Original Article

Clinical and epidemiological profile of bacterial pathogens isolated from infected lesions in Kathmandu University Hospital.

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Abstract

Introduction: Treatment of the patient with wound infected with multidrug resistant organism is a major burden and challenge to the health care persons. This study was conducted to identify the clinical and epidemiological profile of such patients.

Methods: The study was a cross-sectional study conducted between November 2017 to June 2018 in Kathmandu University Hospital. Wound swabs, pus samples collected from patients during the study period were included. Specimen collection, culture, identification tests were done following standard guidelines and patient information was collected after informed consent.

Results: Total number of patients observed for wound infection was 2,763. 1,550(56.10%) were postoperative wound and 1213(43.90%) were non-post-operative wound. Pathogenic bacteria were detected in 252(9.12%) samples. 167(66.27%) were multidrug resistant.

Conclusion: Since, limited data is available in Nepal, determination of clinical and epidemiological profile of wound infection might become a useful tool to prepare guidelines for controlling and treating infected wound in healthcare centers and community.

Keywords: Clinical epidemiology profile, bacterial pathogens, drug resistant, hospital

Introduction

A wound is defined as any injury that damages the skin and therefore compromises its protective function. A wound is defined as being chronic if it has failed to heal (i.e. achieved anatomical and functional integrity) within three months.[1]

The most common type of chronic wound is an ulcer, usually on the lower leg, and usually associated with underlying diabetes or vascular causes. [2]

Systemic factors which may delay wound healing include predisposing medical condition, e.g. diabetes, which compromises the health of the skin and increases the risk of infection, older age, obesity, smoking, poor nutrition; immunosuppression associated with either an illness, e.g. AIDS, or medicine, e.g. chemotherapy, corticosteroids.[1, 3]

The bacterial agents often incriminated in wound infections include Staphylococcus, Pseudomonas, Klebsiella, Proteus species and *Escherichia coli* as well as anaerobes such as Clostridium and Bacteroides species. [4, 5]

Methods

The study was cross-sectional study done at Kathmandu University Hospital, Dhulikhel, Nepal. Pus sample, wound swab etc. from outpatients and inpatients

collected between November 2017 to June 2018 from which pathogenic bacteria was isolated was included in the study. Clinical and epidemiological information was collected from the patient after taking informed consent from the patient. Ethical clearance was taken from Institutional Review Committee of Kathmandu University Hospital before the study was conducted. Sample processing was done according to the guidelines given by American Society for Microbiology.[6] The antibiotic susceptibility test was done as recommended by Clinical and Laboratory Standards Institute (CLSI).[7] Data were analyzed by (SPSS) version 11.5 software and P value less than 0.05 was considered to be significant.

Results

The total number of patients observed for wound infection during the study period was 2,763. Out of this 1,550(56.10%) were postoperative wound and 1213(43.90%) were non-post-operative wound. Out of this growth of pathogenic bacteria was detected in 252(9.12%) samples. 146 patients from whom pathogenic bacteria was isolated were male patients and 106 were female patients. 233 patients were inpatients and 19 were out patients.

Regarding the types of samples, highest number of samples with growth, 105(41.67%) were from infected post-operative wounds and 147(58.33%) were from infected non-post-operative wound and of this, least samples, 4(1.58%) were from infected burn wounds as shown in table 1.

Table 1: Types of samples

S. No.	Types of samples	Number of samples	Percentage (%)
1.	Postoperative wounds	105	41.67%
2.	Non-post-operative wounds		
	a. Abscesses	33	13.10%
	b. Infected traumatic wound	25	9.92%
	c. Diabetic foot ulcers	12	4.76%
	d. Burn wound	4	1.58%
	e. Other pyogenic wounds	73	28.98%
	Total	147	58.33%
	Grand Total	**252**	**100%**

105(6.77%) out of 1,550 postoperative wound under study was infected and 147(12.11%) out of 1,213 non-operative wound under study was infected as shown in table 2. Non-post-operative wound was observed to be significantly infected (12.11%) compared to post-operative wound (6.77%) and this was statistically significant with P value of 0.0001.

Table 2: Prevalence of Postoperative and Non-operative wound infections

Wound	Processed	Infected wound (positive growth)
Postoperative	1,550(56.10%)	105(6.77%)
Non-operative	1,213(43.90%)	147(12.11%)
Total	**2,763**	**252**

Regarding age wise distribution, highest number of samples with positive growth 58(23.01%) was detected among age group of 21-30 years and least number of samples with positive growth 5(1.98%) was detected among age group of 81-90 years as shown in table 3.

Regarding gender and age wise distribution of positive growth of pathogen from infected lesions, 24 males and 34 females (total 58) of age group 21-30 was found to have highest number of positive growths and only 3 males and 2 females (total 5) of age group 81-90 years, were the least number of positive growths as shown in table 3.

Table 3: Age-wise and gender-wise distribution of patients

Age (years)	Male	Female	Total	Percentage (%)
0-10	5	3	8	3.17%
11-20	19	13	32	12.70%
21-30	24	34	58	23.02%
31-40	33	13	46	18.25%
41-50	27	10	37	14.70%
51-60	13	13	26	10.31%
61-70	14	14	28	11.11%
71-80	8	4	12	4.76%
81-90	3	2	5	1.98%
Total	**146**	**106**	**252**	**100%**

Regarding distribution of bacterial pathogens in the samples, *E. coli* was the most predominant bacterium 102(40.48%) isolated followed by *S. aureus* 52(20.63%) as shown in table 4. 70 out of 102 *E. coli* isolates were multidrug resistant.

42 out of 52 *S. aureus* and 30 out of 42 *S. epidermidis* were multidrug resistant (Methicillin-resistant) as shown in table 4. Overall out of 252 bacterial pathogens 167(66.27%) were multidrug resistant and only 85(33.73%) were non-multidrug resistant strains as shown in table 4.

Table 4: Distribution of bacterial pathogens isolated in the samples

S. No.	Bacteriae	MDR	Non-MDR	Total
1.	*Escherichia coli*	70(27.78%)	32(12.70%)	102(40.48%)
2.	*Staphylococcus aureus*	42(16.67%)	10(3.97%)	52(20.64%)
3.	*Staphylococcus epidermidis*	30(11.91%)	12(4.76%)	42(16.67%)
4.	*Pseudomonas aeruginosa*	3(1.19%)	12(4.76%)	15(5.95%)
5.	*Acinetobacter species*	6(2.38%)	9(3.57%)	15(5.95%)
6.	*Klebsiella pneumoniae*	8(3.17%)	2(0.80%)	10(3.97%)
7.	*Enterococcus faecalis*	5(1.98%)	1(0.40%)	6(2.38%)
8.	*Enterobacter species*	0(0%)	3(1.20%)	3(1.20%)
9.	*Klebsiella oxytoca*	0(0%)	2(0.80%)	2(0.80%)
10.	*Streptococcus pyogenes*	1(0.40%)	1(0.40%)	2(0.80)
11.	*Serratia marcescens*	0(0%)	1(0.40%)	1(0.40%)
12.	*Proteus mirabilis*	1(0.40%)	0(0%)	1(0.40%)
13.	*Proteus vulgaris*	1(0.40%)	0(0%)	1(0.40%)
	Total	**167(66.27%)**	**85(33.73%)**	**252(100%)**

In the study, 73 (76.04%) Gram positive bacteriae isolated in the study was found to be multidrug resistant compared to 94 (60.26%) of Gram negative bacteriae. Statistical analysis showed p-value of 0.0148, which was significant. 73(76.04%) Gram positive bacteriae isolated in the study was found to be multidrug resistant compared to 94(60.26%) of Gram negative bacteriae. Statistical analysis showed P-value of 0.0148, which was significant.

Table 5: Distribution of pathogen according to Gram staining

S.No.	Bacteriae	MDR	Non-MDR	Total
1.	Gram positive	73(76.04%)	23(23.96%)	96 (38.10%)
2.	Gram negative	94(60.26%)	62(39.74%)	156(61.90%)
		167(66.27%)	**85(33.73%)**	**252 9100%)**

The most predominant pathogen among other pyogenic wound was *E. coli* followed by *S. epidermidis*. *S. aureus* was mostly found in abscesses. Predominant pathogen in burn wound was *P. aeruginosa*. Predominant pathogen in infected traumatic wound and diabetic foot ulcer was *E. coli* and it was also predominant pathogen in postoperative wounds as dipicted in table 6.

Table 6: Distribution of bacterial pathogens isolated from each type of samples

Organism/ Department/Type of wound.	Postoperative wound			Non-post-operative wounds					Total
	General Surgery	OBG	Orthopedics	Abscesses	Infected traumatic wound	Diabetic foot ulcers	Burn wound	Other pyogenic wounds	
1. E. coli	21	15	12	10	8	6	0	30	**102**
2. S. aureus	6	9	10	20	5	1	0	1	**52**
3. S. epidermidis	3	7	2	1	4	3	0	22	**42**
4. P. aeruginosa	2	1	3	1	1	1	4	2	**15**
5. Acinetobacter species	1	1	2	0	3	1	0	7	**15**
6. K. pneumoniae	1	1	1	0	1	0	0	6	**10**
7. E. faecalis	1	0	0	0	1	0	0	4	**6**
8. Enterobacter species	1	0	0	1	0	0	0	1	**3**
9. K. oxytoca	1	1	0	0	0	0	0	0	**2**
10. S. pyogenes	0	0	0	0	2	0	0	0	**2**
11. S. marcescens	1	0	0	0	0	0	0	0	**1**
12. P. mirabilis	1	0	0	0	0	0	0	0	**1**
13. P. vulgaris	1	0	0	0	0	0	0	0	**1**
Total	**40**	**35**	**30**	**33**	**25**	**12**	**4**	**73**	**252**

Discussion

This study investigated the clinical and epidemiological profile of bacterial pathogens from infected lesions. The total number of patients observed for wound infection during the study period was 2,763. Out of this 1,550(56.10%) were postoperative wound and 1213(43.90%) were non-post-operative wound. Out of this growth of pathogenic bacteria was detected i.e. wound infection developed in 252(9.12%) of the patients which is little more than what was observed by *Sule et al* in which 130(7.78%) developed wound infection out of 1670 patients who were observed for wound infection for the same study duration of one year.[8]

In this study 146 patients from whom pathogenic bacteria was isolated were male patients and 106 were female patients. Hence, it seemed that male patients were at higher risk for wound infection which is in accordance with the finding of *B. Cohen et al.* [9] 233 were inpatients and 19 were out patients in the study, which indicates that hospital admitted patients had significantly more wound infection than patients who visited OPD. Regarding the types of samples, highest number of samples with growth, 105(41.67%) were from infected postoperative wounds and 147(58.33%) were from infected non-post-operative wound and of this, least number of samples, 4(1.58%) were from infected burn wounds. 105(6.77%) out of 1,550 postoperative wound under study was infected and 147(12.11%) out of 1,213 non-operative wound under study was infected which is similar to the finding of *Sule et al.* [8]

Regarding age wise distribution, highest number of samples with positive growth 58(23.01%) was detected among age group of 21-30 years and least number of samples with positive growth 5(1.98%) was detected among age group of 81-90 years. This finding is different from the findings of *C.P. Bhatt et al.* in which growth was observed more among age group 31-40 years and least growth was detected among age group 0-10 years. [9]

Regarding gender wise distribution, samples from 33 males of age group 31-40 year, and 34 females of age group 21-30 year, had the highest number of positive growths. Samples from 3 males and 2 females of age group 81-90 year were the least number of positive growths. This correlates with finding of *C.P. Bhatt et al* but only if male patients were considered. [9]

Regarding distribution of bacterial pathogens in the samples, *E. coli* was the most predominant bacterium 102(40.48%) isolated followed by *S. aureus* 52(20.63%). This finding seems similar to the findings of *Mohammad SR et al.* according to type of organism but when the predominance was considered it was just opposite, where *S. aureus* was found in 37.5% of wounds with positive growth and 25% wounds had *E. coli.* [10]

Overall out of 252 bacterial pathogens 167(66.27%) were multidrug in our study which correlates with the finding or *C.P. Bhatt et al* in which almost same (65.38%) of the total isolates were MDR.[9]

70 out of 102 *E. coli* isolates were multidrug resistant. 8 out of 10, *K. pneumoniae* isolates were multidrug resistant. All 3 *Enterobacter* isolates and both *K. oxytoca* isolates were non-multidrug resistant. Single isolates each of *P. mirabilis* and *P. vulgaris* were all multidrug resistant. Single isolate of *S. marcescens* was non-multidrug resistant. *E. coli* and *K. pneumoniae,* especially multidrug resistant *E. coli* infecting postoperative wound may be related to poor hospital hygiene, nosocomial infection and also because of acquirement of normal endogenous microbial fecal flora of the patients themselves. [11,12,13]

Some of the limitations of this study might be the study duration was too short and patients were too less to determine all possible pathogens which cause wound infection. Beside this only aerobic and facultative anaerobic bacteria were investigated and no anaerobic bacteria or fungal pathogens were determined.

Conclusion

The clinical and epidemiological profile of multidrug resistant as well as non-multidrug resistant bacterial pathogens in patients with infective lesion was determined. The data from this study can help in preparing guideline for prevention and control of wound infection in healthcare centers.

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Conflict of Interest: None declared

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