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Research Article

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Bacteriological Profile of Diabetic Foot Infected Patients and their Susceptibility Pattern

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ABSTRACT

Background *- Foot infections are very frequent in patients with diabetes and are associated with high morbidity and risk of lower extremity amputation. Diabetic foot infections may be mild, moderate, or severe. Tissue samples obtained after scraping the base of the ulcer or by wound or bone biopsy is strongly chosen to wound swabs. Surgery is the keystone of treatment for deep diabetic foot infection and ulceration after being treated with empirical therapy. Procedures range from simple incision and drainage to wide multiple surgical debridement and amputation.*

Objectives *- Bacterial isolation and antibiotic susceptibility pattern of patients with diabetic foot and their correlation between age, sex and their socio-economic status.*

Material and methods *- 62 patients with diabetic foot admitted in surgical wards were included. Pus and other relevant samples from the patient were collected. Gram staining & culture was done via conventional techniques followed by AST by Kirby Bauer disk diffusion technique.*

Results *- Out of total 62 patients males (41) were predominant over females (21). Gram negative (17) were leading over gram positive (7). In gram positive organism maximum isolates were S. aureus followed by Enterococcus and in gram negative organism's maximum isolate was Pseudomonas Aeruginosa followed by E. coli, Proteus & Klebsiella.*

Conclusion *- Pseudomonas Aeruginosa and Staphylococcus aureus were found to be equally responsible for infection followed by E. coli, Proteus, Klebsiella and Enterococcus. First line of generation, of Cephalosporins and most of the Aminoglycosides were active against gram positives whereas successive generations of cephalosporins were active against gram negatives including some penicillin drugs like Ampicillin, Amoxicillin, and Pipracillin-Tazobactum which were sensitive for both gram positive and gram negative organisms.*

Keywords: *Diabetic foot infection, Bacterial isolation, Bacterial characterization, Antibiotic susceptibility testing (AST).*

INTRODUCTION

Diabetic foot wounds are a major social, medical and economic problem and are the prominent cause of hospitalization for patients worldwide. It is characterized by numerous pathological complications such as neuropathy, peripheral vascular disease, foot ulceration and infection with or without osteomyelitis, which leads to the development of gangrene and which even makes limb amputation necessary.

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According to the data diabetic population in our country is likely to increase up to 57 million by the upcoming years[2]. Infected wounds should be cultured after debridement. Foot complications such as foot ulcer constitute a most important public health problem and impose a serious burden on health services[3]. Infectious causes are associated with amputation of the infected foot if not treated punctually. Timely and aggressive surgical debridement or limited resection or amputation may decrease the need for more extensive amputation.

These infections requires proper management by appropriate antibiotic choice based on culture and antimicrobial susceptibility testing; however, initial treatment comprises empirical antimicrobial therapy which is frequently based on susceptibility data concluded from studies performed on general clinical isolates[1].

MATERIAL AND METHODS

The present study was conducted on 62 patients with diabetic foot and abscess admitted in surgical wards of all age group after taking a relevant clinical history whose samples were processed, in the department of microbiology at MMIMSR, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala.

Inclusion Criteria- All the diabetic patients with wound infections admitted in surgical ward were included for study.

Exclusion Criteria- Patients with wound Infections without diabetes and abscesses were excluded.

Sample collection - The pus and serous fluid samples from the wounds were collected with the help of two sterile moist swab sticks from the patients, under all aseptic conditions.

Transportation and Storage- Swab sticks were transported in 2ml sterile normal saline & BHI broth to laboratory as early as possible. In case of any delay the samples were refrigerated.

Processing of samples - One swab stick was dipped in normal saline which was used for gram staining & was incubated for 24 hours at 37°C & other swab stick which was dipped in BHI was inoculated on Blood Agar & MacConkey Agar and were cultured for 24-48 hours at 37°C, followed by the identification of the isolates based on their cultural characteristics and morphology with their biochemical reactions (like IMViC Pattern, Catalase, Coagulase, Oxidase & Urease test). All the isolates were tested for antimicrobial susceptibility by Kirby Bauer disk diffusion technique on Muller Hinton Agar. Antibiotics used for susceptibility testing were: Amikacin, Amoxyclav, Ampicillin, Azithromycin, Cefepime, Cefixime, Cefopodaxime, Cefotaxime, Ceftizidime, Ceftriaxone, Ciprofloxacin, Cotrimaxazole, Erythromycin, Gentamycin, Linozalid, Piperacillin-Tazobactum.

RESULT

Of the total 62 diabetic foot patients studied, 41 were males and 21 were females (Fig.1). Males were found to be dominant over females. The maximum number of patients having diabetic foot infections belonged to the age group of 41-50 years (Fig.2), the cases was with diabetes mellitus for more than a decade. On the basis of lifestyle, 17 females were found to be housewives and 4 were students (Fig.3), on the other hand 23 were laborers and 18 were skilled workers (Fig.4). This ratio shows patients with low socio economic status and hard working lifestyles were found to be more prone to diabetic foot infection and ulceration.

On the basis of pathogenicity 31 out of 62 were found to be sterile with 24 pathogenic and 7 non pathogenic specimens (Fig.5). Gram negatives (17) were predominant over gram positive organisms (7) (Fig.6). In gram positive organism maximum isolates were *S.aureus* followed by *Enterococcus* (Fig.7) and in gram negative organism's maximum isolate was Pseudomonas Aeruginosa followed by *E.coli*, *Proteus* & *Klebsiella* (Fig.8). *Pseudomonas Aeruginosa* and Staphylococcus Aureus were found to be equally responsible for infection followed by *E.Coli, Proteus, Klebsiella* and *Enterococcus*. First line of generation, of Cephalosporins and most of the Aminoglycosides were active against gram positives whereas successive generations of cephalosporins were active against gram negatives including some penicillin drugs like Ampicillin, Amoxicillin, and Pipracillin-Tazobactum which were sensitive for both gram positive and gram negative organisms (Fig.9,10).

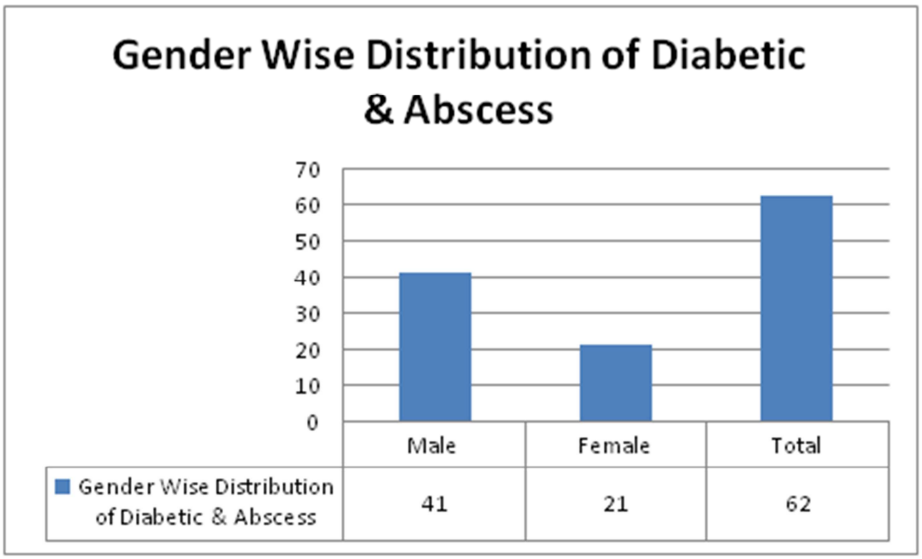

Fig. 1: Depicting Male Predominance Over Females

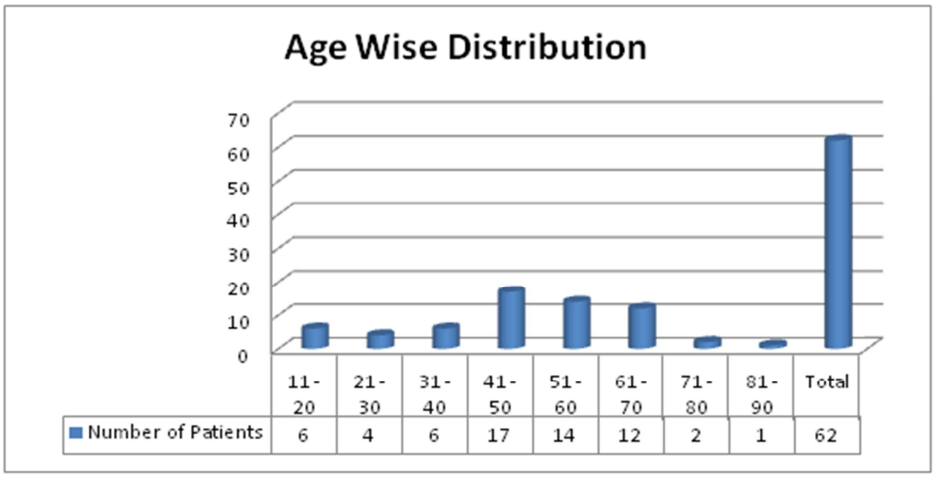

Fig. 2: Depicting Age Wise Distribution

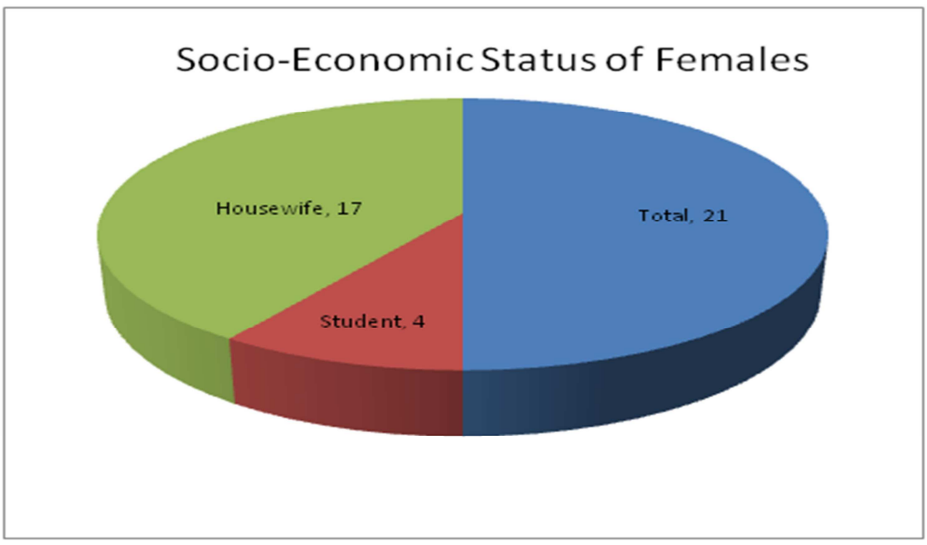

Fig. 3: Depicting socioeconomic status of Females

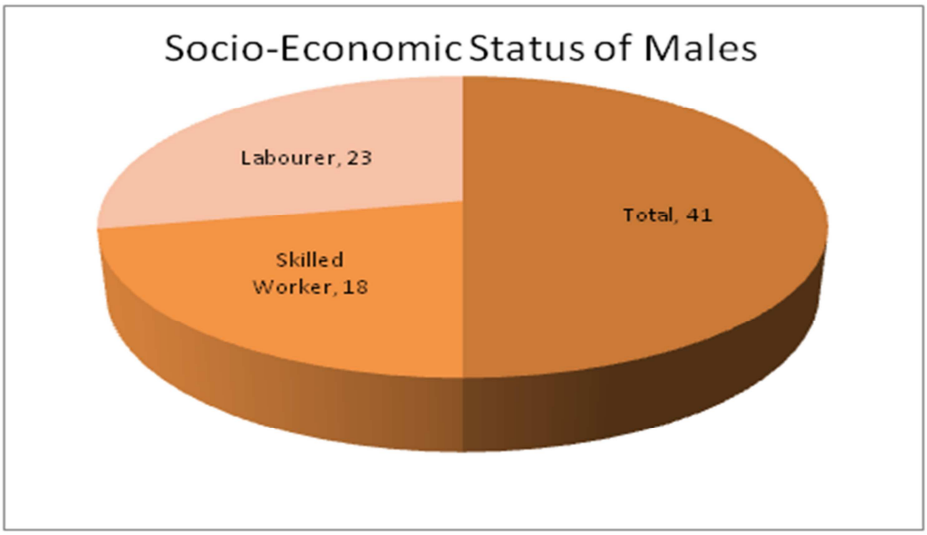

Fig. 4: Depicting Socioeconomic Status of Males

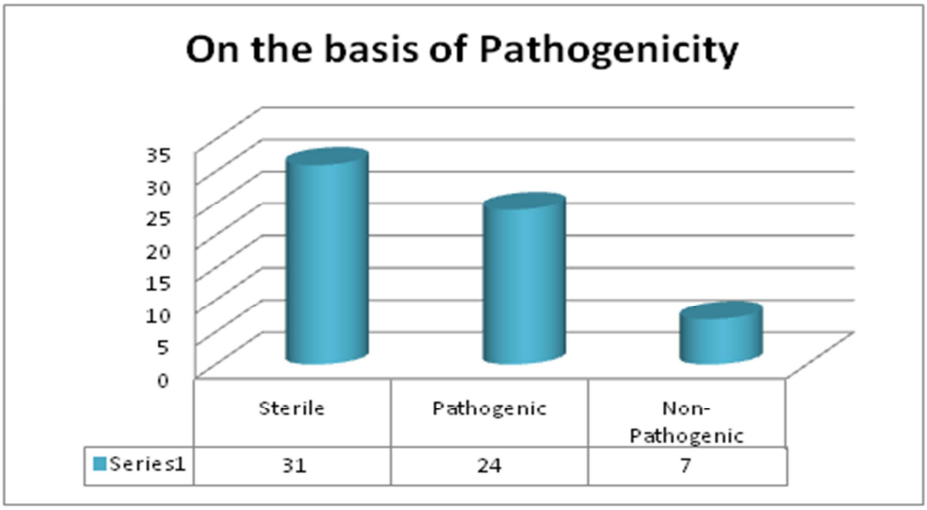

Fig. 5: Depicting Pathogenicity of Strains

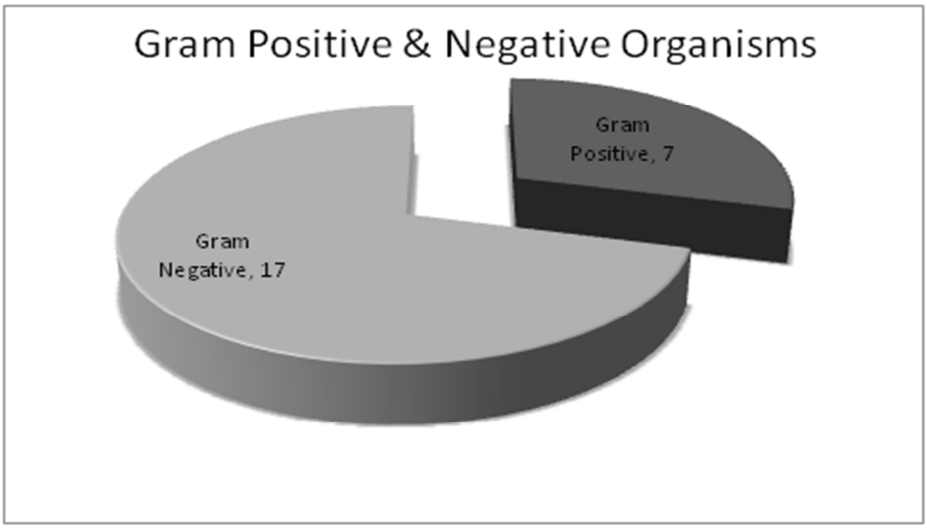

Fig. 6: Pie Chart Depicting the Organisms on the Basis of Gram Staining

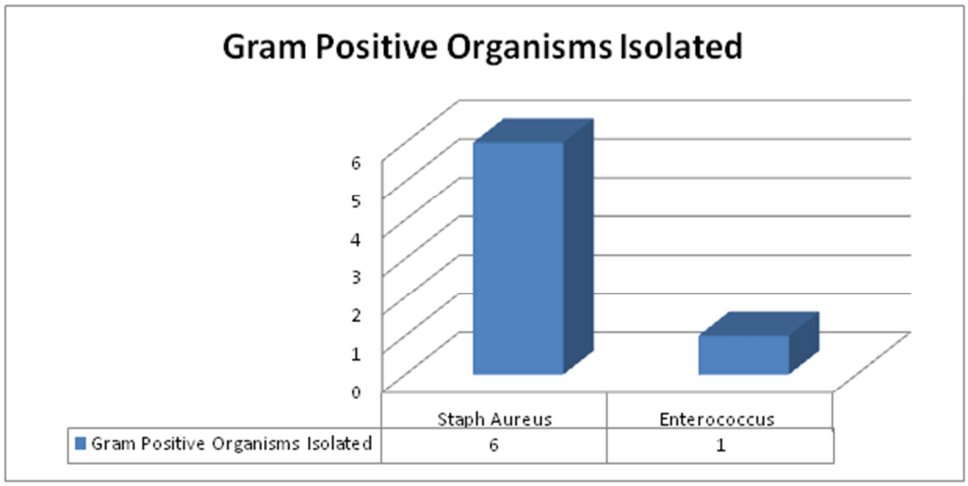

Fig. 7: Depicting Gram Positive Strains

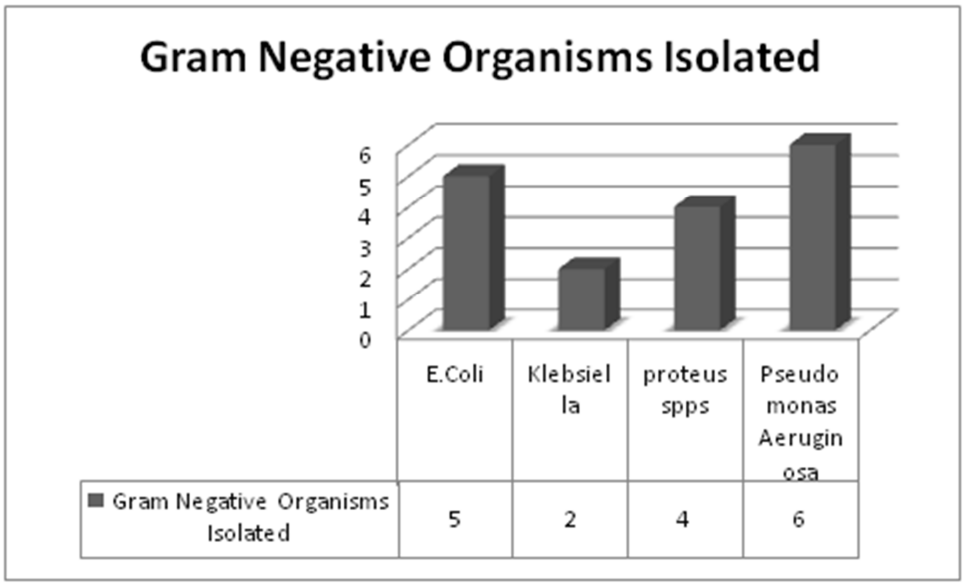

Fig. 8: Depicting Gram Negative Strains

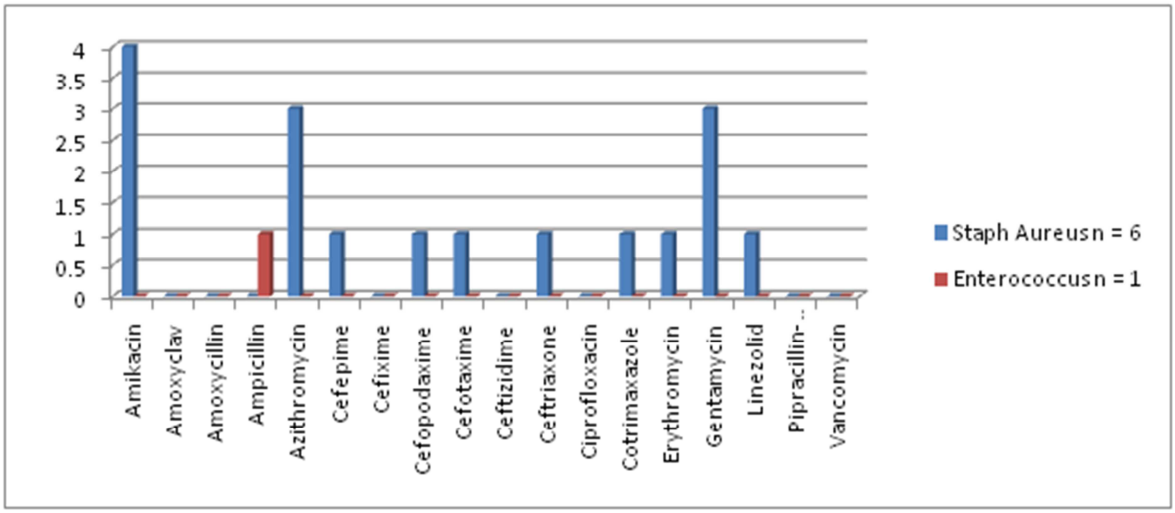

Fig. 9: Bar Chart Depicting the Antibiotic Susceptibility of Gram Positive Organisms

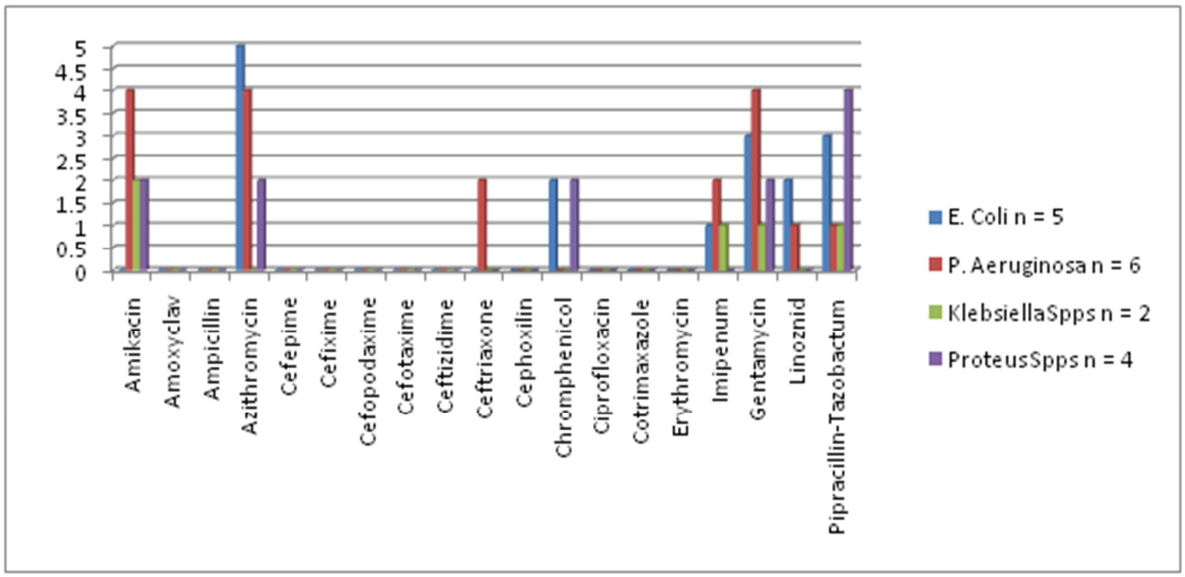

Fig.10: Bar Chart Depicting the Antibiotic Susceptibility of Gram Negative Organisms

DISCUSSION

Diabetic Foot infection is the most relentless complication affecting patients which is not limited to certain apparent underlying subcutaneous tissue. According to American Diabetes Association, the diabetic foot infection and ulceration arises from uncontrolled diabetes and improper healthcare[4,5]. A study states that, clinically and microbiologically it has been seen that majority of the patients with DFU or DFI were males and older than 40 years and it was consistent with other reported studies[6,7]. Differences in diabetic people may be due to factors such as the differences in their life styles and professional activities and jobs, causing the feet to tolerate more pressure and different underlying conditions.

According to our study, out of 62 we found 7 Gram-positive strains, 6 *Staphlococcus* and 1 *Enteroccous* strains were isolated, which is very much similar in a way to some previous studies which states that more gram-positive strains were isolated[8,9,10]. They found that *Staphylococcus spp.* being the most common pathogen[11,12] . Followed by *Enterococcus spp.* which was the second most organisms isolated, might be due to previous usage of antibiotics. According to an another study, *Enterococci* were frequently detected from compromised patients, such as diabetics, and the patients with foot ulcers, but their role in infections at these sites is not yet clearly defined[13].

In contrast to above studies, Gadepalli et al. found that Gram-negative bacteria (*Proteus species, E. coli,* and *Pseudomonas aeruginosa*) were predominant strains rather than gram positives. Whereas our study found equal ratio of *staph spp.* and *pseudomonas spp.* isolated[14]. According to studies Source of infection, use of antibiotic drug for treatment, sample collection method, geographical variation, and type and severity of the infections can influence the pathogens diversity.

CONCLUSION

Pseudomonas Aeruginosa and *Staph. Aureus* were found to be equally responsible for infection followed by *E.Coli, Proteus, Klebsiella* and *Enterococcus*. First line of generation, of Cephalosporins and most of the Aminoglycosides were active against gram positives whereas successive generations of cephalosporins were active against gram negatives including some penicillin drugs like Ampicillin, Amoxicillin, and Pipracillin-Tazobactum which were sensitive for both gram positive and gram negative organisms.

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Department of Microbiology and Surgery who were very kind to me throughout my research.

Abbreviations

BHI - Brain Heart Infusion
DFU - Diabetic Foot Ulceration
DFI -Diabetic Foot Infection
AST- Antibiotic Susceptibility Testing

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