Screening of hospitalised diabetic patients for lower limb ischaemia: is it necessary?

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ABSTRACT

Introduction: Diabetes mellitus is a major risk factor for atherosclerosis and consequently lower limb ischaemia. This study aimed at screening hospitalised diabetic patients for lower limb ischaemia by measuring their ankle brachial pressure index (ABI).

Methods: ABI was measured, utilising hand-held Doppler ultrasound, for 100 patients with type 2 diabetes mellitus, who were admitted to the surgical ward, King Abdullah University Hospital, Irbid, Jordan, for non lower-limb related problems. The presence of hypertension, angina and intermittent claudication was examined. Findings were compared with those of another 100 non-diabetic patients as a control group.

Results: The results revealed a significant increase in the incidence of hypertension, angina, and claudication in the diabetic patients. Foot pulses were palpable in 96 patients of the control group and in 84 patients of the diabetes mellitus group. The mean ABIs in the diabetes mellitus and control groups were 0.99 and 1.1, respectively. It was less than 0.9 in 34 and 25 patients of the diabetes mellitus and control groups, respectively. ABI was significantly lower in the hypertension and angina patients, while it was not significantly low in the claudication patients.

Conclusion: We recommend the routine measurement of ABI for hospitalised diabetic patients, especially those with hypertension and angina, as comorbid problems of atherosclerosis. Those with a reading of less than 0.9 should be directed for further vascular evaluation.

Keywords: ankle brachial pressure index, atherosclerosis, diabetes mellitus, lower limb ischaemia, pressure index

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INTRODUCTION

Atherosclerosis is the commonest occlusive disease of the arteries supplying the lower extremities. It affects middle-aged and elderly people. Its incidence in patients with diabetes mellitus is many times those without diabetes mellitus.[1] Diabetes mellitus is a major risk factor for the evolution of atherosclerosis. It has been shown that diabetic patients have many times the chance of developing the disease compared to non-diabetic patients.[2] Furthermore, more than 30% of patients with diabetes mellitus have evidence of peripheral arterial disease (PAD), when they are older than 40 years of age.[3] More than one study confirmed the role of screening the lower limbs for PAD in people at risk, especially those with diabetes mellitus.[4,5] Its detection should help in early management and prevent or decrease its complications. Measuring ankle brachial pressure index (ABI) by Doppler ultrasonography (US) is an easy and objective way to evaluate lower limb blood flow in patients with lower limb ischaemia, and also has an important role as a screening method in subjects at risk of developing PAD.[6-8] This study aimed at the detection of lower limb ischaemia in hospitalised diabetic patients, who were admitted for non lower-limb related problems, depending mainly on ABI measurement, and comparing them with non-diabetic patients.

METHODS

During the period June 2004 to March 2005, 100 patients with type 2 diabetes mellitus and 100 non-diabetic patients (control group) were admitted to the surgical ward for elective treatment of non lower-limb related problems. All were above 40 years of age and of Arab Jordanian nationality. Patients with foot ulcer, infection, or one or more toe amputations, secondary to diabetic foot complication, were excluded from the study. Besides demographical factors of age, gender, duration of diabetes mellitus and smoking habit, the presence of hypertension was confirmed in the patients by history and being on regular antihypertensive medication. Symptoms suggestive of angina or intermittent claudication, according to the World Health Organisation (WHO) questionnaire,[9] were also looked for. Vascular lower limb examination was done, by feeling the foot pulses (dorsalis pedis and posterior tibial arteries), and identifying the

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Table I. Demographical criteria with prevalence of comorbid problems in the diabetic and control groups.

Patient demographics	Control group* (%)	Diabetic group* (%)	p-value
Age (mean ± SD) (years)	60.1 ± 9.6	60.1 ± 10.5	0.99
Gender			
Female	49 (49)	48 (48)	
Male	51 (51)	52 (52)	
Smoking habit	50 (50)	50 (50)	0.99
Hypertension	24 (24)	67 (67)	< 0.001
Angina	6 (6)	22 (22)	< 0.001
Claudication	4 (4)	12 (12)	0.035

* n = 100

Table II. Differences between the best palpable foot pulses and ABI readings in the two groups.

Dependent variable	Control group*	Diabetes group*	p-value
Palpable foot pulse	96	84	0.004
ABI			
> 0.9	75	66	
< 0.9	25	34	0.201

* n = 100

Table III. ABI of patients with comorbid problems in relation to all patients.

Comorbidity	No. of patients with ABI		No. of patients without ABI		Total	p-value
	< 0.9	≥ 0.9	< 0.9	≥ 0.9		
Angina	15	13	45	127	200	0.003
Claudicatin	3	13	57	127	200	0.312
Hypertension	40	51	20	89	200	0.001

best palpable one. ABI was measured, by using the sphygmomanometer and a sonic aid hand-held Doppler probe (GIMA Ultrasound Technology Ltd, UK), utilising the best-identified note of foot arteries and measuring its index in relation to the brachial artery. This examination was performed by one of the authors. The pressure index of 0.9 or less was referred to as suggestive of lower limb ischaemia. The ABI measurements were compared between the two groups, with special concentration on patients with hypertension, intermittent claudication and angina as comorbid problems of atherosclerosis. The Statistical Package for Social Sciences (SPSS Inc, Chicago, IL, USA) was used to analyse the data. Student *t*-test was used to compare the ages between the control group and diabetic group. Pearson's chi-square test was used to compare percentages. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The two groups of patients were identical with respect to their age, gender, and smoking habits. The duration of diabetes mellitus ranged between 1 and 27 (mean 11) years in the diabetes mellitus group. Hypertension, history of intermittent claudication and angina were present significantly more in the diabetic than in the control group (Table I). One or more foot pulses were palpable in 96 patients of the control group; in the diabetic group, it was palpable in 84 patients. This difference was statistically significant (p-value of 0.004). ABI ranged between 0.7 and 1.4 in the control group (mean 1.01), and between 0.65 and 1.3 in the diabetic group (mean 0.99); the difference between these groups was not significant, even with reference to the cut-off point of 0.9 (Table II).

Of the 200 patients, hypertension was present in 91 (67 diabetic vs. 24 control) patients, angina in 28 (22 vs. 6) patients, and claudication was present in 16 (12 vs. 4) patients. Comparing their ABI with the rest of the patients, it was significantly lower in the hypertension and angina patients. However, it was not that low in the claudication group. With respect to the 0.9 reading of ABI as a cut-off point for ischaemia, the number of patients with ischaemic level of ABI was more among patients

with comorbidity. ABI was significantly lower in the hypertension and angina patients, while it was not in the claudication patients, even when using the cut-off point of 0.9 (Table III). The mean ABI reading in the subgroups of diabetic patients with comorbid problems was lower than their counter groups in the controls (0.95 vs. 0.97) in the hypertension patients, 0.94 vs. 0.98 in the angina patients, and 0.9 vs. 1.01 in the claudication patients; however, the differences were not statistically significant. Regarding the smokers, their numbers as well as their ABI readings were not significantly different between the two groups. It was less than 0.9 in 29% of the control group and in 31% of the diabetic group.

DISCUSSION

Lower limb ischaemia, resulting from atherosclerosis, is a common finding in middle-aged and elderly people. Its prevalence is significantly higher in diabetic patients than in non-diabetic patients.[1] A recent study by the Morbidity and Mortality Weekly Report (MMWR) showed that 5% of adults who were older than 40 years of age had PAD, and two-thirds had no symptoms. This study found that the prevalence of the disease is 1.8 times among diabetic patients than non-diabetic patients, thus early detection of the disease in people at risk would help in early management.[10] Screening of PAD of the lower limb was performed utilising different ways, such as history suggestive of lower limb claudication, palpation of foot pulses, and measuring ABI by Doppler US.[6,7,10] Relying on the history of intermittent claudication alone to make a diagnosis of PAD, or even as a screening method before further detailed examination, may cause many cases to be missed because of common comorbid problems that may cause leg pain.[11,12] The same applies for palpating foot pulses, as 8% of the dorsalis pedis and 2% of the posterior tibial arteries are not palpable in healthy individuals, but detectable by Doppler US.[13] ABI is an easy and objective way of evaluating lower limb blood flow.[4,8,10] In fact, it was also shown that the PAD screening score using a hand-held Doppler US provides the greatest diagnostic accuracy.[14,15]

In Jordan, screening for PAD was not performed previously except on limited in-hospital bases for patients with diabetic foot infection.[16] We thought that undertaking this examination for hospitalised diabetic patients, who are at risk of developing PAD and have no lower-limb related problems, should be helpful as a screening method in detecting lower limb ischaemia, and proceed for further management for those who need it. Again, we were able to compare the prevalence of the disease and its related comorbid problems in hospitalised diabetic and non-diabetic patients. The two groups of our patient population were identical in their age, gender and smoking habit. This facilitated the comparison of other variables within the two groups. Beside other factors, diabetes mellitus is considered a major risk for the evolution of atherosclerosis and consequently, its effect on the patient presentation.[1,2] This is clearly shown in our study by the higher numbers of hypertensive patients as well as patients with ischaemic heart disease and claudication.

On top of atherosclerotic changes of the blood vessels, medial calcification affecting arteries, secondary to diabetes mellitus, could make peripheral foot pulses more difficult to feel as well as to compress when inflating the sphygmomanometer cuff to measure the ankle flow pressure.[14] These changes may explain the difficulty in feeling foot pulses in the diabetic group compared to the non-diabetic group (84 vs. 96); they may also be inaccurately reflected on the ABI reading by giving false high pressures. The Strong Heart Study group has shown that the incidence of non-compressible arteries is highest in diabetic and elderly patients, where it may sometimes be difficult to abolish the systolic pressure signal, despite cuff inflation to high pressures.[17] This point might be taken as a possible explanation to the narrow difference of ABI between the two groups of our patients in general, even between the subgroups of patients with hypertension, claudication and angina.

An ABI index of 0.9 is mostly used as an indicator of lower limb ischaemia. This index was suggested to be raised to 1.0 in diabetic patients, because of the expected effect of arterial wall calcification that gives the false high readings.[14,15] On looking at our results, where the mean ABI was less than the 1.0 in the diabetic group in general, and especially in the subgroups of patients with comorbid problems of atherosclerosis, we could appreciate why the difference in the index between the diabetic and the control group did not reach statistical significance. However, their mean ABI was around 0.9 and less than 1.0, a level which could be taken as ischaemic, especially in patients discovered to have intermittent claudication by history-taking rather than as a presenting symptom.

In conclusion, our patients population is not large enough as it was limited to hospitalised patients only; still the number of patients having ABI of less than 0.9 is considerable. We feel that although our numbers could not give statistical support for routine ABI measurements for all hospitalised patients at risk of PAD, we could still recommend its routine measurement for diabetic patients with hypertension and ischaemic heart disease, as they showed significantly lower ABI and are likely to be at risk of developing lower limb ischaemia. Those discovered to have intermittent claudication will need this investigation as part of their work-up. Patients found to have ABI findings suggestive of impaired blood flow

could be directed for further follow-up in a vascular surgery service. Early detection and management of these cases could decrease the possibility of developing foot complications secondary to bed rest and hospitalisation, especially those with other foot complication of diabetes mellitus, such as neuropathy.

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