ta ise %54,1 olarak belirlendi. Enfeksiyöz hastaların 81'inde (%59,9) Gram negatif bakteri izole edildi. Enfekte yarası olan hastaların 39'unda (%32,7) cerrahi alan enfeksiyonu, 25'inde (%21) protez enfeksiyonu, 3'ünde (%2,5) diyabetik ayak enfeksiyonu vardı. Ameliyatlı, protezli ve diyabetik ayaklı hastalarda enfeksiyon oranları istatistiksel olarak anlamlı derecede yüksekti (*p*=0,054).

Sonuç: Q skorlaması yara enfeksiyonunda etkenin saptanması ve kolonizasyonun dışlanmasında güçlü bir belirteçtir ve gereksiz antibiyotik kullanımının önlenmesine

yardımcı olur. Onkolojik hastalar gibi özel hasta gruplarının ampirik tedavilerinin verilmesinde lokal antibiyotik duyarlılık verilerinin güncel olarak incelenmesi gereklidir.
Anahtar kelimeler: Yara kültürü, Q skoru, onkoloji hastaları, antimikrobiyal duyarlılık.

Introduction

Wound infections are one of the most common causes of healthcare-associated infections (HCAIs) and lead to high mortality and morbidity. Timely and accurate evaluation of wound infections is vital. Determining the causative pathogens and their antimicrobial susceptibility increases the effectiveness of treatment and reduces mortality and morbidity. Management of wound infections will also contribute to the Sustainable Development Goals. According to 2017 data from the National Healthcare-Associated Infections Surveillance Network (USHIESA), 8,194 cases (1.3%) out of 617,745 total healthcare infections were attributed to surgical site infections (SSIs) [1].

The aim of this study is to differentiate whether the bacteria isolated from wound cultures are pathogens or colonization, to determine the antimicrobial susceptibility of bacteria interpreted as causative agents, and to evaluate the demographic, clinical and laboratory data of the patients.

Material and methods

Cultures of 186 patients were included in the study between January 1, 2021 and December 31, 2022. Demographic data, clinical data and laboratory results of the patients (including C-reactive protein-CRP levels, procalcitonin levels and leukocyte counts) were evaluated. Clinical samples sent to the Medical Microbiology Laboratory were stained with Gram stain and microscopic examination was performed. Culture samples were simultaneously inoculated into 5% sheep blood agar and eosin methylene blue agar and evaluated after the appropriate incubation period. The isolated bacteria were identified using traditional microbiological methods and the VITEK® 2 automated system (BioMérieux, France). Antibiotic susceptibility test results were determined according to EUCAST standards. Antibiotic susceptibility tests were performed both with the disc diffusion method and the VITEK® 2 automatic system (BioMérieux, France). Sensitive (S) and sensitive increasing exposure (I) results were considered sensitive.

In this retrospective study, demographic and clinical findings of the patients were obtained from the hospital data system. CRP and procalcitonin level were determined by AU5800 (Beckman Coulter INC) and Centaur XP (Siemens Healthcare), and leukocyte count levels were evaluated using the Automated Hematology Analyzer (Mindray BC-6200, Shenzhen Mindray Bio-Medical Electronics Co., Ltd., Shenzhen, China).

Colonization was characterized by the isolation of microorganisms from the wound without local and/or systemic signs and symptoms of infection. Local infection was defined by the presence of signs and symptoms of infection, which included erythema, local warmth, swelling, purulent discharge, delayed wound healing beyond expected timelines, the appearance of new or intensified pain, and increased foul odor [2]. Surgical site infections (SSI) are defined as infections that affect the incisional wound created during the surgical procedure or occur near the surgical site or organ. SSI was diagnosed according to the criteria of the Center for Disease Control and Prevention (CDC). Infections that occurred within 30 days after surgery and 90 days when an implant (e.g., hip prosthesis) was used were designated as SSIs [3].

The Q score system was used to evaluate sample quality and determine the required extent of culture investigation for potential pathogens (PP). The Q score assigns positive values to the number of polymorphonuclear cells (PMNs) and negative values to the number of squamous epithelial cells (SECs) observed directly in the Gram-stained smear. The number resulting from the addition of these values creates the "Q score". Starting with a maximum value of 3, the score then continues to decrease values, maintaining the lower limit of zero; Negative numbers are always rounded to zero in the final calculation of the Q score [4, 5].

Statistical data were analysed using SPSS (Version 26) (SPSS Inc., Chicago, USA) and were expressed as percentage, numbers, median, p value <0.05 was considered to be significant statistically.

This research was approved by the Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital Non-Interventional Clinical Research Ethics Committee.

Results

Of the 186 patients with positive wound cultures, 71 (38.2%) were male and 115 (61.8%) were female. The average age of the patients was 61.72 years. One hundred twenty nine (69.4%) of the cases were inpatients and 27 (14.5%) were outpatients. Thirty (16.1%) patients were from intensive care unit. One hundred fortytwo (76.3%) of the samples consisted of wound swabs, and 44 (23.7%) consisted of tissue, debridement and drainage fluids. According to CDC criteria, 119 (64%) of the bacteria isolated from wound cultures were identified as causative agents and 42 (22.6%) were identified as colonization (Table 1).

Out of 154 samples with available Gram stain results, in 53 samples (34.4%), the leukocyte count was ≥25, and no epithelium was observed under x10 magnification microscopy. The Q score for these 53 samples was assessed as Q3. In 41 samples

(26.6%), the leukocyte count during the x10 scan fell within the range of 1-9, and epithelium was absent. The Q score for these 41 samples was also Q3. For 42 samples (27.2%) where no cells were detected, the Q Score was designated as Q3. The Q score for these 136 samples (88.2%) was assessed as Q3. In 11 samples (7.2%), only 1-9 squamous epithelial cells were visible in each x10 scan area, and no leukocytes were detected so the Q score was determined as Q0.

Bacterial or yeast cells were observed in only seven samples (4.6%) by direct microscopy. The most frequently isolated microorganisms from wound cultures were coagulase-negative staphylococci (CoNS) (19%), *Escherichia coli* (14.8%) and *Staphylococcus aureus* (13.1%), respectively (Table 2). A single agent was isolated in 155 of the patients included in the study, two agents were isolated in 29 patients, and three or more different microorganisms were isolated in two patients. It was observed that the microorganism isolated from wound cultures was simultaneously isolated from non-wound samples in 25 of the patients. Especially *E. coli* (8 cases), *Staphylococcus* spp. (5 cases) and *Candida* spp. (5 cases) were the most common isolates in these concurrent samples.

The methicillin resistance rate was 55.5% in CoNS and 54.1% in *S. aureus* (Table 3). Antimicrobial susceptibility of *Enterobacterales* to cephalosporins and carbapenem was observed 49.9% and 78.3%, respectively. In non-fermenter Gram-negative bacteria, ceftazidime and carbapenem susceptibility was 32% and 52%, respectively (Table 4). In particular, ceftazidime-avibactam susceptibility was performed for multidrug resistance 42 Gram-negative isolates and 88% (37/42) was susceptible.

In our study, we evaluated the clinical, laboratory data and treatment schedule and divided the patients into two groups: infection and colonization; (Table 5). Since we could not access the data of 25 patients, we evaluated infection or colonization in a total of 161 patients (Table 5). There was no significant difference in the presence of fever, local infection symptoms, CRP level, procalcitonin level and leukocyte count in patients with infection and colonization ($p>0.05$). (Table 5). However, in 77.6% (125/161) of the cases, CRP levels were above normal limits, with an average of 98.4. Regarding procalcitonin, high levels were observed in 17.4% (28/161) of the patients tested. Empirical treatment and post-culture treatment was significantly compatible ($p \leq 0.05$). Wound isolates identified as pathogens were diagnosed with cancer in 65 cases (54.6%), while among those considered as colonization, 22 cases (52.3%) were diagnosed with cancer. Patients with infectious wounds, 39 (32.8%) had surgical site infection, 25 (21%) had prosthesis infection, and 3 (2.5%) had diabetic foot infection. Infection rates were higher in patients with surgery, prosthesis and diabetic feet ($p=0.054$). While gram-negative bacteria were isolated in 81 (60%) of the patients with infectious wounds, gram-positive bacteria were isolated in 30 (71.4%) of the patients with colonization.

Discussion

The human skin hosts a wide variety of microorganisms, many of which play a crucial role in defending against harmful pathogens through a phenomenon known as bacterial interference. These microorganisms, constituting the skin's flora, can be categorized as either resident or transient. Resident bacteria refer to the naturally occurring microorganisms that inhabit an individual's skin. These bacteria make their home on visible skin areas and within the skin's accessory structures. Transient bacteria are acquired when individuals come into contact with others or are exposed to surfaces teeming with bacterial presence. Among the diverse array of bacteria present on human skin, notable species include *Staphylococcus, Micrococcus, Peptococcus, Corynebacterium, Brevibacterium, Propionibacterium, Streptococcus, Neisseria,* and *Acinetobacter* species. Additionally, *Candida* spp. and the mites also take up residence on the skin. The quantity of bacteria within the stratum corneum is regulated to a certain extent by the continuous shedding of squames from the uppermost skin layer. The research findings highlighted that a significant portion of wound infections are caused by microorganisms commonly found in the body's natural flora and were seen in hospitalized patients. The skin's microbial community can generate biofilm, potentially leading to colonization and subsequent infection [6-11]. Similarly, in our study, the majority of the patients (>85%) were hospitalized patients. In our study, gram-negative bacteria isolation was detected in 60% of patients with infectious wounds, and gram-positive bacteria in 71.4% of patients with colonization. This data suggested that Gram-negative bacterial wound infections were more frequent in our hospital.

The colonized wounds' progress into infections is determined by several crucial factors. These factors encompass the concentration of bacteria per Gram of tissue and the host's immune system. In cases with appropriate wound care and management, the infection can escalate into septicemia, potentially leading to fatal outcomes. Wounds that have not progressed through the normal healing process and are open for ≥1 month are classified as chronic wounds. The most common risk factors of chronic wound infections were reported as metabolic disruptions (e.g., diabetes), vascular deficits (e.g., venous or arterial insufficiency), or mechanical impacts. A breach in the skin integrity heals uneventfully with time and is defined as an acute wounds. Acute wounds are injuries that occur suddenly and typically heal within a predictable timeframe. They are often caused by external trauma, such as cuts, burns, abrasions, or surgical incisions. Advanced age, inadequate nutrition, obesity, diabetes, prolonged use of steroids, and compromised immune function were the factors for wound infections [7,8]. In a retrospective study from China, 815 patients were analyzed. Microbial culture positivity was most pronounced in the wound tissue of ulcers resulting from infections (87.6%), with pressure-related ulcers following closely at (77.1%), followed by diabetes-related ulcers at (68.3%), and venous diseases at (67.7%), Within this patient group, (63.9%) of the tested samples exhibited microbial growth, comprising (13.4%) polymicrobial infections and (86.6%) monomicrobial infections. [9]. The surgery, presence of prosthesis, and diabetes mellitus were the most common risk factors for wound infections. Similarly, in our study, monomicrobial isolation was frequent in wound infections. We found that the patients with surgery, prosthesis, diabetes mellitus, advanced age, and, immunosuppression were at risk for the development of wound infections. Immunsupression is very common in our study group due to 54.6% of the patients had cancer.

Within acute care settings, surgical wounds constitute the most prevalent wound type and they can cause potential complications like bleeding and wound reopening. SSI primarily manifest at the location of the surgical procedure, encompassing both the deep regions within the surgical zone contiguous to the operated organ (such as the hip, colon, pelvis, or brain) and the point of incision (the fascia, subcutaneous tissue, or skin). In conditions where a surgical site infection develops following a joint replacement procedure, the source of the infectious agent may be the nearby skin or the operating room. In an international study, the incidence of surgical site infections was estimated to occur in 1.9% to 40% of surgical procedures [6, 10]. In our study, among 119 patients evaluated as infected, 32.8% were surgical site infections. It was showed that surgical site infections were problematic in our hospital. We suggested avoiding improper decontamination procedures (inappropriate antibiotic selection, compromised sterility practices) to decrease the incidence of post-surgical complications.

When evaluated clinically, infection in both acute and chronic wounds is typically characterized by an exaggerated inflammatory response surrounding the wound, elevated body temperature, pain, cellulitis, wound dehiscence, foul-smelling discharge, presence of pus, swelling, and warmth. Infection involves the infiltration of bacteria into tissue, while colonization is generally limited to the surface of the wound [7]. Our study indicated that, among the clinical findings, fever (21.8%), local signs of infection (10.9%), serous discharge (18.5%), and purulent discharge (19.3%) rates were higher in patients with infectious wounds than patients with colonization, although not statistically significant. We recommended evaluation of local and systemic singns, Gram-staining and culture results together for the diagnosis of the infection and colonization findings.

In a study conducted with 249 patients who cesarean delivery, serum PCT, CRP levels, and WBC counts were measured at the postoperative 6th, 12th, and 24th hours. SSI assessments were conducted on the patients on the 2nd, 4th, and 7th days postoperatively. The study reported that 6% of the patients developed surgical site infections. The area under the curve (AUC) for PCT in predicting the SSI was 0.912 (95% CI: 0.79-1) with a sensitivity of 93.3% and specificity of 92.3% (p<0.001). The AUC for CRP was 0.854 and with a sensitivity of 80%, and specificity of 82.4%. Serum procalcitonin levels proved to be a more sensitive and specific indicator for the early diagnosis of SSIs following cesarean operation compared to others [12]. In our study, laboratory findings including elevated levels of CRP (82.3%), procalcitonin (15.9%), and higher numbers of leukocytes (34.4%) were seen in patients with infectious wounds. Although these results were not statistically significant, we recommended evaluating clinal and laboratory findings together in the diagnosis and following of wound infections. On the other hand, due to the majority of our patients having comorbidity and immunosuppression, there might be no statistically significant difference between infection and colonization.

Antibiotic resistance is a significant public health problem. In a study evaluating wound cultures, 600 isolates were analyzed, with 46.2% identified as Gram-positive bacteria, 51.3% as Gram-negative bacteria, and 2.5% as Candida spp. The most common isolates included S. aureus (29.2%), E. coli (11.5%), P. aeruginosa (11%), Proteus mirabilis (8%), and Klebsiella pneumoniae (5.8%). In a study evaluating wound cultures, 600 isolates were analyzed, with 46.2% identified as gram-positive bacteria, 51.3% as gram-negative bacteria, and 2.5% as *Candida* spp. The most common isolates were *S. aureus* (29.2%), *E. coli* (11.5%), *P. aeruginosa* (11%), *Proteus mirabilis* (8%), and *Klebsiella pneumoniae* (5.8%). Susceptibility tests revealed that 116 of the cultured bacteria exhibited resistance to multiple drugs, indicating the presence of multidrug-resistant strains. The resistance rates of *S. aureus* were >50% to methicillin, 92% to penicillin, 58.3% to erythromycin, and 50.9% to clindamycin. The resistance rates of *E. coli* were 68.1% to ampicillin, 68.1% to ciprofloxacin, 60.9% to levofloxacin, 3.9% to tigecycline, and 3.6% to amikacin [9]. In a study conducted with 5409 wound swabs in Saudi Arabia, a total of 14 different bacterial species were isolated and 9 of them were determined to be Gram negative bacteria. The most common isolates were *Klebsiella pneumoniae*, followed by *Pseudomonas aeruginosa*, *Escherichia coli*, *Acinetobacter baumannii*, methicillin-resistant *S. aureus* (MRSA), vancomycin-resistant *Enterococci*

(VRE), and vancomycin-resistant *S. aureus* (VRSA). Multidrug resistant strains were determined as follows: *A. baumannii*, 97%; *K. pneumoniae*, 81%; *E. coli*, 71%; MRSA, 60%; *P. aeruginosa*, 33%; VRE, 22%; and VRSA, 2% [13]. In our study, the most common infection/colonization wound culture isolates were CoNS (19.4%), *E. coli* (14.8%), and *S. aureus* (13.1%). However, the Gram-negative isolation rate was higher in patients with infectious wounds than in patients with colonization (60% vs 16.6%). The rate of methicillin resistance was >50% in both CoNS and *S. aureus*. Within enteric bacilli, the resistance rate for 3rd generation cephalosporin was 55.1% and carbapenem 21.7%. In nonfermenter Gram-negative bacteria, resistance for ceftazidime was 68% and for carbapenem 48%. Notably, ceftazidime-avibactam was assessed in 42 Gram-negative isolates with a resistance rate of 22%. In our study, 75.6% of patients with infectious wounds and 66.6% of patients with colonization received empirical treatment. Narrowed post-culture antimicrobial therapy was applied for 11.8%, and extended post-culture antimicrobial therapy for 36.1% of the patients with infectious wounds. Additionally, 13.4% of the patients with infectious wounds received antimicrobials for the first time after culture. Our study data suggested that every hospital should know the pathogenic agents and their antibiotic susceptibility patterns. The culture and antibiogram results had an important role in the management of wound infections and infection control. When choosing an empirical antimicrobial treatment option by clinicians, it should be kept in mind that Gram-negative bacterial wound infections are at the forefront in our hospital.

Our presented study, literature data [4, 5] indicated that the presence of microorganisms in Gram staining was not a good evaluating criteria for diagnosis of wound infection. The Q score for 136 samples (85.5%) was assessed as Q3. It was shown that Q scoring which assigns positive values to the count of PMNL cells and negative values to the count of squamous epithelial cells was a powerful marker for the determination of sample quality. In our study, it was determined that 76.3% of the wound samples were swab samples. It was reported that samples should be taken with at least two swabs for culture and Gram staining. The swab should be placed in 1-2 ml physiological saline or liquid medium, vortexed, and then inoculated into the medium, then the preparation is prepared for Gram staining [14]. We suggested that for an accurate diagnosis, appropriate and timely collection of swab samples and the application of laboratory sending criteria were necessary. If the samples dry out, the probability of bacterial isolation decreases. Given that clinical samples are not typically submitted to the laboratory in sets of two swabs, the reliability of our study Gram staining process becomes a concern.

In conclusion, wound infection rates, especially SSIs were common in our hospital among oncological patients. The most commonly isolated organisms from wound cultures were CoNS, *E. coli* and *S. aureus*. Gram negative isolation rate was higher in patients with infectious wounds than patients with colonization. Gram positive isolation rate was higher in colonized patients than patients with infectious wounds. The patients with surgery, prothesis, diabetes mellitus, and old age, immunsupression were prone wound infection. Among the clinical findings, the presence of fever, local signs of infection, serous discharge, purulent discharge, elevated levels of CRP, procalcitonin, and higher numbers of leukocyte contributed to the diagnosis of wound infection. We recommended to evaluate clinal and laboratory findings together in the diagnose of wound infections. The culture and antibiogram results had an important role for the management of wound infections and infection control. When choosing an empirical antimicrobial treatment option by clinicians, it should be kept in mind that Gram-negative pathogen rates isolated from wound infections are common in our hospital. Q scoring was a powerful marker for diagnosis of wound infection and exclude of colonization. The appropriate and timely collection of swab samples were necessary. Avoiding inproper decontamination procedures (inappropriate antibiotic selection, compromised sterility practices) will decrease the incidence of post-surgical complications.

Conflict of interest: No conflict of interest was declared by the authors

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Ethics committee approval: Permission was obtained from University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital Non-Interventional Clinical Research Ethics Committee for the study (permission date: 11.01.2024, permission number: 2023-12/125).

Authors' contributions to the article

F.A., I.M., T.D. constructed the main idea and hypothesis of the study. F.A., I.M., T.D., G.I., N.I., S.S.Y. developed the theory and arranged/edited the material and method section. F.A., E.T., B.D., T.U. have done the evaluation of the data in the Results section. Discussion section of the article written by F.A., I.M., T.D., S.G., reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.

Table 1. Demographic and clinical characteristics of patients

Demographic characteristics	
The average age (years)	61.7
Gender:	
Female	115 (61.8%)
Male	71 (38.2%)
Hospital Unit	
Inpatient	129 (69.4%)
Outpatient	27 (14.5%)
Intensive care patients	30 (16.1%)
Distribution of wound samples	
Wound swab	142 (76.3%)
Tissue, debridement	44 (23.7%)
Infection	119 (64%)
Colonization	42 (22.6%)
Undetermined sample	25 (13.4%)

Table 2. The distribution of microorganism species isolated in wound cultures

Microorganism	**Number (n=236)**	**Percent (%)**
Coagulase negative staphylococci	46	19.4
Escherichia coli	35	14.8
Staphylococcus aureus	31	13.1
Klebsiella spp.	26	11
Enterococcus faecalis/faecium	18	7.6
Acinetobacter baumannii	13	5.5
Pseudomonas aeruginosa	12	5
Enterobacter spp.	11	4.6
Candida spp.	8	3.3
Proteus spp.	6	2.5
Others	30	13.2

Table 3. Distribution of antibiotic susceptibility of Gram-positive microorganisms isolated in wound culture

	AM (%)	**GN (%)**	**GNHR (%)**	**CIP (%)**	**LEV (%)**	**E (%)**	**DA (%)**	**LNZ (%)**	**VA (%)**	**TEC (%)**	**FA (%)**	**SXT (%)**	**FOX (%)**
CoNS (n=46)	NA	NA	NA	23.2*	27.2*	26.6	97	97.8	100	100	41.3	71.7	44,5
S. *aureus* (n=31)	NA	NA	NA	62.5*	NA	67.7	77.4	96.7	100	100	89.2	90.3	45,9
Enterococcus spp. (n=18)	50	75	40	36.6	50	IR	IR	100	72.2	77.7	IR	IR	NA

AM: Ampicillin GN: Gentamicin GNHR: Gentamicin high dose resistance CIP: Ciprofloxacin
E: Erythromycin DA: Clindamycin LNZ: Linezolid VA: Vancomycin TEC: Teicoplanin
FA: Fusidic acid SXT: Trimethoprim-Sulphamethoxazole FOX: Cefoxitin NA: Not applicable
(*): Susceptible, increased exposure IR: Intrinsic Resistance

Table 4. Distribution of antibiotic susceptibility of Gram-negative microorganisms isolated in wound cultures

	CN (%)	AK (%)	AM (%)	TPZ (%)	CXM (%)	CAZ (%)	CRO (%)	FEP (%)	ETP (%)	MEM (%)	IMP (%)	CIP (%)	LEV (%)	TGC (%)	SCF (%)	SXT (%)
E. coli (n=35)	84	100	22.8	60.6	6.2	54.8	51.5	52.9	88.5	100	100	50	61.5	81.4	89.9	54.2
Klebsiella spp. (n=26)	46.1	54.1	IR	36.3	5.8	30.7	30.7	36	57.6	57.6	66.6	38.4	25	80	50	42.3
Enterobacter spp. (n=11)	70	100	IR	72.7	0	63.6	54.5	70	90.9	100	100	72.7	NA	NA	77.7	72.7
Proteus spp. (n=6)	40	100	16.6	100	0	100	83.3	100	100	100	100	50	100	16.6	100	33.3
Pseudomonas aeruginosa (n=12)	16.6	100	NA	33.3	NA	66.6	NA	100	NA	90.9	66.6	50	66.6	IR	100	NA
Acinetobacter baumannii (n=13)	36.3	58.3	NA	15.3	NA	27.2	NA	NA	NA	23	50	9	0	87.5	33.3	41.6

CN: Gentamicin AK: Amicasin AM: Ampicillin TPZ: Piperacillin-tazobactam
CXM: Cefuroxime CAZ: Ceftazidime CRO: Ceftriaxone FEP: Cefepime
ETP: Ertapenem MEM: Meropenem IMP: İmipenem CIP: Ciprofloxacin
LEV: Levofloxacin TGC: Tigecycline SCF: Cefoperazone/sulbactam
SXT: Trimethoprim/sulfamethoxazole NA: Not applicable IR: Intrinsic Resistance

Table 5. Clinical and laboratory findings of patients with wound infection/colonization

	Infection n=119, (%)	**Colonization n=42, (%)**	***p* value**
Clinical findings			
Fever	26 (21.8)	5 (11.9)	0.282
Local signs of infection			0.787
Fever, erythema, pain, tenderness	13 (10.9)	4 (9.5)	
Serous discharge	22 (18.5)	6 (14.2)	
Fistula	3 (2.5)	1 (2.3)	
Purulent discharge	23 (19.3)	7 (16.6)	
Local signs of infection ≥1	27 (22.7)	8 (19)	
Laboratory findings			
Increased CRP (C-reactive protein)	98 (82.3)	27 (64.2)	0.069
Increased Procalcitonin	19 (15.9)	9 (21.4)	0.407
Increased Leukocyte count	41 (34.4)	15 (35.7)	0.282
Receiving empirical treatment	90 (75.6)	28 (66.6)	
Compliance with empirical therapy and post-culture therapy			
The same with post-culture treatment	38 (32)	21 (50)	
Narrowed Post-culture therapy	14 (11.8)	0	
Extended post-culture therapy	43 (36.1)	11 (26.2)	
Antibiotic started patients for the first time after culture	16 (13.4)	2 (4.8)	
Patients not given antibiotics	8 (6.7)	8 (19)	
The presence of cancer	65 (54.6)	22 (52.3)	0.606
The presence of prosthesis	28 (23.5)	8 (19)	0.152
Clinic/followed unit			0.974
Outpatient	16 (13.5)	6 (14.3)	
Inpatient	81 (68)	28 (66.7)	
Intensive care unit	22 (18.5)	8 (19)	
Wound types			0.054
Surgical side	39 (32.8)	8 (19)	
Prosthesis	25 (21)	6 (14.3)	
Diabetic foot	3 (2.5)	2 (4.8)	
Other	52 (43.7)	26 (61.9)	
History of hospitalization in the last three months	51 (42.8)	14 (33.3)	
Culture result	**n=135**	**n=42**	
Gram negative isolation	81 (60)	7 (16.6)	
Gram positive isolation	51 (37.8)	30 (71.4)	
Candida isolation	3 (2.2)	5 (12)	

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