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Peripheral vasculopathy in patients with diabetic foot in tertiary care hospital
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Abstract
Background: Diabetes mellitus(DM) is characterized by high blood sugar levels over a prolonged period due to alteration in either insulin secretion, insulin action, or both. Worldwide, as of the recent data collected from the World Health Organization (WHO) around 422 million adults have DM which is estimated to almost doubled by 2030 , mainly type 2 diabetes . The early detection of peripheral vascular disease in asymptomatic patients goes a long way in reduction of major and minor lower limb amputations and mortality. Hence, there is a need for evaluation of peripheral vascular disease (PVD) in all diabetics, especially those with diabetic foot by formulating effective management protocols, thereby limiting the morbidity, mortality and social costs associated with the disease. **Methods:** Patients who are admitted for diabetic foot ulcers between January 2017 and June 2018 in Department of General Surgery , ESIC MC & PGIMSR , Rajajinagar ,Bengaluru, India were taken for study. **Results:** 100 cases satisfying the inclusion criteria were taken up for the study from January 2017 to June 2018. Study population contains predominently(68%) male patients . Out of 100 patients, 49 patients presented with pain as their most distressing symotom .Ankle brachial pressure index is less than 0.9 in 52 patiens and less than 0.3 in 06 patients. 62 Patients have documented abnormal blood flow in doppler study and CT angiogram due PVD. Most common site of block is femoropopliteal artery and collaterals are developed around the knee joint. Athersclerosis is the cause of PVD in 87% of patients.**Conclusions:** The prevalence of peripheral artery disease in patients with diabetic foot is significantly high i.e. 62 % as per this study. Males have a higher predilection for developing peripheral vascular disease than females. The average age of presentation of PAD in diabetics is 40 -60 years. The most common level of arterial occlusion in PAD associated diabetic foot is femoro-popliteal segment followed by tibial segment. Due to high prevalence of PVD mortality and morbidity is are significantly high these patients.
Keywords: Diabetic foot, Peripheral vascular disease, diabetes mellitus.

Introduction

The prevalence of diabetes mellitus is growing at epidemic proportions worldwide[1]. An estimated 20% of urban Indians and 10% of rural Indians are afflicted with diabetes and with the longevity of this population increasing, the prevalence of diabetes related complications are continue to rise at an alarming rate. Diabetic Foot (DF) diseases are a major source of morbidity and a leading cause of hospitalization for persons with diabetes. Ulceration, infection, gangrene, and amputation are significant complications of the disease, estimated to cost billions of dollars each year. DF disease is the leading precursor to lower extremity amputation in diabetic patients[2]. Clinicians must determine how to more effectively preventulceration. Although not all diabetic foot disorders can be prevented, it is possible to effect dramatic reductions in their incidence and morbidity through appropriate evidence-based prevention and management protocols.Diabetes is a major contributing factor in up to 70% of lower limb amputations. In majority of diabetic patients, the underlying factor contributing to eventual amputation is diabetic foot ulcer. The burden of diabetic foot disease and ulceration is set to increase further due to the co-existence of contributory co morbidities including peripheral

vascular disease and peripheral neuropathy. Lower extremity amputation is twice with diabetes compared with non-diabetic persons, affecting 30% of subjects with diabetes 40 years and older. Foot ulcers cause substantial emotional, physical, productivity and financial losses. More than 60% of the diabetic foot ulcers have insufficient blood flow due to peripheral vascular disease. The atherosclerotic disease is usually manifested below the popliteal artery and involves one or more of the three lower-leg arteries: the femoral artery, the posterior tibial artery and dorsalispedis artery.There is an increased prevalence of PVD among individuals with diabetes in both the sexes compared with non-diabetic individuals[3]. In epidemiologic studies, PVD (Peripheral Vascular Disease) is commonly measured as intermittent claudication, the symptom of cramping calf pain introduced by walking and relieved by rest, the absence or marked impairment of at least one major arterial pulse. Prevalence of PVD more among poorly controlled diabetes[4].The risk factors of PVD in the general population including hypertension, elevated cholesterol, tobacco use, smoking habits also contribute[5].Complications affecting the lower limb are among the most common manifestations of diabete. Foot tissues can become ischemic because of macrovascular disease (atherosclerosis) but can also be complicated by associated microvascular disease[6]. Neuroishaemia is a leading cause for many Diabetic Foot Ulcers[7]. Diabetic complications have become a serious issue in India and the dramatic rise in the number of patients with diabetes has exacerbated this problem. However, awareness of on serious health condition,

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namely, diabetic foot disease is inadequate among patients and healthcare providers.

Materials and Methods

The study design is a observational study, conducted at ESIC MC & PGIMSR, Rajajinagar , Banglore. Patients admitted with Diabetic Foot in the ward are included in the study.100 patients are included in the study. Before starting the study Institutional Ethical Comittee approval is taken and consent is taken from patients after explaining procedure in detail.Data collected including demographic factors age, gender, occupation and history of hypertension, history of smoking and duration of diabetes. Patient is examined important clinical findings pertaining to peripheral vascular disease are collected. Ulcers are examined and   graded by Wagner's classification. Vascular system is evaluated by imaging using doppler and CT angiogram. Diabetic foot   patients with associated with venous ulcers, trauma and lymphoedema are excluded from the study.

Patient is treated with debridement, antibiotics based on culture and sensitivity, minor and major ampuations based on severity of DF.

Some of the patients are referred to higher centre for vascular surgeon opinion and intervention.

Statistical Analysis

Numerical data will be expressed Mean+/- SD   whereas non numerical data as frequency   and proportion (percentage). Categorical data will be expressed by Bar graph or Pie chart. P value < 0.05 will be considered as statistically significant and statistical package SPSS 21.0 will be used for analysis.

Results

In our study majority 68 out 100 patients are males . Diabetic foot complications are frequent among males.   Most of the patients presented in fifth and sixth decade of their lives. 98% of patients had type 2 diabetes. 49 people presented with claudication pain as their main symptom and classified according to Boyd's classification as shown in the table 1. 17 patients already had rest pain at the time of presentation which indicates more advanced disease. Ulcer paraesthesia and gangrene are the other frequent symptoms present in these patients.

Table 1: Severity of Pain

Claudication Pain	Number of Patients
No	51
Boyd's 1	15
Boyd's 2	08
Boyd's 3	09
Rest Pain	17

On clinical examication of patients , 52 patients in the study group had ankle brachial pressure index (ABPI) below 0.9, as shown in the table 2. It is a clinical sign which suggests vascular compromise the need of further workup of vascular system. Along with peripheralvascular disease patients found to have coronary artery disease ,retinopathy and nephropathy as vascular comorbidities on further evaluation.

Table 2: ABPI of Patients

ABPI	Number of Patients
>0.9	48
0.5-0.9	29
0.3-0.5	17
<0.3	06

All 100 patients underwent dopplerstudy   and CT angiogram   . Among them 62 people had compromised blood flow in peripheral blood vessels. Most of these patients belongs to fifth decade . So 62% of study population had documented PVD , its incidence rises to 74.2% in fiffth decade as shown in table 3. Our study also shows incidence of PVD increases with duration of diabetics and HBA1c levels.

Table 3: Age Wise Distribution of PVD Patients

Age	<30	30-40	40-50	50-60	60-70	>70
Total Number Patients	2	5	20	35	30	8
Patients With **PVD**	0	1	10	26	17	8
Percentage	0	20	50	74.2	56.6	100

Doppler study showed in figure 1,   normal triphasic study in 38 patients   and no flow in 11 patients which is confirmed by ctangiogram. Most common site of block is femoropolliteal artery followed by popliteal artery.
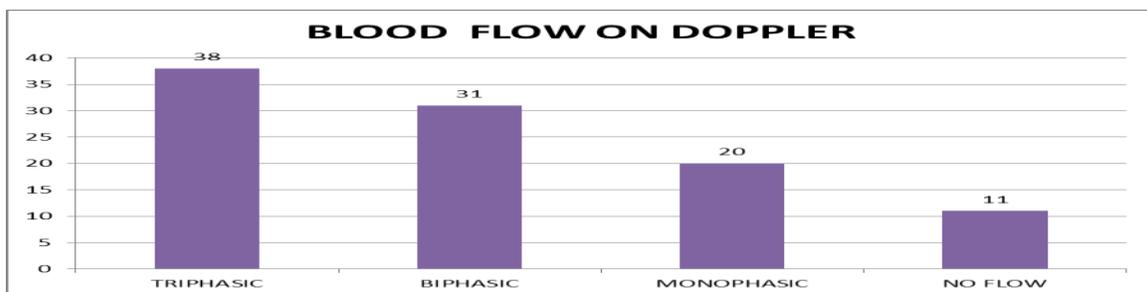

Fig 1: Doppler Study

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Ct angiogram further helps to quantify the block in PVD patients as shown in table no 4, 20 out of 62 PVD patients had less than 50% flow indicating severe compromise in blood flow which may leads to major or minor amputations. Ct also give imformation about collateral circulation and cause of block, importantfacors predicting the prognosis of the limb. 87% of patients had atherosclerosis as cause for PVD. 60% (37) patients had collateral circulation and knee being the common site of collaterals.

Table 4: Degree of Block in CT Angiogram

Degree of Block	No of Patients
<30%	25
30-50%	17
>50%	20

Discussion

The prevalence of peripheral artery disease in patients with diabetic foot is significantly high i.e. 62% as per this study. All patients may not be symptomatic or show obvious signs of PVD but need to investigate them.The higher incidence can be attributed to poor glycemic control, bare foot practices , poor care of the foot, associated smoking and tabacco chewing and failure of early detection of vascular compromise. Pandurengan Kconducted observational study in Chennai on vasculopathy in diabetic foot[8].Peripheral neuropathy found in 78% of the patients and peripheral vascular disease(89%), were closely associated with a higher risk of lower limb amputation.Richards-George P et al shows that 23% of diabetics with peripheral occlusive arterial disease (POAD) are mostly asymptomatic[9]. Prevalence POAD was 13% in community , prevalence was 47% in patients who has been diabetic for 20 years. Incidence of PVD is 62% in our study which is significantly high compared to 38% and 23% in alli Muthiah[11] and Zegreba study respectively. Males have a higher predilection for developing peripheral vascular disease than females. and prevalence of PVD increases with duration of diabetics. The older the individual, the higher are the chances of having peripheral vascular compromise. The average age of presentation of PVD in diabetics is 40-60 years. Older the age the chance of PVD increases. Measuring ABPI is objective way of assesing PVD. The prevalence of Nephropathy, Retinopathy,CAD and CVA are significantly increased in patients with PVD are marker of systemic vascular involvement. These are leading mortality and morbidity among diabetic foot patients.The most common level of arterial occlusion in PVD associated diabetic foot is femoro-popliteal segment followed by tibial segment. Fryberg RG et al did study to investigate whether color duplex imaging alone could safely and effectively be used to diagnose lower limb arterial lesions[11]. Duplex imaging was used to diagnose and guide percutaneous transluminal angioplasty in 50 legs of 45 patients. PVD influences the outcome of diabetic foot ulcers significantly with higher rate of amputations in PVD patients. Even though the neuropathy has been the initiating factor for the diabetic foot disease in association with secondary infection, the vascular component should be considered as the major factor for wound healing and also the deciding factor for limb amputation because once the infra popliteal vessel blockade occurs the progression of collaterals development is very low and even though if collaterals develops that vessel also goes for atherosclerotic changes

Conclusion

This study and others in the past have consistently proved the benefits and need of investigating diabetics for peripheral vascular disease through clinical palpation for peripheral pulses and ankle brachial index. Hence diabetic angiopathy should be taken into serious consideration and initial evaluation The use of Arterial Doppler along with clinical methods can be of great significance in the proper evaluation and appropriate management of these individuals. ABPI and peripheral pulse examinations can be recommended for screening of peripheral vasculopathy in all newly detected diabetic patients and regular follow up.

References

1. Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. Lancet. 2005; 366: 1719-1724.
2. Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA. 2005; 293:217-228.
3. Kannel WB, McGee DL. Diabetes and glucose tolerance as risk factors for cardiovascular disease. The Framingham study. Diabetes Care. 1979;2:120-6.
4. Melton LJ III, Macken KM, Palumbo PJ, Elveback LR. Incidence and prevalence of clinical peripheral vascular diseases in a population based cohort of diabetic patients. Diabetes Care. 1980;3:650-4.
5. Delbridge L, Apple Burg M, Reeve TS. Factors associated with the development of foot lesions in the diabetic. Surgery. 1983; 93:78-82.
6. Akbari CM, LoGerfo FW. Microvascular changes in the diabetic foot. In: Veves A, Giurini J, LoGerfo FW, eds. The diabetic foot. Totowa: Humana, 2002.
7. Limperopoulou D, Bates M, Petrova NL, MEE. The epidemic of neuroischaemic foot. In: Diabetic Foot Study Group. Chalkidiki, 2005:9
8. Pandurengan K. Diabetic foot: vasculopathyassesment and analysis of risk factors of amputation. Int J Res Med Sci. 2015; 3:70-76.
9. Richard-George P. Vasculopathy in diabetic foot. West Indian Med J. 2001; 50:18-20.
10. Muthiah A, Kandasamy R, Nagulan S, Madasamy A. A study on diabetic foot and its association with peripheral artery disease.IntSurg J. 2017;4:1217-21.
11. Frykberg RG, Znonis T, Armstrong DG, Driver VR, Giurini JM, Kravitz SR et al. A Diabetic Foot Disorders: A Clinical practice guideline. Jr of Foot AnkleSurg, 2006, 49.

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