Risk Factor Analysis in Diabetic Foot Ulcer Patients

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Abstract:

Purpose: To determine retrospectively various risk factors leading to the development of Diabetic Foot ulcer (DFU).

Methods: A retrospective analysis of 250 Diabetic patients, who had attended the Surgical OPD during a one year period from feb 2017 to feb 2018 was conducted. Among them 150 had DFU and 100 did not have DFU(NDFU). Various aspects like patient age and gender, duration and control of DM, history of smoking, type of occupation of the patient and presence of peripheral neuropathy by clinical examination were analyzed as possible risk factors.

Results: The prevalence of DFU was higher among males (86.7%) compared to females (13.3%) with p value of 0.001249. Among DFU patients a significantly greater number of patients had DM for > 10 years (60%, p value <0.00001), Hb_{A1c} values >7.5% (88%, p value <0.00001), history of smoking (68.5%, p value <0.00001), presence of peripheral neuropathy (65.3%, p value 0.00) and had manual labour as occupation (85.3%, p value<0.00001), compared to non-DFU patients.

Conclusion: Male sex, longer duration and poor control of DM, improper foot care, smoking and peripheral neuropathy increase the risk of developing DFU. Hence increased patient awareness and regular physician screening are important to prevent as well as reduce the morbidity and mortality due to DFU.

I. Introduction:

India is called 'diabetic capital' since highest number of diabetics are detected in India. The diabetic population has been predicted to increase to 57 million by 2025 [1]. Diabetic foot ulcers (DFU), a complication of diabetes is likely to increase in the near future in our country especially among low socio economic groups. Treatment of DFU involves control of diabetes, repeated dressings, antibiotics, plastic surgery procedures like flaps or split skin grafts wherever needed and amputations also in some patients. DFU treatment is going to be a big burden for govt hospitals and medical college hospitals providing free treatment. It is going to be one of the leading causes for the man-hours lost. Early detection and treatment can definitely reduce the morbidity and mortality associated with this condition [2]. With this in mind, we analyzed the risk factors retrospectively in DFU patients, in order to enable early detection and treatment for patients in future.

II. Materials And Methods

In a retrospective study of DFU patients treated in our hospital for one year in 2017 were analysed for the risk factors .150 patients of DFUs and 100 diabetic patients without DFU (hereafter mentioned as NDFUs) who presented to our department for other causes were taken as a control. All of them had undergone proper clinical examination, necessary investigations like blood sugar, RFT, X-ray and Hb_{A1c} (glycosylated haemoglobin).Doppler study was done in cases that needed flaps or those who were taken up for below knee amputation. Peripheral neuropathy was assessed by proper documentation on loss of touch (using cotton swab and also fingers of the examiners over all toes, dorsum and sole of feet) and temperature sensations over the foot area by clinical exam. Age, sex, duration of diabetes before the onset of DFUs, glycosylated haemoglobin levels at the time of their first visit to our hospital, smoking habits, type of job of the patient and presence of neuropathy were taken up for analysis as risk factors. The association between DFU and each of the risk factors was determined by the Chi square test. The results were considered significant when the p value was <0.05.

III. Results

1.   Age was not significantly related to the risk of DFUs in our study group. However among the DFU patients males were significantly more (86.7%) compared to females (13.3%). This was found to be statistically significant with a p value of 0.001249.

Table 1: Association of age with Diabetic foot ulcer

Age / Presence of Diabetic foot ulcer	< 30 years (n=38)	30-40 years (n=120)	40-50 years (n=92)	Total
Diabetics with foot ulcer (n=150)	20 (13.3%)	70 (46.7%)	60 (40%)	150 (60%)
Diabetics without foot ulcer (n=100)	18 (18%)	50 (50%)	32 (32%)	100 (40%)
Total	38 (15.2%)	120 (48%)	92 (36.8%)	250 (100%)
Chi square= 2.042	p value= 0.360232			

Table. 2: Association of gender with Diabetic foot ulcer

Gender / Presence of Diabetic foot ulcer	Males (n=200)	Females (n=50)	Total
Diabetics with foot ulcer (n=150)	130 (86.7%)	20 (13.3%)	150 (60%)
Diabetics without foot ulcer (n=100)	70 (70%)	30 (30%)	50 (20%)
Total	200 (80%)	100 (40%)	250 (100%)
Chi square= 10.4167	p value= 0.001249		

2. Duration of diabetes

In our study, 50 out of 150 DFU patients(33.3%) were diabetic for a period between 5 to 10 years .another 65 out of 150 DFU patients were diabetic for 10 to 15 years(43.3%). 25 patients had DM for more than 10 years (16.7%) and only 10 patients (6.7%) had DM for less than 5 years. This distribution was significant with a p value of <0.00001.

Table. 3: Association of Duration of DM with Diabetic foot ulcer

Duration of DM / Presence of diabetic foot ulcer	<5 years	5-10 years	10-15 years	>15 years	Total
Diabetics with foot ulcer (n=150)	10 (6.7%)	50 (33.3%)	65 (43.3%)	25 (16.7%)	150 (60%)
Diabetics without foot ulcer (n=100)	56 (56%)	32 (32%)	11 (11%)	1 (1%)	100 (40%)
Total	66 (26.4%)	82 (32.8%)	76 (30.4%)	26 (10.4%)	250 (100%)
Chi square= 90.1397		p value<0.00001			

3. Glycosylated haemoglobin levels at the time of first visit

All patients had undergone estimation of Hb_{A1c} levels at the time of their first visit.DFU patients were divided into two groups—those with Hb_{A1c} > 7.5% and those with a value < 7.5%. 132 out of 150 patients (88%) of the DFU patients were having Hb_{A1c} > 7.5% and 18 (12%) had Hb_{A1c} < 7.5%. Among those without DFU, 18 (18%) only had Hb_{A1c} >7.5% while 82 patients (82%) had Hb_{A1c} < 7.5%. The higher values of Hb_{A1c} among DFU patients was found to be statistically significant with a p value <0.00001.

Table. 4: Association of Hb_{A1c} at the time of first visit/admission with Diabetic foot ulcer

Hb_{A1c} values / Presence of Diabetic foot ulcer	<7.5%	>7.5%	Total
Diabetics with foot ulcer (n=150)	18 (12%)	132 (88%)	150 (60%)

Diabetics without foot ulcer (n=100)	82 (82%)	18 (18%)	100 (40%)
Total	100 (40%)	150 (60%)	250 (100%)
Chi square= 122.5		p value <0.00001	

4.   Type of job

Among the patients with DFU, 128 (85.3%) were manual labourers and 22 (14.7%) were not. Among those without foot ulcer, 57 (57%) were manual labourers and 43 (43%) belonged to other occupations. Diabetic foot ulcer was found to be significantly higher among manual labourers with a p value < 0.00001.

Table.5: Association of type of occupation of the patient with Diabetic foot ulcer

Occupation Presence of Diabetic foot ulcer	Manual laborers	Other occupations	Total
Diabetics with foot ulcer (n=150)	128 (85.3%)	22 (14.7%)	150 (60%)
Diabetics without foot ulcer (n=100)	57 (57%)	43 (43%)	100 (40%)
Total	185 (74%)	65 (26%)	250 (100%)
Chi square= 25.0347		p value <0.00001	

5.   Smoking as a risk factor

Only males were smokers in our study population. 89 out of 130 males (68.5%) with DFU were smokers for a long duration whereas only 16 (22.8%) DM patients in NDFU group were smokers (16 out of 70 male patients). This history of smoking among DFU patients was found to be statistically significant with a p value <0.00001.

Table.6: Association of smoking with Diabetic foot ulcer

History of smoking Presence of Diabetic foot ulcer	Smokers	Non-smokers	Total
Diabetic males with foot ulcer (n=130)	89 (68.5%)	41 (31.5%)	130 (65%)
Diabetic males without foot ulcer (n=70)	16 (22.8%)	54 (77.2%)	70 (35%)
Total	105 (52.5%)	95 (47.5%)	200 (100%)
Chi square= 37.9465		p value <0.00001	

6.   Peripheral neuropathy

98 (65.3%) patients in DFU group had varying degrees of neuropathy while 52 (34.7%) had no neuropathy. Only 16 out of 100 patients (16%) had peripheral neuropathy in NDFU. These were found to be statistically significant with a p value of about 0.00.

Table.7: Association of peripheral neuropathy with Diabetic foot ulcer

Presence of peripheral neuropathy Presence of Diabetic foot ulcer	Peripheral neuropathy present (n=114)	Peripheral neuropathy absent (n=136)	Total
Diabetics with foot ulcer (n=150)	98 (65.3%)	52 (34.7%)	150 (60%)
Diabetics without foot ulcer (n=100)	16 (16%)	84 (84%)	100 (40%)
Total	114 (45.6%)	136 (54.4%)	250 (100%)
Chi square= 58.8665		p value = 0.00	

7. Ischemia

Reduced blood flow is proven to be a risk factor as per literature. Since Doppler study was done in only a few patients in our study group, it was not analysed.

IV. Discussion

Foot ulcer is a disabling complication in patients with DM. The disability and possible progression to the loss (amputation) of digits and limbs make it a serious issue [3]. In our study, age was not a significant risk factor in both groups, in agreement with the study by Al Kafrawy *et al* [4].We found significantly more male patients to be more affected with foot ulcers, similar to the cross-sectional studies carried out by Frykberg *et al*. who found that male sex was identified as a risk factor for DFUs [5]. We observed that the duration of diabetes was significantly higher in DFU patients ($P < 0.001$). This is in agreement with other studies that showed that long duration of diabetes was the main factor causing DFUs [6, 7]. Smoking was a significant risk factor for DFU in our study. This is similar to the study of Moss *et al*. [8]. In this study, peripheral neuropathy was found to be significant in patients with DFU. Previous studies have also shown that peripheral neuropathy is a strong independent risk factor for the development of DFU [9, 10]. Elevated levels of HbA1c were observed in patients with DFU. Previous studies have also shown that HbA1c was a contributory factor for DFU [7, 11]. In our study manual labourers were found to have an increased risk of developing foot ulcers compared to other occupations. This can be attributed to the lack of awareness regarding proper foot care among them. Various studies from other developing countries such as Nigeria and Iran also showed poor awareness regarding foot care [12, 13].

Male sex, poor control and longer duration of DM, smoking, peripheral neuropathy and poor awareness of foot care increase the risk of diabetic foot ulcer. Therefore it is important to increase community awareness regarding control and complications of DM, proper foot care and seeking medical attention early. Periodic examination of the foot by the patient as well as by primary health care provider is a must in all patients with diabetes, to ensure early detection of complications of DM. An increased patient awareness coupled with regular physician reinforcement is needed to reduce the gap in the knowledge of foot care among the diabetics and to reduce the risk of DFUs and amputations.

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