Isolated Organism(s) Amongst Stroke Patients With Pressure Ulcers: A 14 Year University Teaching Hospital Experience.

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Abstract

Micro-organism infection of pressure ulcer isvery important and a significant complication of immobilization following stroke. It is a cause of increasing morbidity and mortality, among stroke patients, but there is paucity of information regarding the microbiology of infected ulcer amongst stroke patients in Nigeria.The aim of this study was to compile and describe the spectrum of organisms in pressure ulcers amongstroke patients, with hope that it will provide insight into therapy.This was a retrospective review of microbiological laboratory records of pressure ulcers of stroke patients admitted into the stroke ward from 2004 to 2018 atthe University of Benin Teaching Hospital.Demographics data were extracted, the type of strokeand isolates from the pressure sores were recorded.During the 14years period (2004 to 2018), six hundred and seventy-nine (679) stroke patients on admission, developed pressure ulcer and had microbiological assessments of their pressure ulcers. The mean age of the patients was 64.2(10.8) years. Ischemic stroke constituted 78% while hemorrhagic stroke was 22%. Fifty-four percent (363) of the sampled ulcers were from female patients and about 61% of the isolates were aerobic Gram-negative baccilli, while 39% were aerobic Gram-positive cocci..*Proteus mirabilis*, accounted for 33.3% of the isolates, *Enterococcus spp*24.2%*Staphylococci spp*11.2% and *Klebsiellaoxytoca* (1.1%) was the least isolated microorganism.Pressure ulcers in the stroke patients becomes eventually infected mainly by bacteria. Emphasis should be placed on preventing pressure ulcer development in the hospital and at home following discharge amongst stroke patients

Key words. Micro-organisms, pressure ulcer, stroke, University Teaching Hospital

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Introduction

A pressure ulcer is a localized injury to the skin with or without involvement of the underlying tissue and usually over bony prominences.[1]It has variously been named pressure sores, bed sores, or decubitus ulcers. Pressure ulcers are very important and significant complication of immobilization following a stroke.[2,3]

Risk factors in the stroke patient for the development of pressure ulcers are either extrinsic or intrinsic. Extrinsic factors include pressure from bony prominences, shear stress and moisture, while intrinsic factors includes limited mobility, poor nutrition, incontinence, increasing age and diabetes mellitus[4,5] The common anatomic site for pressure ulcers formation includes the sacrum, greater trochanter, ischial tuberosity, iliac crest, lateral malleolus, heel, scapular, occiput, elbow, the spinous processes and the lower leg. [6,7]

The incidence and prevalence of pressure ulcers vary greatly depending on the staging of the ulceration and health care settings, with incidence ranging from 1% to 30% and prevalence from 3% to 30%.[8,9,10] It has been found to cause great discomfort to patients, a source of discouragement to relations, providing a route for infection, complicating recovery, increasing nursing time, adding to the cost of care, delaying early discharge from hospital and contributing to mortality in some cases.[11,12,13]Infection by micro-organism is an important, and significant complication associated with pressure ulcers. An infected pressure ulcer may result in soft tissue and bone infection which includes, cellulitis, abscess formation and osteomyelitis. Bacteremia in many stroke patients follows an infected pressure ulcer.[14,15,16]

The most common isolates in infected pressure ulcers are aerobic Gram-negative baccilliand aerobic Gram-positive cocci.[17]Earlier studies evaluating the microbiology of pressure ulcers in the general populace have recognized, *Proteus mirabilis, Staphylococcusaureus, Staphylococcus epidermidis, Pseudomonasaeruginosa* as common organisms identified from ulcers.[18,19,20] Other Isolates recovered included *Escherichia coli, Enterococci, and Pseudomonas species.* Anaerobic isolates included *Peptostreptococcus species, Bacteriodesfragilis*and *Clostridium perfringes.*[18,19,20]*Proteus mirabilis* was previously the most frequently isolated bacterium, but there is a trend for the predominance of *Staphylococcus*

aureus to be increasingly identified in later studies[21,22]. There are variability in the predominant organisms identified in infected pressure ulcer, due largely to the study population.[23,24]

We are not aware of any study in the South-south region of Nigeria that has described the epidemiology of pressureulcers infection amongst stroke patients. The aim of this study is to compile microbiological data of pressure ulcers in stroke patients, and it is hoped that a better understanding of microbiologic colonization and wound infection of the pressure ulcer would provide insight into therapeutic strategies that would ensure reduction in morbidity and mortality amongst stroke patients.

Materials and Methods

This study was done at the University of Benin Teaching Hospital. This is the main tertiary hospital in the state capital with a 900 bed space capacity.

It was a retrospective study, covering a period of 14years, from 2004 to 2018 involving all stroke patients admitted into the stroke ward with pressure ulcers requiring the attention of microbiologists.

Referred stoke patients to microbiology, had wound swab and glass slide imprint done on the pressure ulcer by L.P.V.O and specimens transferred immediately to the microbiology laboratory of the hospital for microscopy, culture and sensitivity tests with biochemical analysis for speciation and antibiogram were done. Microbiologic records spanning between, 2004 to 2018 were retrieved, reviewed in details and data extracted by the authors. A data collection sheet was designed to facilitate data extraction of records. The variables that were extracted includedtheyear of referral, diagnosis, reason for referral, gender, age, type of stroke, duration of admission, microbiology report of wound ulcers, and the microbial isolates. Ethical approval was obtained from the ethics and research committee of the University ofBeninTeaching Hospital.

The statistical analysis was performed using SPSS version 21. Continuous variables was presented using means, median, standard deviation and range with comparison using student's-test. Frequency and percentages was used to summarize categorical variables with chi-square to assess the association between variables.

Results

This was a retrospective record review, spanning 14years from 2004 to 2018, involving six hundred and seventy-nine (679) stroke patients on admission at the University of Benin Teaching Hospital, who developed pressure ulcer and had microbiological assessments of ulcers

The mean age of the patients was 64.2(10.8) years, with the age range from 37 to 97 years.78% had ischemic stroke while 22% had hemorrhagic stroke. About fifty-four percent (363) of the sampled ulcers were fromfemale participants while 46.5% (316) were from male participants. The age range with highest

Table I : Demographics of the 679 stroke patient with infected pressure ulcers

Age range (years)	Number (%)
35 to 40	95 (14.0)
41 to 45	98 (14.4)
46 to 50	88 (13.0)
51 to 60	82 (12.1)
61 to 65	102 (15.0)
66 to 70	70 (10.3)
71 to 75	49 (7.2)
76 to 80	22 (3.2)
81 to 85	22 (3.2)
86 to 90	18 (2.7)
91 to 95	26 (3.8)
96 to 100	7 (1.0)
Mean age(s.d)	64.2(10.8) years
Gender	
Male	316 (46.5%)
Female	363 (53.5%)
Stroke type	
Ischemic stroke	530 (78.1%)
Hemorrhagic stroke	149 (21.9%)

Table II Isolated organisms from the pressure ulcers of the 679 stroke patients

Isolated organisms	Male (%)	Female (%)	Total ((%)
Proteus mirabilis	14	19	33
Enterococci species	7	17	24
Staphylococci species	5.8	5.4	11.2
Citrobacterfreundii	2.8	6.2	9
Enterobacteraerogenes	3.8	3.2	7
Eschericha coli	1.2	4.9	6.1
Klebsiella pneumonia	2.3	2.4	4.7
Klebsiellaoxytoca	0.7	0.4	1.1
Candida albicans	0.7	0.9	1.6
Mixed bacteria growth	1.1	1.2	2.3

isolates was 40 to 65years, while the older age group had the least isolates as shown in Table 1. About 61% of the isolates were aerobic Gram-negative baccilli, with six unique genera (*Proteus mirabilis, , Enterobacteraerogenes, Citrobacterfreundii, Eschericha coli, Klebsiella pneumonia,* and*Klebsiellaoxytoca)*ascompared to aerobic Gram-positive cocci (*Staphylococci species,* and *Enterococci species*).Anaerobic studies were not done. The female stroke patients had more of*Proteus mirabilis 19%, Enterococci species 17%, Citrobacterfreundii 6.2%,* and *Eschericha coli 4.9%,* while *Staphylococci species* 5.8% and *Enterobacteraerogenes* 3.8% were commoner in the male stroke patients. 33% of the isolates was due to *Proteus mirabilis*, 24.2% by *Enterococcus species* while 11.2% was by *Staphylococci species*. *Klebsiellaoxytoca* (1.1%) was the least isolated microorganism, while *Candida albicans* was isolated in the pressure ulcers of the stroke patients who had diabetes mellitus. 2.3% of the pressure ulcers had mixed bacteria growth as shown inTable II

Discussion

The infected pressure ulcer is a very important and significant complication of immobilization amongst stroke patients.[2,3,4,5]Prevention of pressure ulcer is always better but once the ulcer is infected it would be proper to have an idea of the infecting organism(s) with sensitivity done, which should guide management. Pressure ulcers are commonly infected by normal skin flora or enteric organisms, but the isolates of microbial flora could change based on the host immunity and other external factors[.5,10,12,17,23,24]In managing an infected pressure ulcer, a detailed clinical examination of the infected pressure ulcer is mandatory, following which microbiological evaluation should be done, but with bone involvement imaging studies, and histopathology of deep-tissue biopsy specimens may be necessary. [25]

Six hundred and seventy nine (679) of our stroke patients who developed pressure ulcers, had their pressure ulcers sampled and specimens sent for microscopy, culture and sensitivity. We observed that the majority of the patients with infected pressure ulcers were within the younger age bracket, this contrasts with a study that showed 11.2% of patients aged 70–79 years and 34% of patients aged 90 years with pressure ulcers. [26] The difference in the mortality rates amongst the different age groups in our study could be contributory as with aging there is increasing mortality and this may not give time for ulcer formation. Our study revealed that the infected ulcers and mixed bacteria growth were commoner among the female patients. In comparison some studies have found the male patients to be at a higher risk to developing pressure ulcer. [27,28]It is possible that the female patients had less family support which could explain this contrasting findings

The most common isolates in infected pressure ulcers are aerobic Gram-negative baccilli and aerobic Gram-positive cocci. [17, 24, 25] In this study *Proteus mirabilis* was the commonest isolate, accounting for a third of the isolates, this finding can be compared with the studies ofGalpin et al [29]Vaziri et al [30] and Sugarman et al [31] were *Proteus mirabilis* was found to be the predominant isolates, 18% ,17% and 17% respectively.*Proteus mirabilis* can swarm (highly motile organism) and does readily infects any ulcer present even at some distance.

Enterococcus species closely follows as the second commonest isolate in pressure ulcers amongst stroke patients in this study, other studies have found *Enterococcus species* accounting for over half of bacterial isolates. [32] *Proteus mirabilis* and *Enterococcus species* are not surprising preeminent isolates since these bacteria are normal flora of fecal matter. In the stroke patients, altered sensorium associated poor bodily hygiene,the presence of neurogenic bladder dysfunction, external condom catheter use, fecal/urinary incontinence, changes in skin pH, does facilitates infections by these organisms. [2,3 4,5 6]*Staphylococci spp* was the third commonest isolate from pressure ulcers in the stroke patients, this findings is at variance to other studies that have *staphylococcus aureus*as the predominant organism [34-41]Variable Staphylococci*spp* antibiotics resistance elsewhere[37-45], and differences in culture methods could be responsible The stroke patient is vulnerable to other kinds of infections, and are exposed to several antibiotics, sometimes prescribed empirically, and it is suspected that this could lead to the emergence of resistant strains of these microbial isolates. The findings of significant isolates of aerobic Gram-negative baccillis is comparable to a study of skin flora in the genitalia,[11]similarly the proportion of *Eschericha Coli*and *Klebsiella pneumonia* found is comparable to the prevalence in another study .[46]This study revealed, a small proportionof the ulcers had mixed isolates and this is at variance with other studies with a high proportion of polymicrobial isolates, with percentage range of 5 to 69% [30.31. 36. 39. 40..] This could be explained by the associated soft tissue and bone infection, with local or systemic antibiotics use in combination with local wound care which could determine the variety of isolates from a pressure ulcer. Additionally wound characteristics like presence of tissue necrosis may be predictive of the type of microbial organisms. Medical and or surgical interventions may be necessary in the management of pressure ulcer. Devices, such as foam-air-fluid bed, or fluid-filled mattresses or supports which ensures that pressure is dispersed over a greater area and also achieve a greater degree of pressure reduction would mitigate pressure ulcer formation.

Additionally quality nursing care is invaluable in the prevention of pressure [8,10, 12, 13,22]Systemic antimicrobial therapy for serious pressure ulcer infections, including cellulitis, osteomyelitis, or bacteremia, while Surgical debridement to remove necrotic tissue, drain abscesses with, drainage is also important. Antibiotics choice should be based on the antibiogram of isolated organism from pressure ulcers.

This study had limitations including the fact that it was retrospective relying on the records, non-staging of the ulcer, we could not determine if patient has already had antibiotics prior to or in the course of the admission and no distinction was made between the stroke patient who came on admission with pressure ulcers and those who developed ulcer in the ward, all were referred for microbiological evaluation. The number of the isolates may be underestimated due to non- availability of anaerobic culture methods and inability to grow fastidious organisms. We used the traditional culture method and not the more efficient molecular techniques. [17.48] Speciation of the organisms were not also done.

Conclusion

Emphasis should be placed on preventing pressure ulcers in the hospital and at home,this is achievable by identifying at risk patients, improving general health, management of comorbid conditionsand educating caregivers about pressure ulcers on discharge from hospital.

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