

Risk of Diabetic Foot in Diabetic Patients with Peripheral Arterial Disease

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ABSTRACT

Background

The prevalence of peripheral arterial disease is higher in diabetic patients. And 11.6% of the patients with diabetic foot ulcer have associated peripheral arterial disease.

Objective

The main objective of the study is to assess the risk of diabetic foot in diabetic patients with peripheral arterial disease.

Method

This was a case control study conducted in Bir Hospital, National Academy of Medical Sciences (NAMS). The sample size was 173 out of which cases (diabetic foot) and unmatched controls (diabetics without diabetic foot) were divided in the ratio of 1:2. The Odds Ratio (OR) of peripheral arterial disease in diabetic foot was calculated. The study was conducted after taking ethical clearance from Institutional Review Board of National Academy of Medical Sciences.

Result

There were 173 participants enrolled in the study. Four were excluded, 55 participants were cases of diabetic foot (cases) and 114 participants were diabetics without diabetic foot (controls). The odds of diabetic foot in patients with peripheral arterial disease was 4.12, $p < 0.001$.

Conclusion

The risk of diabetic foot in diabetic patients with peripheral arterial disease was higher as compared to diabetic patients without peripheral arterial disease.

KEY WORDS

Diabetes, Diabetic foot, Peripheral arterial disease

INTRODUCTION

Diabetic foot is a complication of diabetes. The risk factors leading to diabetic foot are impaired blood supply, neuropathy and infection.^{1,2} The data from Asia on diabetic foot are sparse.³ Among diabetics, 15% will develop a foot ulcer during their lifetime.⁴ Peripheral Arterial Disease (PAD) is a complication of diabetes.⁵ The early endovascular revascularization and local surgical treatment contributes in limiting amputation levels in patients with diabetic foot infection.⁶ The distal bypass surgery is associated with a high likelihood of limb salvage which shows that the early treatment of PAD in diabetics have a role in reducing the incidence of diabetic foot.⁷ The incidence of PAD in patients with diabetes is four times higher than that in individuals without diabetes. And 11.6% of the patients with diabetic foot ulcer have associated peripheral vascular disease.⁸

The aim of the study is to determine the risk of diabetic foot in diabetic patients with peripheral arterial disease.

METHODS

This was a case control study conducted in Bir hospital, National Academy of Medical Sciences (NAMS), from June 2017 to May 2018. The calculated sample size was 173 with consideration of 10% drop out rate. Out of total sample size, the cases and controls were divided in the ratio of 1:2. The controls were unmatched. The inclusion criteria were patient with diagnosis of diabetes, age 15-90 years and informed consent and the exclusion criteria were history of lower limb vascular surgery, lower limb amputation, foot gangrene due to diagnosed peripheral arterial disease, myocardial infarction on aspirin therapy and ischemic cerebrovascular disease on aspirin therapy. The operational definition for diabetes was fasting (no caloric intake for ≥ 8 hours) plasma glucose ≥ 126 mg/dL (7.0 mmol/L), 2-hour plasma glucose ≥ 200 mg/dL (11.1 mmol/L), HbA1C $\geq 6.5\%$ or random plasma glucose ≥ 200 mg/dL (11.1 mmol/L), Ankle Brachial Index (ABI)=Higher of the ankle systolic pressures (posterior tibial or dorsalis pedis)/Higher arm systolic pressure (left or right arm), Normal – ABI > 1 , Claudication - ABI= 0.5-0.7, Rest pain – ABI =0.3-0.5, Gangrene – ABI < 0.3 , peripheral arterial disease was ABI < 0.5 .⁹ The data collection was done by interview and questionnaire, physical examination and recorded in a proforma.

The study participants (cases and controls) were recruited from outpatient clinics and wards in Bir Hospital. The participants were explained about the study and informed consent for participation was taken. The participant were interviewed regarding demographic details such as age and sex. The duration of diabetes, use of insulin or anti diabetic drugs, smoking habit and peripheral vascular disease symptoms were noted in the proforma. The study

participant were explained about the blood pressure measurement procedure. The participant were asked to lie in supine position. The peripheral pulses status were noted. The brachial systolic blood pressure was taken from brachial artery with sphygmomanometer cuff around the arm by palpatory method and the ankle systolic pressure was taken from dorsalis pedis artery or posterior tibial artery (if dorsalis pedis artery not palpable) with sphygmomanometer cuff around the calf by palpatory method. The data was entered in MS Excel for calculations and statistical analysis was be done by SPSS. The Odds Ratio (OR) of PAD in diabetic foot was calculated. The findings was compared using Chi square test. P value < 0.05 was taken as statistically significant. The ethical clearance for the study was taken from Institutional Review Board of National Academy of Medical Sciences.

RESULTS

There were 173 study participants enrolled in the study. Four were excluded as two had ischemic cerebrovascular disease with paraparesis and two had lower limb amputation. Out of 169 study participants, 55 participants were cases of diabetic foot (cases) and 114 participants were diabetics without diabetic foot (controls). The mean age \pm Standard Deviation (SD) of participants in “case” group was 54.5 ± 12.2 years and “control” group was 48.8 ± 16.9 years. The male:female ratio in DF was 2.6:1 and in control group was 0.96:1.

Table 1. Patient characteristics

	Cases	Controls
Mean Age \pm SD	54.5 \pm 12.2	48.8.8 \pm 16.9
Male : female	2.6:1	0.96:1
Mean smoking years \pm SD	23.96 \pm 8.18	16.10 \pm 6.65

Table 2. Diabetic foot characteristics

	Location	%
Foot involvement	right	45.4
	left	49.0
	both	5.4
Location of foot ulcer	anterior	54.6
	middle	15.6
	posterior	29.6
Meggett's classification grade ¹⁹	0- pre ulcer	10.9%
	1-superficial ulcers	18.1%
	2-deep ulcers	34.5%
	3-ulcer c/ bone involvement	20.0%
	4-forefoot gangrene	16.3%
	5-full foot gangrene	0

The right and left foot were almost equally affected with both feet involvement in 5.4% of diabetic foot cases. The location of the foot ulcer was more in the anterior third (54.6%) than posterior third (29.6%). The location of foot ulcer was least in the middle third (15.6%). (Table 2) According the Meggitt's classification, the most common was grade 2(34.5%) followed by grade 3(20%).

Table 3. Peripheral arterial disease versus Diabetic foot

		Diabetic foot		
		Yes	No	
Peripheral arterial disease	Yes	24(a)	18(b)	42
	No	31(c)	96(d)	127
		55	114	169

(Odds Ratio= ad/bc)

The odds of diabetic foot in patients with peripheral arterial disease (as determined by ABPI ≤ 0.9) was 4.12, $P < 0.001$.

DISCUSSION

Diabetic foot presents as a major concern for patients with diabetes and for those who treat them, from both a quality of life and an economic standpoint. The diabetic foot ulcers take a longer duration for healing because of multifactorial causes such as metabolic, neuropathy, edema and peripheral arterial disease.¹⁰ Premalatha et al. concluded that ABI is a good screening tool for diagnosis of peripheral arterial disease but patients with significant stenosis would be missed.¹¹

In our study, the odds ratio of diabetic foot in diabetic patients with peripheral arterial disease was 4.12, $p < 0.001$. Tressiera et al. have shown that there is an association between peripheral arterial disease and diabetic foot (OR 3, 95% CI 1.087-8.242, $p < 0.001$).¹² The finding is similar to the finding from our study. The incidence of peripheral arterial disease in patients with diabetes is at least four times higher than that in individuals without diabetes and it increases with the patient's age and duration of diabetes.¹² PAD prevalence is significantly higher in diabetic patients as compared to normal subjects and the atherosclerotic changes is more severe in distal segments of lower extremity.¹³ An outpatient clinic study from an academic institute in Eastern Nepal showed that 1% of the patients with diabetes had diabetic foot and none had peripheral vascular disease as complications.¹⁴ This finding can be justified as the study was conducted in outpatient clinic only and it was of shorter duration. In Critical Limb Ischemia diabetic patients with ischemic foot ulcer, the vascular involvement is extremely diffuse and particularly

severe in tibial arteries, with high prevalence of long occlusions.¹⁵ The lower limb atherosclerosis in diabetes is more severe in distal segments of the lower extremity while the proximal segments remain less attenuated compared with patients without diabetes.⁵ Many diabetic patients will need revascularisation to achieve timely and durable healing of diabetic foot ulcers.¹⁶ This shows that in cases of diabetic foot, patients need to be investigated for associated PAD and subsequently treated. The management modality of diabetic foot ranges from treatment of chronic diabetic foot ulcer to amputation. Van et al. showed that in comparison to patients without diabetes, patients with diabetes were more than seven times as likely to have a lower extremity amputation and emphasizes that aggressive collaboration of vascular surgery and podiatry can be effective in preventing lower-extremity amputation.¹⁷ This also highlights the need for timely treatment of peripheral vascular disease in patients with diabetic foot to prevent amputation.

In our study, the classification of diabetic foot showed that the most common was grade 2(34.5%) followed by grade 3(20%) according to Meggitt's classification. This was similar to the study by Sharma et al. where the most common diabetic foot was grade 2(53.4%) followed by grade 3(20.9%).⁸ As the most common diabetic foot is grade 2 and grade 3, an aggressive and multimodality treatment can prevent lower limb amputations. Pomposelli et al. have shown the justification regarding the routine use of pedal arterial reconstruction for patients with diabetes with ischemic foot complications.⁷

In patients with diabetic foot, the patients with and without peripheral arterial disease differ in clinical characteristics, outcome and predictors of outcome.¹⁵ Prompers et al. concluded that the predictors of healing differs between patients with and without peripheral arterial disease, suggesting that diabetic foot ulcers with or without concomitant peripheral arterial disease should be defined as two separate disease states.¹⁸

The temporal relationship of diabetic foot in diabetic patients with and without peripheral arterial disease is not compared in this study.

CONCLUSION

The risk of diabetic foot in diabetic patients with peripheral arterial disease was higher as compared to diabetic patients without peripheral arterial disease.

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