Risk Factors for Lower Limb Amputations in Diabetic Patients

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ABSTRACT

Background: Diabetes mellitus is a major health problem. Diabetic foot problems are a major complication that can lead to amputation.

Objectives: This study assess the risk factors for lower limb amputation in patients with "diabetic foot" namely ulcer and infection.

Methods: The study performed from January 2011 till January 2014 in Al-Yarmouk teaching hospital, Baghdad, Iraq. A cross-sectional study of a sample of 165 diabetic patients (type 2) who admitted to the hospital with diabetic foot. Patients are cases of complicated diabetes mellitus who had been admitted in the surgical department because of diabetic foot complication including ulceration and infection. Statistical analysis was performed using Chi- square test and independent sample t test. A P-value less than 0.05 was considered statistically significant.

Results: Among 165 patients there were 123(74.5%) males and 42(25%) females. The mean age was (52.21 ± 8.31) years. The prevalence of amputation within the sample was 126(76.3%), from those amputated patients 30 (23.8%) had minor amputation (toe amputation and forefoot and metatarsal amputation), 74(58.7%) below knee and 22(17.4%) above knee amputations.

Conclusion: Infection, ulcer and history of previous ulcer and/or amputation are the main risk factors for lower limb amputation in diabetic patients.

Keywords: Diabetic foot, Infection, Diabetic ulcer, Lower limb amputation, Minor and major amputation, Peripheral vascular disease.

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Diabetes mellitus is now one of the major clinical problems worldwide; especially in the Western countries and the United States[1]. Increasing numbers of patients are registered each year as diabetics (whether they are of type 1 juvenile onset or type 2 maturity onset, gestational or secondary to endocrine problem). Type 2 diabetes prevalence is increasingly reported in fat young adults. It was globally estimated to be 2.8% in the year 2000 (about 171 million patients), and it will be expected to rise to 4.4% (about 366 million patients) in the year 2030[2].

Since "Diabetic foot" is the most common complication of diabetes where surgeons are consulted, we tried in this study to identify the most common risk factors leading to such disastrous complications, especially when it ends with amputation, assessing their rate and role in this problem aiming to prevent or at least decrease the incidence of such national health problem.

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Millions of dollars are needed each year to cover expenses required for hospitalization and treatment of such diabetic feet disorders. Different specialties (a multidisciplinary team approach) are needed to prevent and reduce the frequency of such dramatic complications[3].

The diabetic foot ulcers (DFU) were graded according to Wagner classification: (grade 0: high-risk foot, grade 1: superficial ulcer, grade 2: deep ulcer penetrating to tendon, bone, or joint, grade 3: deep ulcer with abscess or osteomyelitis, grade 4: localized gangrene, and grade 5: extensive gangrene)[4].

——————————Methods

The study performed from 1st of January 2011 till 1st of January 2014 in Al-Yarmouk teaching hospital in Baghdad, Iraq. A cross-sectional study of a sample of 165 diabetic patients (type 2) who admitted to the hospital with diabetic foot. The patients are cases of complicated diabetes mellitus

who had been admitted in the surgical department because of diabetic foot complication including ulceration and infection. Data were reviewed regarding age, sex, history, clinical examination and investigations including x-ray studies, Doppler studies, type of amputation. Risk factors identified include: infection (severe cellulitis, deep abscess, osteomyelitis, gangrene), ulcer (grades 3,4,5), history of previous foot lesion. We exclude other type of ulcer (neuropathic, ischemic or traumatic) from the study. Specimens for culturing were taken and a mixed growth was isolated from all patients.

All patients in the present study were admitted to the surgical department, treated with antibiotic according to culture and sensitivity. Most common regime of antibiotic treatment used in this study included (meronim or cefitrixon, or lincomycin) and metronidazole, accompanied by drainage of any presented abscess and debridement. Duration of this treatment varied from 1 to 2 weeks or more according to patients response. The data was additionally reviewed for level of amputation.

Collected data are classified, tabulated and statistical analysis was carried out using Chi- square test and independent sample t test. A P-value less than 0.05 was considered statistically significant.

Results

A sample of 165 diabetic type 2 patients included in this study, from those patients there were 123 (74.5%) males and 42(25%) females. According to the residence there were 136 (82.4%) live in urban versus 29(17.6%) live in rural.

The mean of age of patients underwent amputation was (52.21 ± 8.31) years while in non-amputated diabetic patients it was (47.93 ± 10.74) years which is statistically significant (P 0.005).

The prevalence of amputation within the sample was 126 (76.3%), from those 30(23.8%) had minor amputations (toe amputation and amputation of forefoot and metatarsal amputation), 74(58.7%) below knee amputation and 22(17.4%) above knee amputations.

From 165 diabetic patients the ulcers were present in 51(30.9%) patients which involved the forefoot in 16(31%) of cases (Figure 1), while 114(69%) patients were suffering from infection were it affected mainly the forefoot in 36 (32%) of cases (Figure 2).

Male gender, previous history of foot lesions, ulcer, and infection were regarded as significant risk factors for amputation (P 0.014), (P 0.005), (P 0.024) and (P 0.003), respectively, (Table 1).

Among amputated patients, DFU was the main risk factors for major amputation with a significant P value (0.000), (Table 2).

Risk of amputation among diabetic patients with foot ulcer and infection increased in the presence of peripheral vascular diseases, (Table 3).

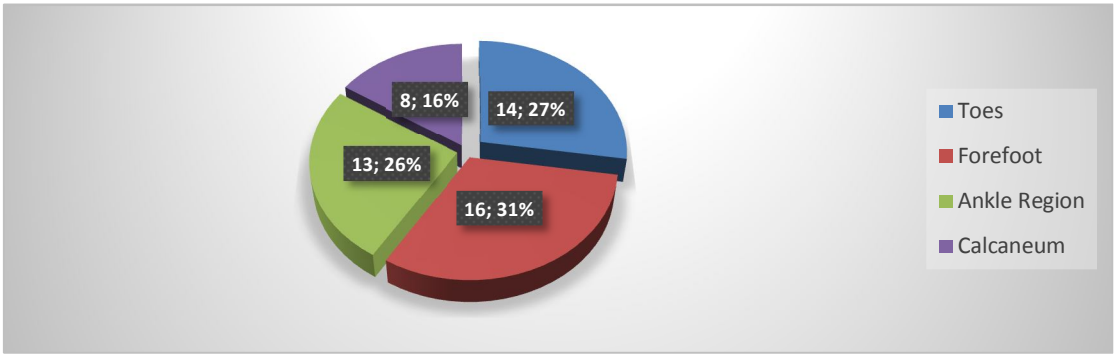

Figure 1: Frequency distribution of the site of the ulcer (n 51).

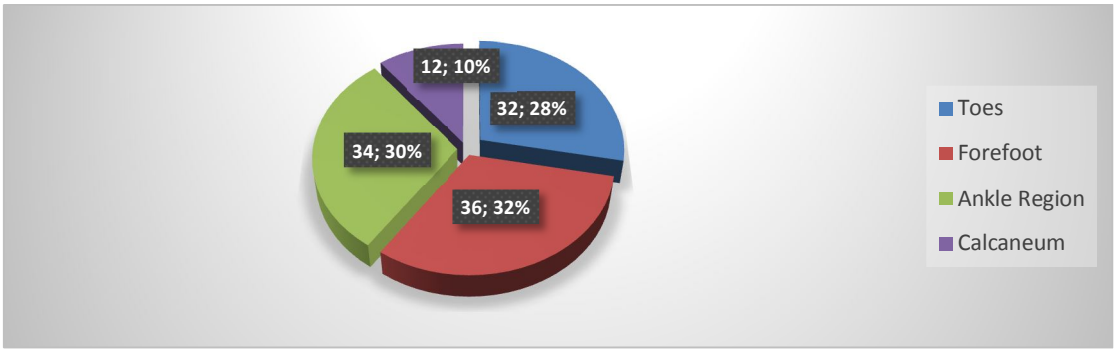

Figure 2: Frequency distribution of the site of infection (n 114).

Table 1: Relationship between the amputation and risk factors (n 165).

Variables		Amputation				*P* Value
		Yes		No		
		Freq.	%	Freq.	%	
Gender	Male	88	71.5	35	28.4	0.014(*)
	Female	23	54.7	19	45.2	
Residence	Urban	91	66.9	45	33.1	0.617(NS)
	Rural	18	62.1	11	37.9	
History of previous foot lesion (ulcer or infection)	Yes	64	58.7	45	41.3	0.005(**)
	No	45	41.1	11	58.9	
Ulcer	Yes	41	80.4	10	19.6	0.024(*)
	No	68	61.3	46	38.7	
Infection	Yes	85	74.5	29	25.5	0.003(*)
	No	26	51	25	49	

*(**NS** Not **S**ignificant) (* Statistically significant at alpha level of < 0.05)(** Statistically significant at alpha level of < 0.01)*

Table 2: Relationship between the type of amputation and risk factors (n 126).

Variables		Type of Amputation						*P* Value
		Minor		Below knee		Above knee		
		Freq.	%	Freq.	%	Freq.	%	
Ulcer	Yes	3	7.3	25	61	13	31.7	0.000(*)
	No	26	38.2	40	58.8	2	2.9	
Infection	Yes	27	31.7	49	57.7	9	10.6	0.355(NS)
	No	5	19.2	17	65.3	4	15.3	

*(**NS** Not **S**ignificant) (* Statistically significant at alpha level of < 0.05)*

Table 3: Relationship between the amputation and risk factors in the presence of peripheral vascular diseases (n 165).

Variables		Amputation				*P* Value
		Yes		No		
		Freq.	%	Freq.	%	
Ulcer with peripheral vascular disease (n 51)	Yes	28	71.7	11	28.3	0.012(*)
	No	4	25	8	75	
Infection with peripheral vascular disease (n 114)	Yes	38	45.2	46	54.8	0.004(*)
	No	5	14.8	25	85.2	

*(**NS** **N**ot **S**ignificant) (* Statistically significant at alpha level of < 0.05)*

Discussion

The prevalence of amputation in the current study was 76.3% (126) out of 165 which is regarded high as compared with the developed countries, in which amputation has a prevalence of about (49.5%) that's may be due to poor glycemic control and restricted health facilities[5]. Most of those diabetic patients had poor foot care and seek medical helps when they reach an advanced stage of foot infection or ulceration that is difficult to be controlled without minor or major amputation. Such critical decision has its own impact on their lifestyle, socioeconomic status, job allowance and on their families[6,7].

In the current study analysis, male diabetic patients are subjected to amputations significantly higher than females. This fact is consistent with other studies[8-11]. Such significant sex variation observed in our analysis is related to job-circumstance, heavy physical stress, non-compliance with drugs, diet regimens and excessive work-related exposure to trauma and unfit shoes. Such findings were not observed by Elivera cancino et al[12], their study showed that female diabetic patients represented 75% of their total number of patients that had an amputation. There was no significant association between residence and amputation in our study.

The prevalence of amputation found to be increased with progressing in age and it was statistically significant (P=0.005), with a mean age of (52.2±8.3) years in amputated patients versus (47.9±10.7) years in non-amputated patients. Studies all over the world revealed that the risk of amputation in diabetic patients increases with age[13,14]. In a study performed by Alexandra Alvarson et al[8] the mean age for amputation in Swedish diabetic patients were 81 years (median: 83, range: 57-96), this has been attributed to better health services in Sweden, well-educated community, and better living standards of Swedish diabetic patients.

In the present study 51 (30.9%) out of 165 patients presented with ulcer, involving the forefoot 16(31%), toes 14(27%)and ankle region 13(26%) and calcaneum 8(16%). According to Wagner classification the patients in this study was (grade 3,4,5). Forty one patients out of 51 underwent lower limb amputation. The risk to perform amputation was significantly influenced by the presence of foot ulcers (80.4%) with (P 0.024).

Also, the presence of ulceration significantly increased the proportion of above and below knee amputations (31.7% and 61%) as compared with those without ulceration (2.9% and 58.8%) with a P value of 0.000. This result is consistent with other studies by Van Houtum WH et al[10] and Pemayun TG et al[15] which showed that up to 85% of diabetic patients with poor healing ulcers proceeded to lower limb amputation. In current paper we observe that presence of peripheral vascular disease among the diabetic patients with ulcers increase the proportion of amputation as 39 patients out of 51 with

ulcer have peripheral vascular disease and 28(71.7%) of these patient ended with amputation. This is statistically significant with (P value 0.012) as the peripheral vascular disease prevent healing of ulcer. This result was also observed by Boulton AJ et al[1] and Al-Rubeaan K et al studies[13] which considered peripheral vascular disease increases the risk of amputation significantly among patients with diabetic foot ulcer. The higher rate of amputation in our diabetic patients with ulcer was related to deficiency in specialized diabetic foot centers, also most of our patients never search medical help when foot ulcer grade 1 or 2 and can be treated and reduce the risk of amputation, poor patient compliance and restricted health services.

The risk to perform amputation was significantly influenced by presence of previous history of foot ulcers and /or amputation with a P value (0.005). Although this result is consistent with other studies including Elivera cancio et al[12], Dos santos et al[5] Martins-Mendes D et al[16], which showing that the presence of history of previous ulcer; when related to amputation, was considered a significant risk factor. Abofazal Shojaiefard et al study implies that history of previous ulcer and/or amputation not a risk factor for amputation and it is related to advance ischemia, poor hygiene and uncontrolled hyperglycemia[17].

Foot infection can threat a limb of diabetic patients especially when associated with bone infection or sepsis[18]. In the present study 114 (69%) patients from the total number of patients in the study (165) presented with foot infection and most of these infections affected the forefoot (36;31%), ankle region (34;30%), and toes (32;29%). From all patients with infection in the present study, 85(74.5%) patients progress to lower limb amputation. The analysis of present paper reveals that infection is a significant risk factor predisposing our diabetic patients to amputation with a (P- value 0.003). This result was reported by other studies including Al-Rubeaan K et al[13], Carlson T et al[19], Treece KA et al[20], Oyibo SO et al[21]. The result of the present study is not consistent with Iranian study by Abolfazl et al[17], Pemayun TG et al [15] which showing that infection cannot be regarded as a significant risk factor for lower limb amputation in diabetic patients with foot infection. The explanation for such differences in this related to better life quality, better foot care and follow up for diabetic foot lesions (debridement, drainage, dressing) in specialized outpatient centers in order to reduce the amputation rate among these diabetic patients. In the present study 38 patients out of 85 patients with foot infection have a peripheral vascular disease and they proceeded to amputation. This result is statistically significant with a (P value 0.004), and agree with other study by Armstrong et al[22] which showing that diabetic patient with foot infection and vascular insufficiency have a probabilities of lower limb amputation up to 90 times more than diabetic patient without peripheral vascular disease and foot infection.

The present study also shows that despite infection was considered as a significant risk factor predisposing diabetic patients for amputation, it does not affect the level of amputation (P 0.355).

In conclusion; infection and ulcer were considered as a risk factors for lower limb amputation in patients with "diabetic foot" especially when associated with peripheral vascular disease, also the history of the presence of previous ulcer and/or previous amputation considered a risk factors for amputation in diabetic foot patients.

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