Clinical Research on Foot & Ankle

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Abstract

Background: Proper management of diabetic foot infection requires appropriate selection of antimicrobials based on culture and antimicrobial susceptibility testing. The aim was to determine the optimal antimicrobial susceptibility to various commonly used antimicrobials for (GPCs) and

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detection was done as per CLSI guidelines. Quality control procedures were incorporated to assure the quality of stains by gram stained smears (gram positive and gram negative pathogens). Quality control strains like ATCC (American Type Culture Collection) S. aureus, E. coli, Pseudomonas aeroginosa were used to check the quality of both plating and biochemical media. Quality control for antibiotic discs was done by CLSI guidelines.

Statistical analysis

Data are expressed as percentages. Chi square was used to identify the most prevalent species among GPCs and GNBs and also to determine the most sensitive antibiotic among the classes of antibiotics for GPCs and GNBs. A p value of <0.05 was considered as statistically significant. Statistical analysis was performed using statistical package SPSS version 16.0 (SPSS, Chicago, IL).

Results

The mean age of total study subjects was 57.4 years and the duration of diabetes varied from 1-30 years with a mean duration of 11.9 ± 7.9 years. 502 (52.2%) patients had ulcer in the left foot and 459 (47.8%) in the right foot. 152 (15.8%) wier=Tw -5(ier=t)-5(i)3(s)5(t)-5(ic)-30the

Antibiotics	GPC (n=367)		p alue
	n	(%)	
Cephalexin	117	(31.8)	<0.001
Clindamycin	219	(59.6)	
Erythromycin	205	(55.8)	
Linezolid	327	(89.1)	<0.001
Vancomycin	365	(99.4)	

Table 2: Comparison between antibiotics against Gram positive cocci.

Class	Antimicrobials	GNB (n=515) n	(%)	p alue
Aminoglycoside	Amikacin	405	(78.6)	
Carbapenems	Imipenem	499	(96.8)	<0.001
	Meropenem	341	(66.2)	
Beta-lactam\ beta-lactamase inhibitors	& H ¿ S L P H ? 7 D] R E D41 W X (85.6)			<0.001
	Cefoperazone \ Sulbactum	364	(70.6)	
	Piperacillin \ Tazobactum	348	(67.5)	
Quinolones	/ H Y R À R [D F L Q	221	(42.9)	0.62
	2 À R [D F L Q	230	(44.6)	
Cephalosporins	Cefuroxime	101	(19.6)	<0.001
	Ceftazidime	183	(35.5)	
	Colistin	130	(25.3)	

Table 3: Comparison between antibiotics against Gram Negative Bacilli

GPCs and GNBs. GPCs and GNBs were also highly susceptible to amikacin, ce pime/tazobactum, cefaperazone/sulbactum, meropenem and piperacillin/tazobactum. GPCs were also highly susceptible to doxycycline and cefuroxime. Levo oxacin and o oxacin showed >50% sensitivity against GPCs and >40% against GNBs.

Table 2 shows the susceptibility of GPCs against oral antibiotics. It was observed that Clindamycin was signi cantly more sensitive than Cephalexin and Erythromycin (p<0.001). Antibiotic sensitivity of anti-MRSA drugs revealed that vancomycin was signi cantly highly sensitive compared to Linezolid (p<0.001).

Comparison between antibiotics for GNBs was done to identify the optimal antimicrobial therapy for GNB (Table 3). It was observed that GNBs were highly susceptible to imipenem than meropenem (p<0.001). Among the beta-lactamase inhibitors ce pime/tazobactum showed the highest sensitivity followed by cefoperazone/sulbactum and piperacillin/tazobactum (p<0.001). Aminoglycoside, viz., amikacin also showed high sensitivity against GNBs. Quinolones (levo oxacin and o oxacin) were equally sensitive (approximately 40%), and among the cephalosporins, ce azidime showed the highest sensitivity compared to colistin and cefuroxime.

Discussion

Infection is a major cause for the non-healing chronic nature of diabetic foot ulcers. In the present investigation, we assessed the susceptibility testing of commonly used antimicrobials for all GPCs and GNBs to identify the best antimicrobial agent to treat DFI. Among the GPCs isolated, Staphylococcus spp were predominant in our study. Of the Staphylococcus spp, 56.7% were Staphylococcus aureus and 43.3% were Coagulase negative staphylococci. Staphylococcus aureus is the most prevalent isolate in DFI together with other aerobes like Staphylococcus epidermidis, Streptococcus, spp, Pseudomonas aeruginosa, Enterococcus spp and Coliform bacteria [17,18]. Among the GNBs, Enterobacteriaceae group of bacilli were more prevalent (40.4%) than Pseudomonas and other species. A similar nding was reported by a recent study by Anjan et al. [19] who showed 37.7% of E. coli, 12.6% of Klebsiella, 7.93% of Proteus spp. About 17% of Pseudomonas Spp were isolated in the present study, which is consistent with the nding of Abdul kadir et al. [20], who reported about 19% of Pseudomonas Spp in Brunei.

Another study from South India showed only the antimicrobial susceptibility pattern of Pseudomonas aeruginosa from a diabetic foot ulcer [21].1.4% of DFI was with candida spp of total isolates [22]. We have isolated 10 cases of Candida spp with the percentage of 1.1% in our study.

Prevalence of MRSA in DFIs ranged from 5% to 30% and there is an alarming trend for increase in many countries [23]. An increase in the incidence of multi-drug resistant (MDR) organisms, namely MRSA and ESBL-producing gram negative bacteria, is threatening the outcome of anti-infectious therapy in the community and in hospitalized patients [24]. 1.35% of MRSA were isolated in our study. In recent years, there has been an increase in the incidence and prevalence of ESBLs also Currently there was paucity of data on ESBL-producing organisms from DFI especially in this part of world. Our study from South India found 3.12% of ESBL-producers.

It was reported that literature regarding antibiotic therapy is inadequate to determine the best antimicrobial agent [25]. In the current study, it was observed that Imipenem was the best choice for both GPCs and GNBs with sensitivity of 99.7% and 96.8% respectively and thus can be used to treat severe foot infection and it can also be used as best choice for ESBL producers. Another recent study by Banashankari et al. [10] also reported 100% susceptibility to imipenem when tested for Enterobacteriaceae family. Other antimicrobials such as amikacin, ce pime-tazobactum, cefaperazone-sulbactum, meropenem and piperacillin-tazobactum also showed considerable sensitivities against both GPCs and GNBs in our study. Similar ndings have been reported in another study from Africa where amikacin was 77.5% sensitive for Pseudomonas spp and 58.3% sensitive for E. coli [26]. A recent study from North India showed that pipercillin-tazobactum showed the highest sensitivity for polymicrobial nature of foot infection [27].

Amikacin can be a better choice for E. coli, Proteus and Klebsiella spp which can be used for severe and moderate grade of foot infections as noted in our study.

Ce pime-tazobactum combination, showed more than 80% sensitivity against Enterobacteriaceae family [28]. Ce pime-tazobactum combinations showed 75.7% susceptiblity to GPCs and 85.6% susceptiblity for GNBs in our study. An important nding in the present study was that cefuroxime, which was commonly used only against GNBs, was more than 70% sensitive against GPCs, as well. is implies that the clinicians can incorporate cefuroxime in their panel of antibiotics against both GPCs and GNBs. Doxycycline was more than 75% sensitive against GPCs, which indicates its potential use against GPCs, including infections caused by MRSA. e present study showed that GPCs were more than 50% susceptible to the quinolones (levo oxacin) than GNBs.

Among the oral forms of antimicrobials tested for GPCs in our study, Clindamycin was found to be highly sensitive than erythromycin and cephalexin. Among the intravenous (IV) anti-MRSA antimicrobials, linezolid and vancomycin showed higher sensitivities against GPCs, with the latter showing signi cantly higher potential. is nding indicates that patients with known MRSA infection can be directly treated with the IV drugs instead of starting with the oral forms, since MRSA is known to have contact transmission. e most reliable predictor for MRSA as a cause of DFI is a previous history of

MRSA infection [29] but one of the limitation of the current study was nonavailablity of data on previous history of MRSA.

In vivo (response) changes that happen whenever an antimicrobial drug is administered is still unclear. erefore, in vitro studies are necessary to derive at an appropriate decision on the use of antimicrobials in the treatment of DFIs.

In conclusion, among the most potential antimicrobials, Imipenem was found to be the best drug of choice against both GPCs and GNBs. Among the combinations, ce pime-tazobactum was the best, among quinolones: o oxacin was a better choice, and among the cephalosporins: ce azidime can be used for mild infections. Appropriate us