

EVALUATION AND MANAGEMENT OF DIABETIC FOOT

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Abstract

The treatment of diabetic foot is very complex because of chronic wounds which heal very slowly and have a major long-term impact on the morbidity, mortality and quality of life.

Purpose: to show our experience in the treatment of patients with diabetic foot disease.

Material and methods: in a period from January 2014 to June 2015 thirty six patients were admitted in the Department of Surgery at the Clinical Hospital of Tetove, because of diabetic foot disease. Most of the patients were with a long time history of Type-II diabetes and were insulin dependent. **Results:** Among 36 patients included in this study 24 were males and 12 females while the median age was around sixty years (from 48 to 82 years). Twenty-nine patients had insulin dependent diabetes. The most common mode of presentation during hospitalization were the foot ulcers registered in 28 patients (77.8 %), whereas the most common microorganism isolated on microbiological cultures was *Staphylococcus aureus*, isolated in fifteen patients with foot ulcers (41.6 %), followed by *E. Coli* in fourteen others (38.8 %). The most used antibiotics (according to the antibiogram) were the second generation of cephalosporins, Co-amoxiclav and piperacillin/tazobactam. In eleven patients treatment of infected wounds is done conservatively, while in eighteen of them a surgical procedures such as incision and drainage of foot abscesses is performed. In other seven due to the progression of the disease a more radical approach was needed. **Conclusion:** Complications of the diabetic foot such as ulcers and gangrene are very difficult to treat despite great advances in medicine and surgery.

I INTRODUCTION

Diabetic foot ulcers are relatively common in patients who suffer from diabetes. It's estimated that around 25% of all diabetic individuals during their lifetimes will experience pathologic changes of their lower extremities that when combined with minor trauma and infection may lead to serious foot problems. A worldwide large study found that approximately 55% of patients with a foot ulcer had a clinically infected wound which without early and optimal intervention can rapidly deteriorate, leading to amputation of the affected limb^{5,13}. The risk of lower-extremity amputation is more than 100 times greater

for patients with a foot infection than those with a clean wound⁷.

A central role in the development of diabetic foot play a peripheral neuropathy and peripheral arterial disease. Ischemia as a result of macrovascular disorders or microvascular dysfunction impair normal perfusion in a diabetic foot and may lead to development of ulcers.

It is important to know that even in the absence of a poor arterial supply, micro-angiopathy (small vessel dysfunction) contributes to poor ulcer healing in diabetic foot.

II OBJECTIVE

The goals of this study is to show the characteristics of patients with diabetic foot disease and to emphasize the importance of early eradication of infection in diabetic

foot wound in order to prevent the major complications which may lead to the amputation of the foot at different levels.

III MATERIAL AND METHODS

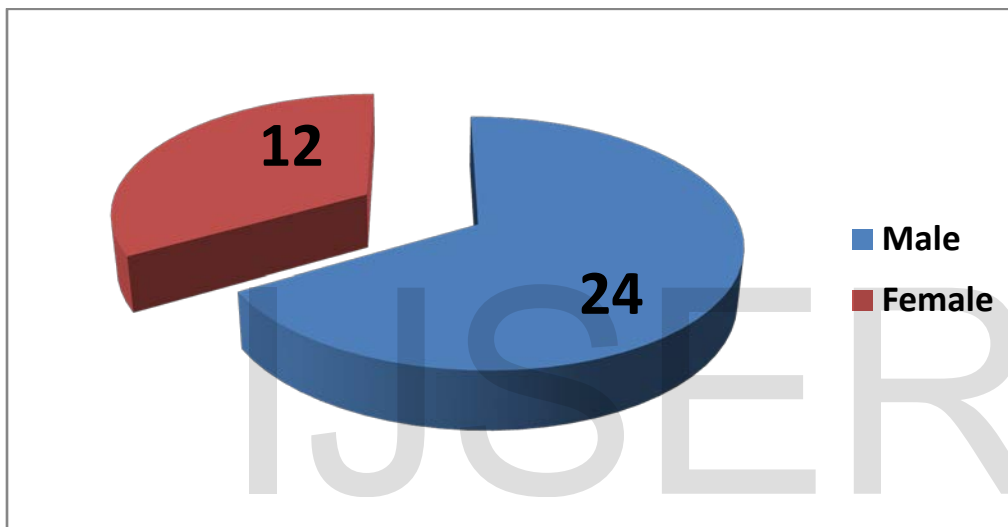
In this prospective study are included thirty six patients with diabetic foot wound treated at the department of surgery in Clinical Hospital of Tetove from January 2014 to June 2015 . Data for eachpatient including signs and symptoms, age, duration of diabetes, and addiction such as smoking were obtained during admission. Peripheral pulses of lower limbs including femoral, popliteal, posterior tibial anddorsalispedis were assessed in each patient by palpation. Pulse strength is usually described as absent, weak, or strong. In all the patients the presence of neuropathieswas checked by touch

sensation in several sites of foot including the plantar surface of the heel, the dorsum of the feet and the plantar surface of the first toe. According to the response of the patients they were categorized as a not feeling, diminished feeling and normal feeling.The control of glycaemia was assessed by measuring HbA1c (glycosylatedhemoglobin). All the foot ulcers were photographed at the start of treatment and then sometimes during treatment.

IV RESULTS

Among 36 patients included in this study 24(66.7 %) were men and 12(33.3 %) women. Our data show that

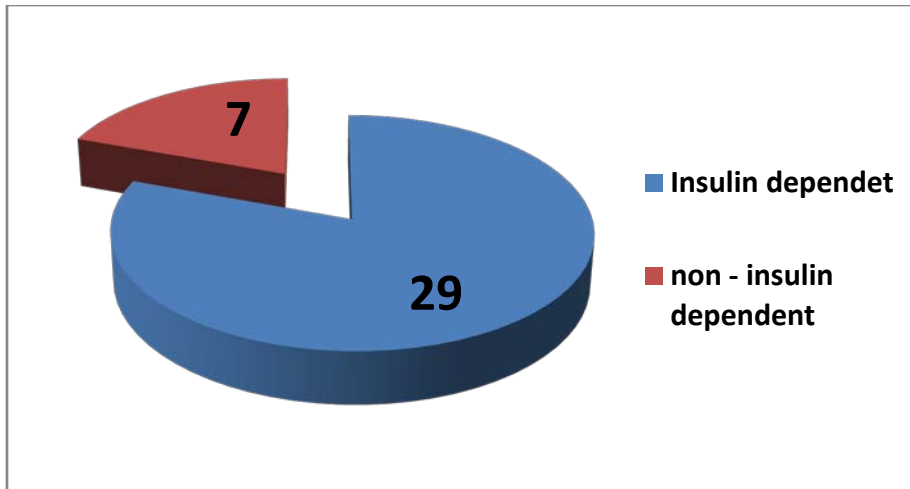
diabetic foot diseases affected man more frequently than women in a ratio of 2:1.



The median age of the patients was around sixty years(from 48 to 82 years), while the median duration of diabetes was 144 months.

Age	Male		Female		Total	
	No.	%	No.	%	No.	%
41 - 50	4	16.7	0	0	2	11.1
51 - 60	10	41.7	6	50	16	44.4
61 - 70	7	29.2	3	25	10	27.8
71 - 80	3	12.5	3	25	6	16.7

Twenty-nine patients had insulin dependent diabetes andseven had non – insulin dependent.



The most common mode of presentation during hospitalization were the foot ulcers registered in 28 patients (77.8 %), followed by fingers ischemia e and gangrene in eight patients.



Pulse evaluation revealed weak femoral pulse in five patients, popliteal in seven, posterior tibialis in ten and dorsalispedis in twelve patients, while in three patients was detected the absence of dorsalispedis pulse.

Pulses	strong	weak	absent

femoral	31	5	0
popliteal	29	7	0
posterior tibial	26	10	0
dorsalispedis	21	12	3

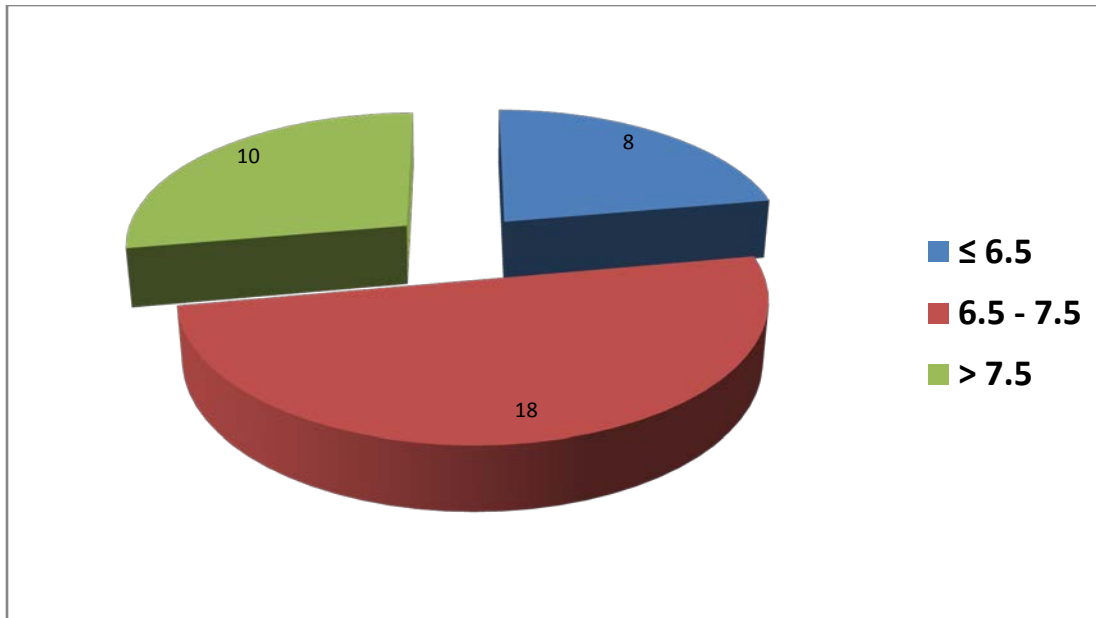
Diabetic nephropathy was documented in nine patients (25 %), cardiovascular problems were present in twenty one patients (58.3 %), resting leg pain was reported also from nine patients (25 %), sensory neuropathy and signs

of peripheral vascular disease was recorded in seven patients (19.4%), while osteomyelitis was detected in two of them (5.5 %).

Risk profile	No	%
Insulin dependent	29	80.5
Cardiovascular problems	21	58.3
Diabetic nephropathy	9	25
Resting leg pain	9	25
Sensory neuropathy and signs of peripheral vascular disease	7	19.4
Presence of osteomyelitis	2	5.5

Fourteen patients refer injuries to the foot as a initial event of the disease. The control of glycaemia was assessed by measuring HbA1c (glycosylated hemoglobin). In eight patients the level of HbA1c was until 6.5 and is considered as good

uncontrolled, in eighteen others the level was between 6.6 - 7.5 and is estimated as uncontrolled, and in teen the level of HbA1c resulted above 7.5 which is considered as bad.



A X-ray examination of the affected foot revealed the presence of osteomyelitis in two patients, while the bacteriological culture from the wound site revealed growth of a single organism in 24 patients (66.6 %), were polymicrobial wound infection is registered in 12 patients (33.4 %). Altogether 63 bacteria were isolated from 36 patients.

Swabbing was the method used for sample collection and the most common microorganism isolated on cultures was *Staphylococcus aureus* which was present in fifteen

patients with foot ulcers (41.6 %), followed by *E. coli* in fourteen patients (38.8 %), *Pseudomonas aeruginosa* in eleven patients (30.5 %), *Enterobacter* spp. in five, *Proteus vulgaris* in two, *Citrobacter* spp. in four, *Klebsiella* spp. in three, *Streptococci* in four, *Proteus mirabilis* in one, *Staphylococcus epidermidis* in two patients. Co-infection with *Candida* spp. was also detected in two cases with Gram negative infection (*E. coli*).

Bacteria	Number	Percent (%)
<i>Staphylococcus aureus</i>	15	41.6
<i>Escherichia coli</i>	14	38.8
<i>Pseudomonas aeruginosa</i>	11	30.5
<i>Enterobacter</i> spp	5	13.8
<i>Streptococci</i>	4	11.1
<i>Proteus mirabilis</i>	2	5.6
<i>Klebsiella</i> spp	3	8.3
<i>Citrobacter</i> spp.	4	11.1
<i>Staphylococcus epidermidis</i>	2	5.6
<i>Proteus vulgaris</i>	1	2.8
<i>Candida</i> spp	2	5.6

The use of antibiotics was based on the antibiogram, whereas the most used antibiotics according to the antibiogram were, the second generation of cephalosporins, then Co-amoxiclav, Piperacillin/Tazobactam followed by amikacin, gentamycin, levofloxacin and metronidazole.

In eleven patients treatment of infected wounds is done conservatively, while in eighteen patients approach is

performed through surgical procedures such as incision and drainage of foot abscesses, followed by the debridement of necrotic tissue. In other seven patients due to the progression of the disease a more radical approach was needed. So amputation of the fingers is done in five patients while in two others a more extensive intervention such as metatarsal amputation of the foot is done.

Type of Treatment	No. of Patients	Percentage
Conservative	11	30.5
Surgical	25	69.4
Incision Drainage	10	27.7
Debridement	8	22.2
Amputations	7	19.4
		69.4

V DISCUSSION

Diabetic foot disease is more common in older age groups and those with long duration of diabetes. Uncontrolled diabetes results in gradual ischemia and neuropathy, making the feet prone to infection. In our study the mean age of the patients with diabetic foot was 56.4 years while the main duration of diabetes results to be > 10 years. At the same time according to our data diabetic foot disease resulted to be more common in male than in female. The male to female ratio resulted to be 2 : 1. Most other studies also showed a male predominance in DFD^{1,2}. Patients who suffered from diabetes are at risk of developing multiple complications while diabetic foot disease is one the most common problem in these patients^{3,21,22}. The triad of neuropathy, ischemia and infection are the cause of tissue damage which leads to amputation if not treated properly^{4,8}. According to our data result that eleven patients were managed conservatively, while twenty five patients with infection and necrosis of the wound were managed by surgical intervention. Treatment of infected wounds is done through surgical procedures such as incision and drainage of abscesses, followed by the debridement of necrotic tissue. That was performed in eighteen patients, while in other seven patients due to the progression of the disease a more radical approach was needed. So amputation of the fingers is done in five patients while two patients requiring a more extensive intervention, respectively a metatarsal amputation of the foot due to progression of the disease. Our results are similar to some international studies that show the same rate of amputations^{5, 28,29,30}. Some

studies indicated that patients required multiple amputations during treatment^{6, 7}.

The quantitative and qualitative microbial evaluations in our department is performed using swab samples, although today tissue biopsies and fluid aspirates are considered the gold standard for diagnosing wound infections^{9,10}. Cultures in our study were positive in 30 patients (86.1 %), and showed wide range of bacteria; however the most commonest were Staphylococcus aureus, E. coli, Pseudomonas aeruginosa, Klebsiella and Proteus. Most other studies show the contamination of diabetic wounds with the similar types of bacteria^{11, 12, 13}. Isolation of antibiotic-resistant organisms such as MRSA and highly resistant Pseudomonas aeruginosa, is an increasing problem and requires specifically targeted antibiotic therapy^{14,15,16,17,18}.

Usually initial empiric therapy is based on the severity of the infection and on microbiological data, such as recent culture results and the local prevalence of pathogens^{19,20,21}. According to our experience and that of the other centers result that the majority of infections can be treated successfully with antibiotics that have a relatively narrow spectrum of action^{22,23,24}. In cases of severe infections, as well as for more extensive infections, it is recommended to commence with a broad-spectrum antibiotics^{25,26}. These agents should provide activity against GPC, common gram-negative and anaerobic organisms to ensure adequate tissue concentrations²⁷. Antibiotics usually are discontinued while the clinical signs and symptoms of infection have resolved.

VI CONCLUSION

Diabetic foot disease usually is a cause of great morbidity, often leading to lower limb amputations. The most common causes of diabetic foot infections in our study were *Staphylococcus aureus*, *Escherichia coli* and

Pseudomonas aeruginosa. Due to compromised vascularization combined with polymicrobial infection and antibiotic resistance, surgical treatment was necessary in some patients.

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