ORIGINAL RESEARCH

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BACTERIOLOGY OF PRESSURE ULCER IN PATIENTS WITH SPINAL CORD INJURY AND PATTERN SENSITIVITY

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ABSTRACT

Chronic skin wound is a major health problem that result in distress and disability and pose a great challenge to the medical community. Infection of pressure ulcers constitutes, besides urinary tract infections, the most frequent complication in spinal cord-injured (SCI). The aims of this study were to investigate types and incidence of bacterial species identified and patterns of sensitivity and resistance for each species and to improve the use of bacteriological results for treating spinal cord-injured patients with infected pressure ulcers. A cross-sectional study was conducted in the Royal Rehabilitation Center. A Total of 200 pathogenic samples of swabs and pus from infected pressure ulcer in SCI patients from Royal Rehabilitation Center were studied. Bacterial species were identified, and antibiotic sensitivity pattern were evaluated by biochemical test using Kirly Bau methods according to CLSI and by Viek 2.Study findings showed that males were more affected by pressure ulcers, and the patients were mostly under 30. The size of pressure ulcer was mainly <3cm^3. The most frequent isolated bacterium was *Escherichia coli* and *Staphylococcus aureus*. On the other hand, the least frequent isolated bacteria were *Streptococcus hemolyticus* and *Proteus mirabilis*. Sensitivity and resistance patterns showed that sulfamethoxazole was the most sensitive antibiotic, and the pathogens were mostly resistant to cefepime. As a conclusion, it is possible that the microorganisms that cause infection in PUs are multi-drug resistant.

KEYWORDS: Pressure ulcer, spinal cord injury, bacteria, antibiotics, sensitivity reactions, resistant reactions.

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INTRODUCTION

Pressure ulcers (PUs) are one of the most common health problems in patients with neurological impairment. Depending on the pressure points for the individual event, it predominates in the sacral, ischial, and trochanteric regions. Pus affects one's quality of life and raises health-care costs[1, 2].

Infection is a common complication in PUs and one of the leading causes of wound healing delays. All untreated wounds can become contaminated and/or colonized with bacteria[3], and infected wounds can cause sepsis, a longer stay in the hospital, higher costs, and higher mortality rates[4-6]. Systemic antimicrobials are rarely used to treat colonized PUs, in contrast to other ulcers. Meanwhile, colonization with pathogenic microorganisms can cause these sores to take longer to heal, depending on the severity of the infection[7, 8]. For the most common invading pathogens and their antibacterial sensitivity for specific centers, empirical treatment for complicated PUs with systemic symptoms before specific medication may require some clinical clues to direct the physicians. In the case of secondary inadvertent infection, the identification of pathogenic microorganisms clarifies the requisite antimicrobial activity spectrum for topical dressings as well as systemic empirical antibiotics [9].

Pressure ulcers are a common complication in people who have had a spinal cord injury (SCI), with an 85 percent lifetime prevalence [10, 11]. They are linked to high healthcare costs, morbidity, and mortality, especially as they progress to advanced stages [12]. In this population, bacterial superinfection of the surrounding soft tissue and bone is a common complication, and pressure ulcers may also be a cause of bacteremia[13]. Bacterial invasion, on the other hand, is an inevitable phenomenon, making microbiological data possibly misleading [14].

For the most common invading pathogen and their antibacterial sensitivity for specific centers, empirical treatment for complicated PUs with systemic symptoms before specific medication may require some clinical clues to direct the physicians. In the case of secondary inadvertent bacteremia, osteomyelitis, and sepsis, the identification of pathogenic microorganisms clarifies the requisite antimicrobial activity range for topical dressings as well as systemic empirical antibiotics [15].

The potential for ecological collateral damage in SCI patients must be considered when selecting antimicrobials. Antimicrobial treatment should be as brief as practicable, tailored to the microbiological identification, and bioavailability should be adequate. However, in impaired patients who are already extremely exposed to antimicrobial therapy and multidrug-resistant organism colonization, managing contaminated pressure ulcers is a major concern. It is necessary to collect a large amount of data.

Study objectives:

The aims of this study were to investigate types and incidence of bacterial species identified and patterns of sensitivity for each species and to improve the use of bacteriological results for treating spinal cord-injured patients with infected pressure ulcers.

METHODOLOGY:

Study design and setting:

A cross-sectional study was conducted in the Royal Rehabilitation Center.

Study sample:

A Total of 200 pathogenic samples of swabs and pus from infected pressure ulcer in SCI from Royal Rehabilitation Center were taken.

Study procedure:

Following obtaining the ethical approval, files of 200 patients with SCI and reported pressure ulcers were reviewed. Demographic data such as age, gender, and pressure ulcer size were recorded. Bacterial species were identified in microbiology laboratory and patterns of sensitivity and resistance to antibiotics were determined.

Statistical analysis:

Descriptive statistical analysis was used to describe data such as frequencies and percentages. Tables were used to represent data

RESULTS:

General characteristics of participants

As shown in table (1), swabs were taken from 200 participants of whom 88% were males.A total of 90 (45%) patientswere under 30,32% in the age group 30-40 years, and 23% were more than 40. Thesize of pressure ulcer was in most of cases (47%)≤3cm^3,28% of participants had ulcer size 3.1-13 cm^3, and in quarter of participants, the ulcer size was >13 cm^3.

Table 1: General characteristics of participants

Variable	Frequency (N)	Percentage (%)
Gender:		
- **Male**	**176**	**88%**
- **Female**	**24**	**12%**
Age group (years):		
- **<30**	**90**	**45%**
- **30-40**	**64**	**32%**
- **>40**	**46**	**23%**
Pressure ulcer size (cm^3):		
- **≤3**	**94**	**47%**
- **3.1-13**	**56**	**28%**
- **>13**	**50**	**25%**

Frequency of isolated bacteria from pressure ulcers of patients with SCI

As shown in table (2), isolated bacteria from pressure ulcers of patients with SCI includedseveral bacteria according to their frequency. The most frequent bacterium was *Escherichia coli* (37%), followed by *Staphylococcus aureus*(20%), *Staphylococcus epidermidis*(10%), *Enterobacter species*(10%), *Streptococcus viridans*(6%), *Pseudomonas aeruginosa*(4%), *Klebsiella pneumoniae*(4%), *Acinetobacter spp.* (3%), *Coagulative negative staphylococci* (3.5%), *Streptococcus hemolyticus*(1.5%), and *Proteus mirabilis*(1%).

Table 2: Frequency of isolated bacteria from pressure ulcers of patients with SCI

Bacteria	Frequency (N)	Percentage (%)
Escherichia coli	**74**	**37%**
Staphylococcus aureus	**40**	**20%**
Staphylococcus epidermidis	**20**	**10%**
Enterobacter species	**20**	**10%**
Streptococcus viridans	**12**	**6%**
Pseudomonas aeruginosa	**8**	**4%**
Klebsiella pneumoniae	**8**	**4%**
Acinetobacter spp.	**6**	**3%**
Coagulative negative staphylococci	**7**	**3.5%**
Streptococcus hemolyticus	**3**	**1.5%**
Proteus mirabilis	**2**	**1%**
Total	**200**	**100%**

Sensitivity and resistant patterns of antibiotics used to treat pressure ulcers of patients with SCI

As illustrated in table (3), there were several types of antibiotics including: amikacin (25% sensitive), amoxicillin (34.5% sensitive), cefepime (22.5% sensitive), cefpodoxime (32.5% sensitive), Cefprozil (36% sensitive), gentamicin (55% sensitive), sulfamethoxazole (62.5% sensitive), and vancomycin (42.5% sensitive).

Table 3: Sensitivity and resistant patterns of antibiotics used to treat pressure ulcers of patients with SCI

Antibiotic	Sensitive		Resistant	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
Amikacin	**50**	**25%**	**150**	**75%**
Amoxicillin	**69**	**34.5%**	**131**	**65.5%**
Cefepime	**45**	**22.5%**	**155**	**77.5%**
Cefpodoxime	**65**	**32.5%**	**135**	**67.5%**
Cefprozil	**72**	**36%**	**128**	**64%**
Gentamicin	**110**	**%55**	**90**	**%45**
Sulfamethoxazole	**125**	**62.5%**	**75**	**37.5%**
Vancomycin	**85**	**42.5%**	**115**	**57.5%**

DISCUSSION:

The prevention and treatment of PUs is one of the problems of SCI management. Since there are more PU risk factors in some situations, they are more likely to develop PU [16, 17].

The results of the present study showed that males were moreinvolved than females. This may result from the consideration that males are more likely to be exposed to trauma. Other studies reported similar findings [15]. Most participants were under 30, a matter that supported the consideration that trauma is likely to affect persons in this group. Similar trend was reported in other studies [15]. In most cases, the size of pressure ulcer was ≤3 cm^3.In other studies, it was reported that the largest proportion of ulcer size was ≤3 cm3 [15].

The most frequent pathogen in this study was *Escherichia coli.* Gram negative bacteria are more likely to colonize pressure ulcers of patients with SCI which may result from skin normal flora [15, 18]. However, due to impaired tissue perfusion and epithelial defense, all skin flora can become pathogenic in PU patients. Additionally, distant bacteria and other microorganisms can superimpose themselves on the wound [19].

The results showed a pattern of antibiotic sensitivity and resistance to be used if required. The sensitivity patterns are in line with other studies [15, 18].

CONCLUSIONS:

It is possible that the microorganisms that cause infection in PUs are multi-drug resistant, and that their antimicrobial sensitivity and resistance differ from that of the flora. Due to the strong invasion of PUs with multiflora and the risk of systemic sepsis, it is important to keep the wound clean as much as possible by applying antibacterial dressings many times per day. It aids in the prevention of PU colonization and secondary infections.

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