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Original article

Epidemiology of Wound Infection in A Surgical Ward of a Tertiary Care Hospital in Northern Ghana

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ABSTRACT

Background: Wound infection is a global concern as it causes high morbidity and mortality with an associated high cost burden. The aim of this study was to determine the prevalence and factors influencing wound infections in a referral teaching hospital of Northern Ghana. **Methods:** A retrospective cross- sectional study where a month each was randomly selected to represent each quarter of the year 2012. Medical records in inpatient folders and nurses note books of patients admitted to the surgical ward diagnosed with wound infection by an attending physician were reviewed. **Results:** Out of the total of 1096 people admitted to the surgical ward under the period of study, 354 of them were diagnosed as wound infection (community acquired and nosocomial) cases resulting in an overall prevalence of 32.3%. The prevalence of wound infection was higher in males (61.5%) than in females (38.5%). The prevalence of community acquired and nosocomial wound infections was 60.2% and 39.8% respectively. The female gender ($p<0.0001$), living in a rural area ($p=0.04$) and diabetes ($p=0.01$) were found to be significant risk factors influencing wound infection. **Conclusion:** The prevalence of wound infection was relatively high with nosocomial wound infection accounting for approximately 40% of the total wound infections. The female gender, living in a rural setting and diabetes where significant risk factors that influenced wound infection in this tertiary referral hospital.

KEYWORDS: Community acquired, Nosocomial, Northern Ghana, Wound infection, Tamale Teaching Hospital.

INTRODUCTION

Wound infection which is defined as the infection of a wound caused by physical injury of the skin as a result of penetrating trauma from plants, animals, guns, knives or other objects [1], is increasingly becoming a global concern with an increasing awareness of its cost burden [2, 3]. Wound infections are among the most common reasons why people seek medical advice and in more serious acute infections, may require admission to hospital for management. These infections account for around 7% - 10% of hospitalized patients in the United States [4]. Wound infection especially those resulting from surgical wounds are considered to be one of the most common nosocomial infections and are generally a high cause of morbidity and mortality [5-9].

A wide range of factors have been proven to influence wound infection. Some of these factors include pre-existing illness, wound class, wound contamination, extremes of ages, malignancy, metabolic diseases, malnutrition, immunosuppression, cigarette smoking, remote site infection, length of surgical operation, emergency procedures and long duration of pre and postoperative hospitalization amongst others [10-16]. Information on the prevalence and determinants of both community and hospital acquired wound infections rarely exist in Ghana generally and northern Ghana especially. We conducted a retrospective study to determine the prevalence and factors influencing wound infections in the surgical ward of the only tertiary referral hospital in Northern Ghana.

MATERIALS AND METHODS

Study design

This was a retrospective cross- sectional study carried out for the year 2012 in the surgical ward of the Tamale Teaching Hospital in the Northern region of Ghana. The Tamale Teaching Hospital is the only tertiary referral hospital in northern Ghana and serves all the three regions of northern of Ghana including the northern parts of Brong Ahafo region and sometimes northern Cote D'Ivoire and Togo and southern Burkina Faso. The hospital is located in Tamale which is the regional capital of the Northern region. The hospital has a bed capacity of over 900 and is used by

school of medicine and health sciences of the University for Development Studies for the training of medical doctors, nurses and other allied health personnel. The source of patients of this hospital is the whole northern enclave of Ghana and some parts of Cote D'Ivoire, Togo and Burkina Faso. The surgical ward of the hospital has a bed capacity of around one hundred. The ward is divided into two sections of septic and aseptic wards. The septic ward is responsible for the care of all infected wounds brought in from the community and/or referred from lower level health facilities. The aseptic ward takes care of all other surgical cases including both pre and post operative patients.

Data collection

Four months (February, April, September and December) where randomly selected to represent the first, second, third and fourth quarters of the year 2012 respectively. Medical records in inpatient folders and nurses note books of patients admitted to the surgical ward diagnosed with wound infection by an attending physician within the year of study were subsequently reviewed and the data entered in Epi Info software version 3.5.1. Wound infection was defined as the presence of purulent discharge according to the criteria reported by Cutting and Harding [17].

Statistical analysis

The same version of Epi Info software was used to organize, clean and analyze the data. Logistic regressions were run to determine significant contributors to wound infection. Descriptive statistics included relative frequencies for categorical variables and means (and standard deviations) for continuous variables. Bivariate associations were tested by chi square (Mantel-Haenszel) test for two categorical variables. Multiple logistic regression analysis was conducted for the dichotomous outcome variable (wound infection) and p-values derived for the categorical independent variables at <0.05 significant level.

Ethical considerations

Permission for data collection was obtained from the Department of Research and Monitoring of the Tamale Teaching Hospital through the Department of Allied Health Sciences, Faculty of Nursing of the University for Development Studies Tamale Ghana.

RESULTS

A total of 1096 records of patients were reviewed within the study period. However, not all these records were used in the analysis due to incomplete data of some of the variables.

Demographic data

Out of a total of 1091 complete data for gender, 782 (71.7%) were males while 309 (28.3%) were females. The mean age was 35.6 years (SD=34.5). The distribution of age groups of all patients is as shown in table 1.

Table 1: Distribution of age groups of patients

Age group (years)	Frequency	Percentage
≤5	79	7.3
6-12	93	8.5
13-59	742	68.1
≥60	175	16.1
Total	1089	100.0

7 records excluded because of incomplete data

Out of a total of 1045 completed records for location of patients, 55.3% (578/1045) of them were from urban areas whiles 44.3% (467/1045) were from rural areas.

Prevalence of wound infections and surgical procedures

Out of the total of 1096 people admitted to the surgical ward under the period of study, the overall prevalence of wound infection (both community acquired and nosocomial) was 32.3% (354/1096). The prevalence of wound infection was higher in males (61.5%) than in females (38.5%).The distribution of wound infection according to source of infection, period of year and type of infections are shown in table 2.

Table 2: Distribution of wound infection according to source of infection, period of year and type of infection.

Variable		Frequency (percentage)
Source of infection	Community acquired Nosocomial	212 (60.2) 140 (39.8)
Period of year	First quarter Second quarter Third quarter Fourth quarter	61 (17.2) 134 (37.9) 69 (19.5) 90 (25.4)
Type of wound	Surgical Non surgical	137 (39.0) 214 (61.0)

Number of records of various variables excluded from analysis because of incomplete data:a)Source of infection – 2, b)Type of wound – 3

Table 3: Prevalence of wound infections by age group

Age group	Frequency (percentage) n=354
≤5	30 (8.5%)
6-12	34 (9.6%)
13-59	226 (63.8%)
≥60	64 (18.1%)

The minimum (8.5%) and maximum (63.8%) prevalence rates of wound infections were seen among the age group of 1-5 and 36-40 years old (Table 3)

Microbiology (wound swab)

Only 8 (0.7%) wound swab results were found in the records. Out of the 8 results, 4 (50%) of the isolates were *Staphylococcus aureus*, 2 (25%) were *Pseudomonas aeruginosa* and 2 (25%) being *Klebsiella spp*. Results were available for only 7 records after in vitro susceptibility testing with 57.1%, 28.6% and 14.3% of the isolates being sensitive to the cephalosporin's, quinolone's and aminoglycoside groups of antibiotics respectively.

Determinants of wound infection

In the bivariate analysis using chi square test, there was an association between wound infection and gender (X^2=26.74, p<0.0001). An association also existed between wound infection and patient location (X^2=4.03, p=0.04). After a multivariate analysis using an unconditional multiple regression model, the female gender, staying in a rural area and diabetes were found to be significant risk factors of wound infection as shown in table 4. Every period of the year was also found to be a risk factor of wound infection (table 4). However, age groups, hypertension and other co morbidities such as sickle cell anemia were not significant risk factors (table 4).

Table 4: Significance level of risk factors of wound infection

Variable		p-value
Age group (years)	≤5	Reference
	6-12	0.85
	13-59	0.17
	≥60	0.83
Gender	Male	Reference
	Female	<0.0001
Period of year	First quarter	Reference
	Second quarter	0.0004
	Third quarter	0.03
	Fourth quarter	<0.0001
Location	Urban	Reference
	Rural	0.04
Co morbidity	Hypertension	0.19
	Diabetes	0.01
	Others	0.51

p≤0.05 is considered statistically significant

DISCUSSION

In our retrospective cross sectional study of 1,096 patients hospitalized for the treatment of wound infection, we found 32.3% wound infection prevalence which was two times lower than what was found (64.8%) in a tertiary hospital in Nigeria [9] and about three times lower than another previously observed study in Nigeria (90%) [22]. An Indian study also reported a prevalence of 47% [22] which was higher than our finding.

The prevalence of nosocomial wound infection was found to be as high as 48.7% and 73.6% in two previous retrospective cohort studies [18, 19] as compared to our finding of 39.8%. However in another previous retrospective study [20], nosocomial wound infection prevalence was lower (27.2%) than the findings in our study.

Our findings of community acquired wound infection being higher than nosocomial wound infection (60.2% vs. 39.2% respectively) was consistent with findings in a retrospective study done in the United States to determine trends in US hospital admissions for skin and soft tissue infections [21]. This finding was however inconsistent with a previous retrospective cohort study which found a nearly even distribution between nosocomial and community acquired wound infections (48.7% vs. 51.3% respectively) [18].

Whereas there was no significant difference in wound infection prevalence amongst males and females in some previous studies [9, 21, 24, 25], our study found a significant difference with prevalence being higher in males (61.5%) than females (38.5%). The findings in our study was also similar to other previous studies where the prevalence of wound infection was higher amongst males than females [8, 22]. The prevalence of wound infection in this study was generally higher in the less than 60 years age group as compared to the greater than 60 years age group. This finding agreed with other similar studies [21, 26].

Routine wound swap for microbiology is generally not a common practice in this setting except for long standing infected wounds that are not responding to the commonly used prophylactic antibiotics. It was also noticed not all results of requested wound swaps for microbiology and antibiotic sensitivity test were found in patient's medical records. This was mainly due to the fact that most of the patients were discharged before the results were ready or there was poor communication between the ward and the laboratory. However, records of the few wound swaps done for microbiology suggest *Staphylococcus aureus* to be the commonest organism isolated. This finding is consistent with the over whelming evidence of *Staphylococcus aureus* being a major cause of wound infection in both healthcare and community settings as reported by other studies [5, 9, 18, 21, 24, 26, 27].

Diabetes mellitus was the only co morbidity that was found to be a significant predictor (p=0.01) of wound infection in our study. This finding is also consistent with similar other findings across the world [26-32].

Using the male gender as a reference, the female gender was significantly (p<0001) associated with wound infection a finding consistent with a previous retrospective population-based study conducted to determine the Incidence, microbiology and patient characteristics of skin and soft-tissue infect ions in a U.S. population [26]. However, our finding was inconsistent with findings in surgical site infections in India [27].

In an India study which specifically assessed risk factors, outcomes and antimicrobial sensitivity patterns in surgical site infections, no significant association was found to exist between living in an urban area and wound infection [27]. After using living in an urban area as a reference, our study found a significant association (p=04) between living in a rural setting and wound infection in both in both healthcare and community settings.

CONCLUSIONS AND RECOMMENDATIONS

The prevalence of wound infection in our retrospective study was relatively high with nosocomial wound infection accounting for approximately 40% of the total wound infections. Routine wound swab for microbiology and antibiotic sensitivity was rarely done in this setting. Being a female, living in a rural setting and having diabetes where significant factors that influenced wound infection in this tertiary referral hospital.

We recommend that the hospital looks at other factors both institutional and nursing that were beyond the scope of this study to help address the high wound infection situation. A microbiological and antibiotic sensitivity profiling of wound infections in the ward will serve as a valuable tool in informing clinicians on the most effective antibiotics to use for wound infections in the hospital.

Limitation of the study

In this retrospective study as in most retrospective studies, missing or inadequate data could have affected the outcome. Our study did not also take into account other confounding factors like institutional and health worker factors that could have influenced wound infection. Another limitation of this study was its inability to trace the records of laboratory results of wound swabs which could have affected the microbiological results.

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