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Detected frequency of bacteremia in pressure ulcer and the decision to systemic antibiotic

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Abstract

Introduction: Pressure injuries are a significant cause of morbidity and mortality, and a source of considerable expense in health expenditures. Bacteremia is a frequently seen complication of pressure injury, although its incidence has yet to be well defined, and there are scarce studies on the subject. The aim in the present study is to assess the frequency of bacteremia of pressure ulcer origin as an indicator in decisions to start systemic antibiotics in patients with pressure injuries.

Material and method: Included in the study were all patients over the age of 18 years receiving palliative care in hospital, and with a pressure injury. Pressure injury samples of the patients were taken within the first 24 hours of admission to the hospital. All decubitus ulcers were washed with sterile saline and a sample was taken using a sterile cotton swab from the deepest and the most solid part of the ulcers. we included 76 patients whose 40 (52.6%) were male and 36 (47.4%) were female, with a mean age of 70.8±15.6 (18-95) years. 76 of 208 patients hospitalized in palliative care in 2018 had decubitus ulcers. We detected decubit ulcers infections in 75 of 76 patients. Among the 75 (65.2%) patient had pressure ulcers infections at 115 different sites of the body.

Result: The rate of bacteremia in Pressure injury was 13.9% (16/115) , and the agents were found to be polymicrobial in the ulcers cultures of 42 (55.2%) of the patients. The most common accompanying bacteria were *Acinetobacter*, *Pseudomonas aeruginosa* and *Escherichia coli*(E.coli). Among the pressure injurys, 49 (42.6%), 60 (52.4%) and 6 (5.2%) were evaluated as stage 4, 3 and 2 pressure injurys, respectively.

Conclusion: The causative agent of decubitus infections was found to be the agent causing bacteremia in 13.9% of the patients with pressure injury in the present study. The agent growing in the ulcer culture was rarely found to be the causative agent of bacteremia when deciding whether to treat pressure injury infections with systemic antibiotic.

Keywords: Pressure injury, palliative care, elderly, decubitus infections

INTRODUCTION

The term "pressure injury" refers to localized tissue damage in the skin or subcutaneous tissue resulting from tears and/or friction, generally together with pressure in areas of bone protrusion. Pressure injury can develop in any area where bone protrusions are exposed to pressure, and develop most frequently on the sacrum, coccyx or heels in supine position, on the hips and ankle joints of patients lying continuously on the same side, and most frequently on the hips in the sitting position (1). They are commonly found on bedridden patients with comorbidities or on those with limited mobility. The prevalence of Pressure injury has been reported in the range of 4.7–37.1% (2), and 11.7% in every 1000 day of hospitalisation in the intensive care units of hospitals (3). Pressure injury has been reported to be up to 33% in palliative care centers in Turkey (4). The prevalence of Pressure injury in hospitalized geriatric patients has been reported to be 5.8% (2). Pressure injury is a significant cause of morbidity and mortality, and a source of considerable expense in health expenditures (3).

It is a significant health problem in long-term bedridden patients, lowering their quality of life, despite the development of various preventive and treatment methods (5). Bacteremia is a frequently seen complication of pressure injury, although its incidence has yet to be well defined, and there are scarce studies on the subject (5-7).

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Studies investigating the bacteremia associated with Pressure injuries are rare, and ulcers mostly could not be documented as the source of bacteremia (6,8). Pressure injury may not be the focus of bacteremia, since many of the factors that could cause a growth in blood cultures are already present in this patient group (vascular access, catheters and tracheostomy, etc.) (3). The detection of the causative agent can aid in antibiotic selection and when making the decision whether or not to treat pressure injury infections. The causative agent is not always singular, and colonized bacteria are mostly detected, and there is therefore a lack of consensus whether or not to administer antibiotics every time a growing agent is detected in the culture. Systemic antibiotics are suggested for use in the presence of systemic signs such as a positive blood culture, cellulitis, fasciitis, osteomyelitis and sepsis, according to the International Pressure Injury Prevention panel (9,10).

The aim in the present study is to assess the frequency of bacteremia of pressure injury origin as an indicator in decisions to start systemic antibiotics in patients with pressure injuries. The aim in this regard is to demonstrate how frequent the agent causes a growth in the pressure injury when deciding to treat it with systemic antibiotics.

MATERIALS AND METHOD

The study was launched after permission was granted by the Republic of Turkey, Health Sciences University, Erzurum Region Education and Research Hospital (dated: 11.02.2018, number: 37732058-514.10. 208), patients were hospitalized in 2018. 132(%63,5) patients were excluded because they were using systemic antibiotics, ulcer stage, or using local antibiotics. 76(36,5) patients were included in the study. Included in the study were all patients over the age of 18 years receiving palliative care in hospital, and with a pressure injury stage 2 and above. Pressure injury samples of the patients were taken within the first 24 hours of admission to the hospital. All decubitus ulcers were washed with sterile saline and a sample was taken using a sterile cotton swab from the deepest and the most solid part of the ulcers. Patients using systemic antibiotic and local antibiotics for ulcers treatment were excluded from the study, as were patients with a positive urine, catheter or tracheal aspirate culture.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics (Version 22.0. Armonk, NY: IBM Corp.) software. Descriptive statistics, as mean and standard deviation for normally distributed continuous variables and relative frequencies for categorical (qualitative) variables, were generated for all variables. A p-value of <0.05 was considered statistically significant. Demographic data were presented as frequencies and percentages, and continuous variables were presented as mean and standard deviation (SD). For the descriptive analyses, mean and SD were used for continuous variables, and percentages for categorical variables.

RESULTS

In our study, We found the pressure injury in 76 (%36,5) patients of 208 of hospitalized in 2018 in the Palliative Care Service. 76 patients in the Palliative Care Service with various diagnoses, and who had clinical findings of Pressure injury during hospitalization and a positive ulcer swab culture that was considered clinically significant, were included in the study. Among these patients, 40 (52.6%) were male and 36 (47.4%) were female, with a mean age of 70.8±15.6 (18-95) years. Among the diagnoses of the patients, Alzheimer's disease, Cerebrovascular accident and cancer were the most frequently encountered. The distribution of the diagnoses of the patients is presented in **Table 1**.

Table 1. Distribution of the diagnosis of the patients and laboratory findings

	n	**%**
Age (Year)	70.8	±15.6
Sex (Male)	40	%52.6
Cerebrovascular accident	28	36.84%
Neurodegenerative diseases (Alzheimer's, Parkinson Etc.)	20	26.32%
Cancer	9	11.84%
Amyotrophic lateral sclerosis	4	5.26%
Peripheral vascular diseases	4	5.26%
Trauma-fracture	4	5.26%
Chronic obstructive pulmoner disease	3	3.95%
Heart failure	2	2.63%
Multiple sclerosis	1	1.32%
Botulism Intox	1	1.32%
	76	**100.00%**
	mean	**±sd**
Hospitalisation day	62.17	79.48
Urinary catheter (yes)	54	71
Cantral venoz catheter (yes)	38	50
Tracheostomy (yes)	39	51.3
White blood cell ($\times 10^3$ mm^3)	10.98	5.42
Hemoglobin (gr/dl)	11.07	2.30
Platelets ($\times 10^3$ mm^3)	296.071	128.70
Albumine (gr/dl)	2.82	0.52
Creatinine (mg/dl)	0.88	0.58
Blood urea nitrogen (mg/dl)	28.45	22.48
Vitamine D (ng/ml)	20.56	25.54
C-reactive protein (mg/dl)	51.92	52.33
Proteine (gr/dl)	5.88	0.94

Among the 76 patients, 75 (65.2%) had pressure injury infections at 115 different sites of the body. As expected, ulcers were generally found at the sacrum, costa and hips. The distribution of pressure injury infections in terms of location are presented in **Table 2**. The rate of bacteremia in Pressure injury was 13.9% (16/115) , and the agents were found to be polymicrobial in the ulcer cultures of 42 (55.2%) of the patients. The most common accompanying bacteria were *Acinetobacter*, *Pseudomonas aeruginosa* and *E. coli*.

Table 2. Pressure injury locations

Sacrum	55 (48%)
Costa	13 (12%)
Hip	16 (14%)
Heel	13 (12%)
Leg	15 (13%)
Scalp	3 (1%)
Total	**115 (100%)**

Among the pressure injurys, 49 (42.6%), 60 (52.4%) and 6 (5.2%) were evaluated as stage 4, 3 and 2 pressure injurys, respectively.

The microorganisms identified in the pressure injury and blood cultures are presented in **Table 3**.

Table 3. Microorganisms identified in ulcer and blood cultures.

Microorganisms	Ulcer Culture	Blood Culture	Bacteremia
Escherichia coli	12	2	2
Proteus spp.	2	1	1
Klebsiella spp.	8	3	3
Serratia spp.	1	-	-
Pseudomonas aeruginosa	18	4	2
Acinetobacter baumannii	14	5	2
Stenotrophomas maltophilia	1	1	1
Enterococcus spp.	5	3	1
Staf. aureus	7	5	4
Staf. epidermidis	4	3	-
Staf. haemolyticus	2	9	-
Candida albicans	1	3	-
Candida parapsilosis	-	6	-
Staf. cohnii	-	2	-
Staf. simulans	-	2	-
Corynebacterium macruthotii	-	1	-
burkholderia gladioli		2	
Total	**75**	**52**	**16**

DISCUSSION

Bacteria on the surface of the skin may invade the underlying tissue and cause infection. Signs of sepsis and cellulitis, and osteomyelitis due to sepsis, may be seen (8,11).

The diagnosis of pressure injury infection is challenging. A good microbiological and clinical evaluation, in addition to imaging studies and deep tissue biopsy, are recommended (12). A clinical examination is important for the determination of Pressure injury as occult foci of infection. Increased temperature, erythema, local tenderness, bad odor and purulent discharge are valuable signs during a clinical evaluation. Although tissue biopsy samples and aspiration fluid cultures have been recommended for the microbiological diagnosis of pressure ulcer infection, they are not generally preferred due to the difficulty in clinical use and their invasive nature (11,12). The obtaining of bacterial swab cultures is a noninvasive procedure that provides preliminary knowledge on the bacterial density of the ulcer. Surface ulcer cultures show colonization rather than infection, although the colonizing bacteria may cause local infection if they continue to proliferate, delaying ulcer healing (13). The rate of bacteremia due to the Pressure injury was found to be 13.9% in our study, but was reported to be higher in another study (3). This difference may be attributable to the stages of the pressure ulcer in the studies, as the frequency of bacteremia may be higher in advanced stages. There was a large number of patients with stage 3 ulcer in the present study.

Bacterial contamination on the surface of Pressure injury is most common, and such contaminations, in turn, may lead to serious life threatening problems such as bacteremia and sepsis by diffusing into deep tissues, resulting in infection (11). Bacteremia due to Pressure injury should be considered in patients presenting with fever and with no other focus of infection. The optimum approach to the diagnosis of ulcer site infection is tissue biopsy or aspiration (14). Sterile swabs were used in this present study, given their non-invasive ease of use.

The most common colonizing microorganisms in Pressure injuries are gram negative bacteria such as *Escherichia coli*, *Acinetobacter* baumanni, *Pseudomonas aeruginosa* and Enterobacteriaceae, and gram positive Enterococcus (15). The frequency of infection and/or colonization by microorganisms with multi-drug resistance is increasing gradually in pressure injurys. Aerobic cultures generally reveal methicillin resistant S. aureus or multi drug resistant gram negative bacilli, and may lead to local and systemic infection (13).

The sacrum was the most common location for Pressure injury in the present study, concurring with other studies in literature (8,16,17). The reason for this may be the elevated head position of patients due to alleviate the risks associated with aspiration. The risk of infection has been reported to be high in stage 3–4 Pressure injury (11). In line with previous studies, most Pressure injurywere found to be stage 3 (11). Due to the high risk of infection, the prevention of colonization in stage 3 and 4 Pressure injurymay decrease the risk of infection and bacteremia.

Pressure injury-associated bacteremia was identified in 16 of the 21 patients in the study by Jeffrey et al. (7), while pressure injury-associated bacteremia was found in six out of the 27 patients with Pressure injuryin the study by Peromet et al. (18). The rate of bacteremia in Pressure injury was 53,6% (3).

In our study, the incidence of polymicrobial bacteremia was found to be increased in accordance with the literature (6-8).

No clinical or epidemiological sign is present for the prediction of the causative agent of bacteremia in chronic ulcers, since the local infection of pressure injury is polymicrobial, and the risk of colonization with new microorganisms is high. Microorganisms of the flora may grow in the cultures (19). Accordingly, as a starting antibiotherapy, agents with antimicrobial effects against staphylococcus aureus, gram negative enteric bacilli and anaerobic microorganisms, including Bacteroides fragilis, taking into account also local resistance rates, should be considered (16). Antibiotic treatment should be adjusted based on blood culture results (8).

The most commonly isolated bacteria were gram negative enteric bacteria (klebsiella and *E. coli*), followed by staphylococcus aureus in second place, and pseudomonas and *Acinetobacter* in third place. A vast majority of the patients were transferred from hospital beds and had previously been admitted to the intensive care unit. In addition to the bacteria that cause bacteremia, many factors such as the patient's age, immune status, comorbid conditions, feeding, hospitalization period, frequency of interventional procedures etc. are effective (20).

CONCLUSION

Pressure injuries are a significant cause of mortality in long-term bedridden patients, with the most common causative agents being gram negative enteric bacteria, staphylococcus aureus, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*. The recommended criteria for the start of treatment in such patients is the presence of systemic signs or positive blood cultures. The causative agent of decubitus infections was found to be the agent causing bacteremia in 13.9% of the patients with Pressure injury in the present study.

The agent growing in the culture was rarely found to be the causative agent of bacteremia when deciding whether to treat pressure injury infections. Accordingly, we recommend that the identification of the agent causing the pressure injury infection through a swab culture alone should not be a determinant.

Limitations

Our study has limited data due to single-center design. It needs to be supported by multi-center and prospective studies. we had a small number of patients and further studys is needed in this subject.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was launched after permission was granted by the Republic of Turkey, Health Sciences University, Erzurum Region Education and Research Hospital (dated: 11.02.2018, number: 37732058-514.10. 208).

Informed Consent: Written informed consent was obtained from all participants or their relatives who participated in this study.

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