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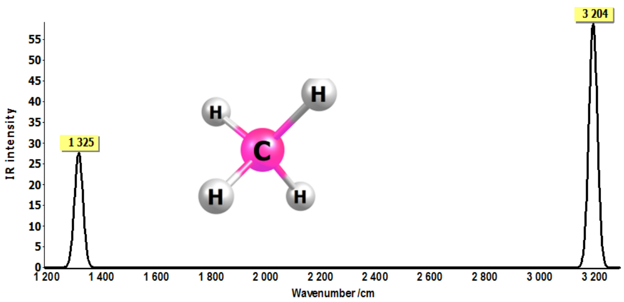

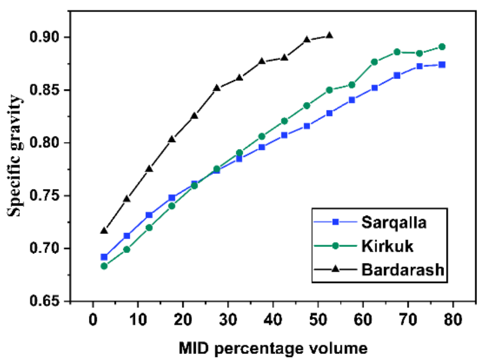

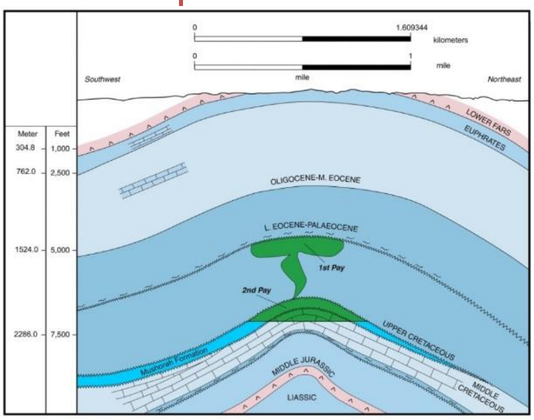

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Microbial prevalence and outcome of diabetic foot ulcers in patient's candidates for minor surgical interventions

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Abstract

Background: Diabetes mellitus is a progressive disease with chronic complications such as diabetic foot infection, a significant difficulty that inevitably leads to gangrene and amputations. **Objective:** This study aims to determine microbial prevalence in diabetic foot infections, identify the significance of aggressive surgical therapy and minor amputations in limb salvage and the prevention of more proximal amputations, and identify predicting factors affecting the outcome of these surgical processes. **Methods:** In this cohort study, microbiological samples were collected from 62 patients with diabetic foot lesions who underwent debridement or minor amputations to determine the prevalence of microorganisms in diabetic foot infections. Then, they were followed up to determine the rate of saved limbs and the factors that affect the outcomes and rate of complications. **Results:** infections were mainly caused by aerobic Gram-positive bacteria (*S. aureus*) 53.5%, and aerobic Gram-negative bacteria of enterobacter species 40.4%. Regarding the outcome of surgical intervention, we found an 80.65% success rate of saving the limb with a 30.6% complication rate. Risk factors such as high levels of inflammatory markers and parameters of the severity of peripheral arterial disease showed significant association with the rate of complications and poor outcomes. **Conclusions**: Debridement and minor surgical amputations effectively prevent more proximal amputations in diabetic foot infections with a high chance of good results. At the same time, the common microorganism in our local population was *S. aureus*, followed by *P. mirabilis*, *E. coli*, and Klebsiella species in diabetic foot infections.

Introduction

Diabetes is a complicated and chronic condition that needs ongoing medical care along with multi-faceted risk-reduction initiatives that go beyond focusing on glucose control alone (1,2). For example, type I diabetes, related to b-cell destruction often results in complete insulin deficiency (1). In contrast, type II diabetes is related to the gradual decline in insulin secretion against a context of insulin resistance (3).
Iraq has a 21.8 per 1000 population prevalence of diabetes, with higher rates in urban than rural regions. In Iraq's southern and central areas, the prevalence is higher than in the Kurdistan region (4).

Long-term diabetes mellitus (DM) consequences frequently manifest in the feet and cause persistent disability. Diabetic foot infection, ulceration, or destruction of deep foot tissues is linked to neuropathy and/or peripheral arterial disease (5,6). Around 25% of hospital admissions among diabetic patients are for foot lesions (2,6-8). The risk factors for foot problems in diabetes patients are peripheral angiopathy/neuropathy, impaired immune function, and poor foot hygiene (9).

Deep infection is a limb-threatening condition that results in an instant amputation in 25–50% of individuals with diabetic foot infections (10,11). Imaging investigations can aid in diagnosing or identifying potential deep soft tissue purulent collections and are typically required to detect pathological findings in bone. An excellent diabetic foot infection management strategy reduces infection-related morbidities, hospitalizations, and amputations. This is achieved through early diagnosis of lesions, early antibiotic therapy, forceful surgical debridement of necrotic soft tissue and bone, and control of host factors (12,13).

The gold standard for superficial diabetic foot ulcer care consists of controlling hyperglycemia and comorbidities, wound debridement to remove devitalized tissue, dressing (using gauze and saline) to keep the moist environment of the ulcer and control exudates, and off-loading of the limb (2,10,14). Other treatments have also been recommended, such as hyperbaric oxygen therapy, sophisticated wound care products, and negative-pressure wound therapy (2). However, there is little evidence of the efficacy and cost-effectiveness of these adjunctive therapies, and no research supports their superiority to debridement and dressing alone (2,10,14).

Lower limb amputations in diabetic patients are more prevalent than in non-diabetics, with diabetes accounting for five out of every six amputations. Of those who come with diabetic feet, 40% require amputations (15, 16), especially in patients with neuropathy, vascular disease, and ulcerative deformities that have caused soft tissue necrosis, osteomyelitis, uncontrolled infection, or unbearable discomfort, foot amputation might be indicated (15, 17).

Therefore, this study aimed to determine microbial prevalence in diabetic foot infections in our local community and identify the significance of surgical therapy (debridement and minor amputations) in limb salvage and the prevention of more proximal amputations in diabetic foot infections. Also, to identify predicting factors affecting the outcome of surgical debridement and minor amputations.

Materials and Methods

Sample size and study design

This is a prospective cohort study of 62 patients (62 feet) with diabetic foot complications from whom a microbiological sample was obtained to determine the microbial prevalence and managed with debridement, toe-disarticulation, and ray amputation with follow-up for at least 6 months or until complete wound healing. The study was conducted in Shorsh Teaching Hospital and Shar Teaching Hospital, Sulaimaniyah, Iraq, from October 2021 to January 2022, while the follow-up continued till July 2022.

Inclusion criteria

Any patient with a diabetic foot complication with Wagner grade 1-3 ulcers confined to one ray at maximum at presentation was included regardless of age and gender.

Exclusion criteria

Patients with Wagner grade 4 and 5 ulcers or whose that doppler examination showed complete obstruction of arteries were excluded despite patients that lost follow-up.

Ethical considerations and patient consent

Ethics approval from the Ethics and Scientific Committee of the College of Medicine, University of Sulaimani, was obtained (No. 223/07/11/2021), and informed consent was taken from each patient to participate in this study. At the same time, they felt free to quit whenever they preferred.

Methods

The population was drawn from 86 patients with diabetic foot complications; all patients underwent minor surgical interventions (debridement and minor amputations). However, 24 individuals were excluded from the study due to patients withdrawing from the research and discontinuing the proposed course of management or losing follow-up before complete wound healing.

Data collection

A. Socio-demographic data and patient profile

Data was collected from each patient via direct interview by a prepared data collection form. Socio-demographic data, including age, gender, premorbid condition, duration and type of diabetes, comorbidities, previous history of diabetic foot complications, and presence of risk factors (such as smoking, alcoholism, and hyperlipidemia), were recorded.

Clinical, radiographic, and laboratory evaluations

Clinical examination, including the examination of the affected foot for determining the type and extent of the lesion, was done, and the contralateral foot was also examined. Capillary refilling time was observed and compared to other healthy parts of the body to assess limb vascularity, accompanied by an examination of the distal pulses at the ankle and foot level. ABI was measured in the supine position. Doppler examination of both lower limbs was obtained to determine the severity of vascular insufficiency patients were categorized according to Doppler reports into normal, mild, moderate, and severe peripheral arterial disease (PAD).

Neurological examination was performed for both feet, looking for autonomic neuropathy (hair loss, fissuring, and dryness of the skin), sensory neuropathy (Ipswitch touch test), quality of Achilles tendon reflex, and motor neuropathy (pes cavus and clawing of toes). Thus, patients were divided into five groups normal, decreased forefoot sensation, absent forefoot sensation, decreased entire foot sensation, and absent entire foot sensation.

Furthermore, radiologic evaluation was done using an x-ray on anterior-posterior (AP) and lateral views of the affected foot for osteomyelitis and the presence of gas. Evaluation of cardiac status was done by echocardiography and echocardiography (ECG). Preoperative laboratory tests included were complete blood count (CBC), erythrocyte sedimentation rate (ESR), renal function tests, total serum protein, serum albumin, blood glucose (fasting and random), HbA1C, serum cholesterol, and triglyceride. Finally, patients according to the intervention needed were classified into three groups, including those who needed debridement and dressing, with superficial ulcers (Wagner grade 1 or 2), those who needed disarticulation or through-metatarsal amputation (Wagner grade 2 or 3), when gangrene and infection were confined to the distal toe together with those who needed ray amputation (Wagner grade 3 confined to one or two rays).

Microbiological sampling

In the operating theatre and under anesthesia (spinal or regional), superficial swabs and tissue samples were taken from every included patient. Briefly, three sterile cotton swabs were obtained, soft tissue and exudates were placed inside the thioglycolate culture, and soft tissue and/or bone were obtained from the ulcer site and sent to examine for Gram staining, acid-fast-bacilli staining, fungal and bacterial culture and direct tissue smears for microbial identification and antimicrobial sensitivity.

Microbiological samples were obtained before starting antibiotics whenever possible or after 48 hours of stopping antibiotics in those patients whose therapy started before the presentation. In patients with a small amount of pus and discharge, the exudates were put in a thioglycollate medium to avoid the risk of desiccation, and samples were taken from representative parts (dry crusts that yielded no living organisms were avoided to be sampled), washout by normal saline was done for the ulcer bed before taking soft tissue samples to prevent contamination.

Patient management

Preoperative optimization of the patient's general condition was achieved by prescribing intravenous (IV) fluids and controlling blood sugar (after consulting the medical department to control blood sugar and the need for antithrombotic medications). In addition, cardiovascular consultation was done for possible vascular interventions of benefit; empiric antibiotics were started after the surgical operation whenever the general condition of the patient allowed and changed to sensitivity-determined antibiotics afterward. Almost all patients were operated on with spinal anesthesia except for five patients whose state did not allow spinal anesthesia or whose minimal ulcers did not need spinal anesthesia, and they were operated on under regional (local + ankle block) anesthesia.

Procedure

Initially, debridement was performed by scalpels in which dry crusts were removed from the edges along with all devitalized tissue in the ulcer bed. Special care was taken to avoid removing healthy granulation tissue (pink-red in color) until a healthy bleeding ulcer bed was produced with saucerization of the ulcer edges.

Consequently, toe-disarticulation of lesser toes was performed via dorsal (y-shaped) and planter incisions; the planter flap was kept longer for coverage, while racket handle incisions performed big toes and little toes amputations. Typically, disarticulation of the metatarsophalangeal joint was performed, but if after thorough soft tissue debridement; the skin and soft tissue left was not enough to cover the metatarsal bone distal articular part were removed, infected tendons debridement was done, and the tendon sheaths opened to allow for drainage and prevent ascending of infections. All diabetic foot amputations were left partially or fully open.

Furthermore, ray amputations were performed through medial or dorsal racket shape incisions. The first metatarsal was excised as distal as possible to allow the surrounding tissue to cover the bone excision of the sesamoid bones, and all necrotic soft tissues were performed. Little toe ray amputations were performed via lateral racket handle incisions, and central rays were excised through dorsal y-shaped and planter incisions, which were standard, infected tendons cut proximal to infection, and the tendon sheaths opened. Incisions were left partially or fully open.

Postoperative follow-up

Daily follow-up was done for three days in which the foot was elevated and placed facing down so that gravity helped in the drainage of the wound, while daily dressing and washout by normal saline were performed. Patients were discharged after their general condition allowed and they could manage their wound care independently, while open wounds were left for secondary healing.

After the first three days, patients were followed up weekly until wound healing to observe the wound for any complications and need for any further intervention. Basic laboratory investigations for glycemic control and inflammatory markers were obtained and patients were advised for partial weight bearing as a form of off-loading until wound healing had been achieved. After complete healing, patients were followed up monthly for up to 6 months postoperatively (Figure 1).

Figure 1. A gangrenous diabetic patients' foot before operation (A), One day after operation (B), One week after operation (C), and complete healing after ten weeks (D).

Statistical analysis

Statistical analysis was performed using a statistical package for the social sciences program (IBM, SPSS, version 26). The frequencies of microbial prevalence were obtained via descriptive statistics, and the association between categorical variables and outcome variables (complications and outcome) was performed using chi-square tests. ANOVA test was used to analyze the association of some quantitative and scale variables (age, BMI, and HbA1C) and the outcome variables (complications and outcome) as these numerical variables had a normal distribution. Other quantitative variables (WBC, ESR, ABI, and serum albumin) associated with the outcome variables were analyzed via the Mann-Whitney U test. P-values of 0.05 were used as a cut-off limit point for the significance of statistical tests.

Results

Table 1 presents the socio-demographic data of patients. The median age of patients was 62±6.7 years; males were slightly more affected than females (51.6%), aged >60 years, and non-insulin-dependent (74.2%) with 10-15 years of diabetes (35.5%). However, most patients had normal body mass index (BMI) (18.5-24.5 Kg/m^2) with independent premorbid activity.

Table 1. Socio-demographic data and characteristics of diabetic patients.

Variable	Value	Frequency	Percentage
Age (Year)	<60	21	33.8 %
	>60	41	66.2 %
Gender	Male	30	51.6 %
	Female	32	48.4 %
Type of diabetes	Insulin-dependent	16	25.8 %
	Non-insulin-dependent	46	74.2 %
Duration of diabetes (Year)	1-5	8	12.9 %
	5-10	15	24.2 %
	10-15	22	35.5 %
	>15	17	27.4 %
BMI (Kg/m^2)	Normal (18.5-24.9)	33	53.2 %
	Overweight (25-29.9)	27	43.5 %
	Obese (30-39.9)	2	3.3 %
	Morbid obesity (>40)	0	0.0 %
Premorbid activity	Using-aid	8	12.9 %
	Independent	54	87.1 %

BMI: Body mass index

Regarding the patient's comorbidities, most of them had no diseases (43.5%), while 21% had hypertension followed by hyperlipidemia (19.4%), Ischemic Heart Disease (IHD) (9.7%), and then Cerebral Vascular Accident (CVA) (6.5%) (Table 2).

Table 2. Studied diabetic patient's comorbidities.

Disease	Frequency	Percentage
Hypertension	13	21%
Hyperlipidemia	12	19.4%
Ischemic Heart Disease	6	9.7%
Cerebral Vascular Accident	4	6.5%
None	27	43.5%

On the other hand, 59.6% of the isolated patient sample were polymicrobial, while 40.4% were monomicrobial samples (Table 3).

Table 3. Microbial prevalence isolated from diabetic patient's foot.

Sample type	Frequency	Percentage
Polymicrobial	37	59.6%
Monomicrobial	25	40.4%
Total	62	100%

In a total of 99 microbial isolates, most isolated microbes were aerobic Gram-positive (53.5%) and aerobic Gram-negative (40.4%), followed by anaerobic Gram-positive (3.03%), then fungal infection of candida species (2.02%). In this regard, the highly isolated bacteria were *S. aureus* (31.3%), followed by *P. mirabilis* (12.1%), then *P. auriginosa* (10.1%), while the least isolated bacteria were *R. kristinae* (1.01%) (Table 4).

Table 4. Distribution of isolated microbes from diabetic patient's foot.

Microbes	Type	Frequency	Percentage
Gram-positive	**-Aerobic**	**53**	**53.5**
	Staphylococcus aureus	31	31.3
	Enterococcus species	9	9.09
	Streptococcus species	5	5.05
	Staphylococcus epidermidis	4	4.04
	Staphylococcus roseus	3	3.03
	Rothia kristinae	1	1.01
	-Anaerobic	**3**	**3.03**
	Staphylococcus lentus	3	3.03
Total		**56**	**56.53**
Gram-negative	**-Aerobic**	**40**	**40.4**
	Eshirichia coli	8	8.08
	Klebsiella pneumoniae	7	7.07
	Proteus mirabilis	12	12.1
	Pseudomonas auriginosa	10	10.1
	Acinobacter baumannii	3	3.1
	-Anaerobic	**1**	**1.2**
	Seratia marscescens	1	1.2
Total		**41**	**41.6**
Fungus		2	2.02
Candida species		2	2.02
Total		**99**	**100**

Regarding the diabetic patient outcome, 50 patients (80.65%) had good outcomes, and the function of the foot and ankle were preserved, and more proximal amputation was prevented. On the other hand, 19 patients had complications, of which seven had a good outcome. In comparison, another 12 patients (19.35%) had poor outcomes, of which six patients (9.6%) had persistent complications that spread to mid-foot and hind-foot and required a more proximal amputation, three patients (4.83%) had infections that spread to another toe (ray) or developed an extra ulcer, and another three patients (4.83%) had multiple complications mainly recurrent infection or a new infection in a different toe after healing of the primary ulcer (Table 5).

Table 5. Complication types and outcomes of studied diabetic patient's.

Complication type	Patient's outcome		Total
	Good	Poor	
Continuous infection	7	6	13
Extra-toe-infection	0	3	3
Multiple complications*	0	3	3
Total	7	12	19

*include recurrent infection or new infection in another toe

Furthermore, we found a significant association between high BMI (p=0.004), the severity of PAD detected by the Doppler study (p=0.016), absence of ankle pulses (p=0.001), and premorbid activity (p=0.001) with the occurrence of complications (Table 6).

Table 6. Categorical variable vs. presence of complications in diabetic patients.

Factor	Variable	Complication		P-value
		Yes	No	
Age (Year)		19	43	0.06
Gender	Male Female	9 10	21 22	0.87
Duration of diabetes (Year)	1-5 5-10 10-15 >15	2 8 6 3	6 7 14 16	0.24
BMI (Kg/m^2)	Normal (18.5-24.9) Overweight (25-29.9) Obese (30.39.9)	4 13 2	28 15 0	0.004*
Comorbidities	Yes No	10 9	22 21	0.1
PDA by Doppler	Normal Mild Moderate Severe	4 8 5 2	12 25 5 1	0.016*
Ankle pulses	Both pulses palpable One pulse palpable Both pulses absent	11 4 4	42 1 0	0.001*
Neuropathy	Normal sensation Decreased forefoot sensation Decreased entire foot sensation Absent forefoot sensation Absent entire foot sensation	3 12 4 0 0	7 23 11 1 1	0.9
Premorbid activity	Independent Using aid	14 5	40 3	0.001*

*: Significant difference; BMI: Body mass index

Moreover, Table 7 shows a significant association between low Ankle Brachial Index (ABI) (p=0.001), high WBC (p=0.005), high ESR (p=0.01), low serum albumin (p=0.001) and occurrence of complications. Additionally, Table 8 displayed a significant association between high BMI (p=0.02), the severity of PAD by the Doppler study (p=0.005), absence of ankle pulses (p=0.003), and premorbid activity (p=0.001) with the poor outcome of minor surgical interventions. Finally, we found a significant association between low ABI (p=0.001), high ESR (p=0.03), high WBC(p=0.02), and low serum albumin (p=0.001) with poor outcomes of minor surgical interventions (Table 9).

Table 7. Categorical variables vs. outcomes of minor surgical interventions in diabetic patients.

Variable	Value	Outcome		P-value
		Good	Poor	
Age (Year)		50	12	0.49
Gender	Male Female	27 23	3 9	0.071
Duration of diabetes (Year)	1-5 years 5-10 years 10-15 years >15 years	8 11 17 14	0 4 5 3	0.45
BMI (Kg/m^2)	Normal (18.5-24.9) Overweight (25-29.9) Obese (30.39.9)	30 19 1	2 9 1	0.02*
Comorbidities	Yes No	24 26	8 4	0.19
PAD by Doppler	Normal Mild Moderate	14 30 5	2 3 5	0.005*

	Severe	1	2	
Ankle pulses	Both pulses palpable One pulse palpable Both pulses absent	48 2 0	5 3 4	0.003*
Neuropathy	Normal sensation Decreased forefoot sensation Decreased entire foot sensation Absent forefoot sensation Absent entire foot sensation	9 26 13 1 1	1 9 2 0 0	0.6
Premorbid activity	Independent Using aid	47 5	7 3	0.001*

*: Significant difference; BMI: Body mass index

Table 8. Shows association between numerical variables vs. outcomes of minor surgical interventions in diabetic patients.

Variable	**Outcome**		**P-value**
	Good	**Poor**	
ABI (Median)	0.91	0.62	0.001*
WBC (Median)	10.8	12.6	0.02*
HbA1C (Mean±SD)	8.1±0.25	8.4±0.3	0.32
ESR (Median)	96	123	0.01*
Serum albumin (Median)	3.25	2.27	0.001*

*: Significant difference

Discussion

In our study, most wounds (59.6%) had polymicrobial isolates, and (40.4%) had mono-microbial isolates. These findings are consistent with other studies on diabetic foot infections in the region and worldwide. In this regard, Kown et al., 2018 (18); Umadevi et al., 2011 (19); Anvarinejad et al., 2015 (20); Zubair et al., 2011 (21); Al Benwan et al., 2011 (22) who reported polymicrobial as more common in diabetic foot infection samples ranging from 53-62%.

In this study, the most frequent microorganisms isolated were aerobic Gram-positive followed by aerobic Gram-negatives, which is consistent with other studies performed worldwide, such as those of Kown et al., 2018 (18), Anvarinejad et al., 2015 (20), Zubair et al., 2011 (21), Mendes et al., 2012 (23), Abdulrazak et al., 2005 (24) who reported the majority of aerobic bacteria in diabetic foot sample isolates.

In the current study, the most frequent microorganism isolated was *S. aureus* (31 isolates; 31.3%), followed by *P. mirabilis* (12 isolates; 12.1%). These results are consistent with other studies where rates from 10-50% were reported by Kown et al., 2018 (18), Mendes et al., 2012 (23), and Tiwari et al. This is also consistent with studies of Anvarinejad et al., Tiwari et al., 2012 (25) who reported a higher rate of Gram-negative isolates including *P. mirabilis*, *P. aurginosa*, and *E. coli* in developing countries in contrast to developed countries.

Regarding the diabetic patient outcome after surgical intervention, in the present study, 50 patients (80.65%) had good results after six months of follow-up, and most patients returned to their usual daily activities. Various data were reported from different countries by various orthopedics. In this respect, Tan et al., 1996 reported good outcomes in 88% of patients who underwent early aggressive debridement or minor amputation for diabetic foot complications (26). Evans et al., 2011 found that 80% of minor amputees were still alive after two years of follow-up and 73% had salvaged limbs after two years, and 64% of them were still ambulatory in comparison to the below knee amputation group in which 52% of them died within two years. Only 64% were ambulatory with leg prostheses (27). Choi et al., 2015 found that the 5-year survival rate was 81.6% in patients with successful limb salvage, which was much lower for patients with failed salvage at only 36.4% (28).

Whereas Svenson et al., 2011 in a study of 410 patients, reported limb salvage success in two-thirds of the patients (29). So aggressive debridement and minor amputations in patients with diabetic foot complications have readily shown to be effective in limb salvage and reducing morbidity and mortality.

The literature has mixed results on the outcome of debridement and minor amputations. The various patient risk influencing the outcome of debridement and minor amputations from preoperative to postoperative periods and afterward may be the source of varied results. Different criteria and follow-up times in those studies may explain such dissimilarities.

Additionally, Izumi et al. found 73.3% good outcomes in diabetic foot patients with minor amputations in a prospective cohort of 227 cases after one year of follow-up. Wong et al. reported 70% good outcomes of minor amputations in a prospective cohort study of 150 cases after one year of follow-up (30,31). Our results are also higher than Murdoch et al., who reported 60% complications within the first year, and Ohsawa et al. reported 40% complications at two years (30). The higher percentage of good outcomes in our study might be attributed to the duration of follow-up, which was longer in the studies above. Furthermore, some risk factors that were considered to be significantly associated with poor outcomes were absent from our study, like diabetic nephropathy, as none of our patients had it. Only one patient in our study was an active smoker, and a negligible number were ex-smokers at some point in their life; the number of patients with severe PAD on Doppler was less in our study.

In this study, we found that the parameters of the severity of PAD such as the absence of ankle pulses, and low ABI severity of PAD on Doppler ultrasound of the limbs were significantly associated with the occurrence of complications and poor outcomes. These results are similar to those of Choi et al., 2014, Zakaria et al., 2015, Wong et al., 2010 and Nather et al., 2013 (30-33). It is undeniable that PAD creates difficulties, and proper blood flow is crucial for wound healing and battling the severe infections that afflict the diabetic foot.

Another risk factor that was found to be significantly associated with complications and poor outcomes was the premorbid activity of daily living. These results are comparable to those of Choi et al., 2014 who reported that the higher the level of ambulation before surgery, the higher the rate of success of limb salvage operation (33).

Elevated inflammatory markers (ESR and WBC) and low levels of serum albumin, a parameter of a poor nutritional state, were also found to be significantly associated with increased complications and poor outcomes in our study. Hambleton et al., 2009 support these findings in their study of 205 diabetic foot patients that found sepsis, high inflammatory markers, and low serum albumin as risk factors for poor outcomes and increased risk for complications (34). The same findings were found by Widerman, 2021 who reported low serum albumin as a risk factor for poor outcomes in controlling infections in general and especially chronic diseases (35). These factors reflect the patient's general state, the degree of damage to the infected foot, and the causative microorganism's aggressiveness, so it's not unexpected they're related to increased complications and failure rates.

High HbA1C percentage was found to be not significantly associated with an increase in complications and poor outcomes, and these findings are consistent with the findings of Choi et al. 2014 (28) and Wong et al., 2010 (33). However, the nature of the parameter could explain these outcomes as it is crucial if it is persistently raised. A single preoperative reading may not provide enough data because most patients have hyperglycemia at this time, but repeated readings during long-term follow-up may give different results.

Conclusions

The most common pathogen in diabetic foot infections was *S. aureus*, and the rate of polymicrobial infections was high in diabetic foot infections. Early aggressive treatment of diabetic foot ulcers with debridement or small amputations is preferable. Debridement and minor foot amputations in the short term are effective treatment plans for diabetic foot infections and can assist in limb salvage. Minor amputations are better to do first than more proximal amputations as they are simple procedures that can be done with regional anesthesia and are associated with a low level of energy consumption and have a lower morbidity and mortality rate postoperatively. Risk factors such as high levels of inflammatory markers and parameters of the severity of peripheral arterial disease showed significant association with the rate of complications and poor outcomes. Multi-specialty team management of diabetic foot complications is of paramount importance for stabilization of a general condition, control of the hyperglycemic state, renal functional/cardiopulmonary status, and limb vascular state both pre-operatively and postoperatively. Foot off-loading postoperatively and patient education regarding daily foot care are essential pillars in the postoperative care of diabetic foot infections. Antimicrobial management according to sensitivity tests is of significant importance and better be encouraged through proper guidelines, and the practice of empiric antibiotics should be discouraged.

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