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Comparison Of Predictive Value Of Risk Of Amputation In Diabetic Foot Ulcer Using Megitt - Wagner System Alone And Megitt - Wagner System With Arterial Doppler.

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ABSTRACT

Identifying and selecting treatment options for DFUs, as well as improving communication between medical experts, depend heavily on classification system. The purpose of the study was to evaluate the predictive value of the risk of amputation in diabetic foot ulcer patients using Meggitt Wagner system alone and Meggitt Wagner system with arterial Doppler in patients presenting with diabetic foot ulcer. The study population consists of 118 Patients with Chronic Diabetic Foot who had been admitted to surgical wards and attended to OPD of KC General Hospital Bangalore between January 2019 to August 2020. IBM SPSS statistics software version 16 was used to analyse the collected data. Out of 118 patients analyzed, 45 patients underwent amputation. Megitt-Wagner's classification revealed that group 3 contained the majority of cases, irrespective of gender. However, grade 4, which accounts for 53.3% of patients, had a higher incidence of diabetic foot amputations. Similarly, amputation of diabetic foot was observed more among monophasic patients which accounting for 95.6%% cases. By classifying the diabetic foot lesions using Megitt-Wagner's classification system and integrating the Arterial Doppler into the model, the most appropriate course for treatment can be established.

Keywords: Diabetic foot ulcers, Lower limb amputation, Grading.

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INTRODUCTION

Diabetes mellitus ranks among the primary factors leading to lower limb amputation. There is considerable importance in recognizing and addressing predictive risk factors to prevent or reduce disability and the potential medical care costs associated with lower extremity amputations [1, 2]. Approximately 15% of patients are anticipated to develop a foot ulcer during their lifetime [3]. Annually, around 1–4% of diabetic patients develop Diabetic Foot Ulcers (DFUs), with a maximum of 25% experiencing DFUs over the course of their disease [4]. The prevalence of diabetic foot ulceration ranges from 4% to 27% [5].

Classification systems for DFUs play a crucial role in assessing and choosing treatment options, as well as enhancing communication among healthcare professionals. In addition, these classification systems play a significant role in establishing uniformity and consistency in the assessment of prognoses related to diabetic foot ulcers (DFUs). This standardization not only enhances the precision of prognostic estimates but also facilitates the identification of patients requiring specialized care based on the specific criteria outlined by the classification system [6].

In this study we will make an attempt to compare the predictive value of risk of amputation in diabetic foot ulcer patients using Meggitt Wagner system alone and Meggitt Wagner system with arterial Doppler in patients presenting with diabetic foot ulcer to the Department of General surgery at K C General Hospital Bangalore.

MATERIAL AND METHODS

The study population consists of 118 Patients with Chronic Diabetic Foot, aged between 37 to 60 years who had been admitted to surgical wards and attended to OPD of KC General Hospital Bangalore (during the two year study period January 2019- August 2020). KC General Hospital receives large number of diabetic foot patients. Patients with symptoms of diabetic foot who met the inclusion and exclusion criteria shall be included for the study after obtaining informed consent.

Inclusion Criteria

- Age limit: 40-70years.
- All subjects suffering from Diabetes mellitus as per WHO criteria who have foot ulcers.

Exclusion Criteria

- All patients with less than two follow up visits during observation period.
- Non diabetic neuropathic ulcers
- Traumatic foot ulcers in diabetic patients
- All non-diabetics with foot ulcers.

History of onset progression and duration of the symptoms was observed. Past, personal history was asked, general, systemic, and local examinations was done. Laboratory investigations like Hemogram, RFT, and Urine routine examination was done. Meggitt wagner score (Table 1) and Meggitt wagner score with arterial Doppler was applied to predict the outcome of diabetic foot amputation was compared and noted. Treatment was carried out in both medical and surgical means.

Study Variables

- Mean diabetic age.
- HBA1C.
- Ulcer grade.

Table 1: Meggitt-Wagner classification for diabetic foot disease [7]

GRADE	FEATURES	TREATMENT
Grade 0	Foot at Risk	Prevention
Grade 1	Localized, superficial ulcer	Antibiotics and Glycemic control
Grade 2	Deep ulcer to bone, ligament or joint	Debridement, Antibiotics and Glycemic control
Grade 3	Deep abscess, osteomyelitis	Debridement, some form of amputation
Grade 4	Gangrene of toes, forefoot	Wide debridement and amputation
Grade 5	Gangrene of entire foot	Below knee amputation

Statistical Analysis

Clinical and biochemical evaluations were performed after obtaining informed consent. Final analysis was done after collecting the complete data for 118 subjects. All the data was entered in Microsoft excel sheet and analyzed with appropriate statistical tools. For statistical analysis, SPSS for Windows, version 16.0 (SPSS Inc., Chicago, Ill., USA) was used. The student "t" test was employed to determine the significance of study parameters on a continuous scale between the two groups. Descriptive statistics including frequency and percentage were used to describe the categorical data and analysed by using chi square test. A p-value <0.05 was considered as statistically significant.

RESULTS

Table 2: Comparison of demographic and clinical characteristics based on gender among the study population

Variables	Distribution	Sex		Total	P value
		Female	Male		
Age	<40 Years	5 (12.8%)	8 (10.1%)	13 (11.0%)	0.533 (NS)
	41-50 Years	19 (48.7%)	32 (40.5%)	51 (43.2%)	
	51-60 Years	15 (38.5%)	39 (49.4%)	54 (45.8%)	
	Mean Age	50.62 ± 7.01	51.39 ± 7.08	51.14 ± 7.03	
HbA1c	<6.5	22 (56.4%)	50 (63.3%)	72 (61.0%)	0.706 (NS)
	6.5-9	11 (28.2%)	17 (21.5%)	28 (23.7%)	
	>9	6 (15.4%)	12 (15.2%)	18 (15.3%)	
	Mean HbA1c	6.95 ± 1.84	6.75 ± 1.99	6.81 ± 1.94	
Diabetic Type	I	0 (0%)	3 (3.8%)	3(2.5%)	0.296 (NS)
	II	39(100%)	76 (96.2%)	115 (97.5%)	
Duration of Diabetes	1-5 years	27 (69.2%)	39 (49.4%)	66 (55.9%)	0.242 (NS)
	6-10 years	7 (17.9%)	24 (30.4%)	31 (26.3%)	
	11-15 years	4 (10.3%)	13 (16.5%)	17 (14.4%)	
	>15 years	1 (2.6%)	3 (3.8%)	4 (3.4%)	
Meggitt-Wagner's Classification	Grade 0	1 (2.6%)	7 (8.9%)	8 (6.8%)	0.530 (NS)
	Grade 1	6 (15.4%)	11 (13.9%)	17 (14.4%)	
	Grade 2	9 (23.1%)	19 (24.1%)	28 (23.7%)	
	Grade 3	16 (41.0%)	21 (26.6%)	37 (31.4%)	
	Grade 4	6 (15.4%)	18 (22.8%)	24 (20.3%)	
	Grade 5	1 (2.6%)	3 (3.8%)	4 (3.4%)	
Meggitt-Wagner's and Doppler	Monophasic	14 (35.9%)	29 (36.7%)	43 (36.4%)	0.970 (NS)
	Biphasic	4 (10.3%)	7 (8.9%)	11 (9.3%)	
	Triphasic	21 (53.8%)	43 (54.4%)	64 (54.2%)	

This study consists of 118 patients (79 males and 39 females) with type 2 diabetes includes both rural and urban subjects between 37-60 years of age inclusive. The mean age of the subjects was 51.14 ±

7.03 years (males 51.39 ± 7.08 years and females 50.62 ± 7.01 years). The maximum numbers of patients were found to be in the age group of 51-60 years.

Table 2 shows the distribution of age, HbA1c, diabetic type, duration of diabetes, Megitt-Wagner's Classification and Megitt-Wagner's Classification with Doppler based on gender among the study population. Patients with diabetes for one to five years accounted for the greatest number of cases. The means and standard deviations of HbA1c in males and females 6.75 ± 1.99 , 6.95 ± 1.84 , respectively. In the present study, mean HbA1c values are more in female (6.95 ± 1.84) than male subjects (6.75 ± 1.99). The results showed no significant gender differences in the study population.

According to Megitt-Wagner's classification, the greatest number of patients, regardless of gender, were discovered to be in group 3. But amputation of diabetic foot was observed more among grade 4 which accounting for 53.3% cases (Table 3). In both genders, we discovered that the greatest proportion of patients belonged to the triphasic category. But amputation of diabetic foot was observed more among monophasic patients which accounting for 95.6% cases (Table 4).

Table 3: Treatment recommended as per Megitt- Wagner Classification

Treatment	Megitt-Wagner's Classification						Total
	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	
Antibiotics	7 (41.2%)	8 (47.1%)	2 (11.8%)	0 (.0%)	0 (.0%)	0 (.0%)	17 (100.0%)
Amputation	0 (.0%)	1(2.2%)	0 (.0%)	16 (35.6%)	24 (53.3%)	4 (8.9%)	45 (100.0%)
Debridment	1(2.1%)	0 (.0%)	26 (54.2%)	21 (43.8%)	0 (.0%)	0 (.0%)	48 (100.0%)
Incision and Drainage	0 (.0%)	6 (100.0%)	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)	6 (100.0%)
SSG	0 (.0%)	2 (100.0%)	0 (.0%)	0 (.0%)	0 (.0%)	0 (.0%)	2 (100.0%)
Total	8 (6.8%)	17 (14.4%)	28 (23.7%)	37 (31.4%)	24 (20.3%)	4 (3.4%)	118 (100.0%)

Table 4: Treatment executed including arterial Doppler into Megitt- Wagner Classification

Treatment	Megitt-Wagner's and Doppler			Total
	Monophasic	Biphasic	Triphasic	
Antibiotics	0 (.0%)	1 (5.9%)	16 (94.1%)	17 (100.0%)
Amputation	43 (95.6%)	0 (.0%)	2 (4.4%)	45 (100.0%)
Debridment	0 (.0%)	10 (20.8%)	38 (79.2%)	48 (100.0%)
Incision and Drainage	0 (.0%)	0 (.0%)	6 (100.0%)	6 (100.0%)
SSG	0 (.0%)	0 (.0%)	2 (100.0%)	2 (100.0%)
Total	43 (36.4%)	11 (9.3%)	64 (54.2%)	118 (100.0%)

DISCUSSION

A usual adverse consequence of long-term diabetes mellitus is diabetic foot ulcers. Over the course of their lives, up to 25% of DM patients develop diabetic foot ulcers. Ulceration and potential limb amputation are frequent consequences of diabetic foot disease, which is primarily attributed to factors such as neuropathy, peripheral vascular disease, and/or infection [1, 2, 8].

The mean age of the study population was 51.14 ± 7.03 years, among males it was 51.39 ± 7.08 years, and among females it was 50.62 ± 7.01 years (p value = 0.575) whereas according to Mohan A et al. (2021), mean age of the study population was found to be 55.48 ± 10.74 years [9] and according to Younis BB et al. (2018), mean age in male and females was 52.76 ± 11.31 years and 49.05 ± 10.08 years respectively. Additionally, they stated that the results of their study indicate that women are more likely than men to get diabetes at a younger age [10].

The patients amputated in our study were patients with diabetes for one to five years accounted for the greatest number of cases (62.2%) and age group of 41-50 years which accounts for 53.3% of cases. 45 out of 210 patients (21.4%) with diabetic foot lesions require significant amputation, according to Miyajima et al. They also mentioned that hemodialysis, HbA1C, and multiple stenosis associated with atherosclerosis obliterans are risk factors for major amputation [11]. In the present study, we reported that the 45 out of 118 patients had amputation which accounts for 38.14% of cases.

A comparable research by Younis BB et al. revealed significant association of diabetic foot ulcer with age, duration of diabetes, HbA1C, peripheral neuropathy and peripheral arterial disease [10]. Indications of Wagner grades 4 and 5 ulcer indicate the existence of either diffuse or localised gangrene, typically resulting from a confluence of infection and ischemia [12-16]. Our research revealed a very substantial correlation between grade 3 and 4 ulcers and amputation and 53.3% of the patients were found to be in grade 4. However, the study conducted by Mohan A et al. has shown a high correlation between grade 4 and 5 ulcers and diabetic foot amputation [9].

According to the findings of Mohan A *et al*, in arterial Doppler examinations, none showed monophasic flow at presentation, but seven (14%) did at three months. Biphasic flow was present in 30 (60%) and 26 (52%) of the patients on day 1 and month 3, respectively. He also mentioned that 20 patients (40%) and 17 patients (34%), respectively, exhibited triphasic flow on day 1 and month 3. Before undergoing major surgery, Doppler scans of all 4 (8%) patients showed monophasic flow [9].

Those who have absent or monophasic peripheral flow on Doppler are at a significant risk of amputation in the future. Monitoring the ulcer grade of individuals with normal triphasic or biphasic flow is recommended. Grades 4 and 5 have an 80% likelihood of being amputated, while grade 0, 1, 2, or 3 limbs have a more than 95% chance of being preserved.

A biphasic or triphasic limb with improved peripheral perfusion significantly lowers the risk of amputation. There is a 20% possibility of limb conservation even in people whose limbs are grade 4 or 5.

Limitation of the study

This was a short-term study on a limited number of cases. Studies with longer follow-up periods and a large number of patients are suggested to validate our results.

CONCLUSION

Appropriate treatment can be chosen by grading the diabetic foot lesions in accordance with Megitt Wagner's categorization and incorporating the Arterial Doppler into the model. The severity of diabetic foot can be decreased by patient awareness and strict glucose management. Reducing morbidity and mortality and improving the course of the disease can be achieved through early diagnosis, hospitalization, and appropriate medical and surgical care based on the grade.

Amputation is required in accordance with the Megitt Wagner categorization grade 3 clinical assessment. We were able to prevent these amputations in grade 3 patients with triphasic/biphasic flow by incorporating Arterial Doppler into Megitt Wagner. Limb salvage is still possible with serial debridements, adequate antibacterial treatment, and glycemic management.

Ethical Approval: The study protocol was approved by the Institutional Ethics Committee of K.C. General Hospital, Malleshwaram, Bangalore. All patients provided written informed consent.

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Conflicts of Interest: The authors have no conflicts of interest to declare.

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