

**Prevalence And Risk Factors of Macro-vascular  
Diseases Among Diabetic Patients In Mukalla City,  
Hadhramout, Yemen**

**معدل شيوع الاختلالات الوعائية وارتباطها بعوامل  
الخطورة لدى مرضى السكري في مدينة المكلا/  
حضرموت- اليمن**

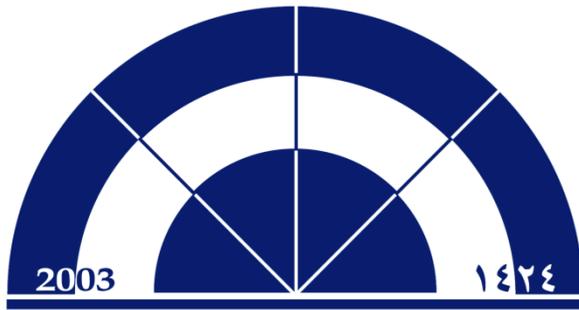
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## Abstract :

**Background:** The prevalence of diabetes mellitus is escalating dramatically throughout all the world and Yemen is not exceptional, reaching an epidemic proportion. So, the prevalence of complications are high.

**Methods & Objectives:** This is a cross sectional study aimed to assess the prevalence of macro-vascular complication and their associated risk factors among diabetic patients attended a private diabetic clinic during the period from August 2012 to July 2013 in Mukalla city, Hadhramout, Yemen.

**Results:** 132 diabetes mellitus patients participated in this study 79 were male (59.8%) and 53 were female (40.2%). The duration of DM ranged between 1-23 years. Only 26 of the patients had HBA<sub>1</sub>C within controlled range (<7). Arterial hypertension was present in 42 (31.8%). Dyslipidemia in 37(28%). 44 (33.3%) had family history of DM. Macro-vascular diseases (MVD) were present among 44 (33.3%) of the patients. Coronary artery diseases

(CAD) was present in 24 (18.2%) while 12 (9.1%) and 8 (6.1%) had peripheral vascular disease (PVD) and cerebrovascular disease (CVD) respectively. The significant factor for developing CAD among diabetic patients were the long duration of the disease (p =0.001) to be male sex (p= 0.002), poorly controlled diabetes and associated presence of hypertension (p= 0.009). The significant predictive risk factor for CVA were poorly controlled DM (p =0.026) and abnormal lipid profile ( p= 0.025).The significant risk factor associated with PVD was presence of dyslipidemia (p= 0.039).

**Conclusion:** Macro-vascular diseases were more frequent among diabetic patients. Good blood sugar control, proper control of blood pressure, maintain of adequate serum cholesterol are a determinant factors to decrease the risk of macro-vascular complications among diabetic patients.

**Keywords:** Diabetes Mellitus, macro-vascular diseases, risk factors

## المخلص :

الاصابة بمرض ارتفاع الضغط الشرياني. كما ارتبطت الاصابة بالمرضى الوعائية الدماغية بارتفاع الكولسترول في الدم وارتفاع الخضاب السكري. بينما ارتبطت الاصابة بأمراض الاوعية الطرفية بمصاحبة الاصابة بارتفاع الضغط الشرياني. مفتاح الكلمات: داء السكري، الاختلالات الوعائية ، عوامل الخطورة

تشهد معدلات الاصابة تصاعداً وبائياً عالمياً واليمن ليس استثناءً. وقد اجريت هذه الدراسة لمعرفة معدل انتشار مضاعفات السكري على الاوعية الدموية الكبيرة . وقد شارك في البحث على ١٣٢ من مرضى السكري من سكان مدينة المكلا -محافظة حضرموت - اليمن. ٧٩(٥٩.٨٪) من الذكور و ٥٣ (٤٠.٢٪) من الاناث. وكان معدل العمر من ١٢ - ٧٦ سنة بمتوسط عمر ٤٨.٢ سنة وانجراف معياري (١٤.٢). وتراوحت فترة الاصابة بالسكري بين ١ - ٢٣ سنة. ٢٤ وكان ٢٤(١٨.٢٪) من المرضى يعالج بالأنسولين. و٢٦ منهم فقط كان معدل الخضاب السكري ضمن المعدل الطبيعي ( اقل من ٧٪). كان امراض الاوعية الدموية الكبيرة موجودة لدى ٤٤ (١٨.٤٪) من ١٣٢ من المرضى وكانت الاصابة بأمراض الشرايين التاجية للقلب موجودة في ٢٤(١٨.٢٪) والاعوية الطرفية في ١٢(٩.١٪) والاعوية الدماغية في ٨(٦.١٪). كما اوجد البحث ترابطاً ايجابياً يعتد به احصائياً بين الاصابة بأمراض الاوعية التاجية وطول فترة الاصابة والذكورة وعدم السيطرة على معدل السكري الطبيعي والكولسترول ومصاحبة

## Introduction :

Diabetes Mellitus (DM) is a major clinical and public health problem worldwide. Its prevalence has increased, reaching epidemic proportions. In 1985, there were approximately 30 million people with diabetes worldwide. This number had escalated to 135 million (4% of the world population), and by 2030, it is estimated that the incidence of diabetes will increase by 42%, affecting more than 300 million people (6.4% of the world population) <sup>(1)</sup>. In the Arab region, the overall prevalence of DM is dramatically increased in the recent years, in the Kingdom of Saudi Arabia is 23.7% among people with age between 30 and 70 years and in the United Arab Emirates, Bahrain, and Kuwait were 20.1%, 14.9% and 12.8%, respectively <sup>(2)</sup>. In Yemen, some a study from the northern part showed that the prevalence of DM was 4.6% <sup>(3)</sup>.

Diabetes mellitus is a major cause of morbidity and mortality. It accounts for almost 4 million deaths worldwide every year <sup>(4)</sup>. It is the main risk factor associated with micro-vascular (e.g. retinopathy, neuropathy, nephropathy) and macro-vascular (e.g. Peripheral vascular (PVD) cerebro-vascular (CVA) or cardiovascular disease (CVD) complications <sup>(5)</sup>. Macro-vascular complications of DM occur due to accelerated form of atherosclerosis that affects coronary, carotid and peripheral arteries, thus leading to myocardial infarction, stroke and diabetic foot diseases <sup>(6)</sup>.

Patients with diabetes are two to four times more likely to die of CVD or CVA than healthy patients of the same age <sup>(7,8)</sup>. Similarly the risk of PVD in DM patient is four times higher than normal <sup>(9, 10)</sup>. In US, there were more than 220,000 death every year related to DM complications, and it was the sixth leading cause of death in 2002 <sup>(11)</sup>.

Good diabetic control of DM is assessed by daily glucose measurement (fasting and post-prandial blood sugar) and estimation of a person's hemoglobin A1C (HbA1c) which is considered as the gold standard and the more practical and less

costly and more convenient for assessing control in people with diabetes<sup>(12)</sup>.

## Methods :

This is a cross sectional study conducted in Mukalla city, Hadhramout governorate, Yemen , aimed to assess the prevalence of macro-vascular complication among diabetic patients attended to private diabetic clinic during the period from August 2012 to July 2013. A pilot study was done on 24 patients to assess the validity and reliability of the study. The study was conventional included all the patients attended the clinic during this period and agreed to participate in the study, all the participants were given a verbal consent and enrolled for the study. Patients who refused to participate or didn't complete the required clinical and laboratory examination due to any reason were excluded. An interviewing questionnaire prepared for the purpose of the study was used. Medical history and clinical examination were done for them according to the study protocol prepared for this purpose. Medical and Socio-demographic data including age, sex, duration of the disease and family history were recorded and the needed laboratory investigations were given.

DM is identified according to the criteria of World Health Organization (WHO)<sup>(13)</sup>. It is considered if the patient had more of one time overnight fasting blood sugar more than 126mg/dl after overnight fasting or if the post prandial blood sugar is more than 200 mg/dl or more or if the patient is using any of hypoglycemic drugs. Types of DM is considered either insulin dependent (IDDM) if the patient is recently on insulin either from the beginning or after failure of oral hypoglycemia and non-insulin dependent (NIDDM) if he is on oral hypoglycemia only.

Hypertension was considered according to 8th report of joint National Committee on prevention, detection, evaluation and treatment of high blood pressure, if the patient had blood pressure  $\geq 140$  mmHg systolic or  $\geq 90$  mmHg diastolic, or if self-reported of currently using antihypertensive medications was considered hypertensive<sup>(14)</sup>.

Height in meters and weight in kilograms were measured using the ordinary scales and body mass index (BMI) was calculated according to Center of Disease Control and Prevention (CDC) recommendations, as weight in kilograms divided by height in square meters (the subject wearing light clothes and taking the shoes off), and this used to determine the degree of obesity and categorized as the following: underweight  $< 18$  Kg/m<sup>2</sup> normal: 18.–24.9 kg/m<sup>2</sup>, overweight: 25.0–29.9 kg/m<sup>2</sup>, obese  $\geq 30.0$  kg/m<sup>2</sup><sup>(15)</sup>.

For all patient fasting blood sample were taken to assess fasting blood sugar, lipid profile, glycated hemoglobin (HbA1c) and 2 hours after meal other blood sample for postprandial blood sugar.

Dyslipidemia is considered if they having abnormal report of any of the lipid profile investigations, Serum total cholesterol, high density-lipoprotein (HDL), low –density lipoprotein ( LDL) cholesterol and serum triglyceride. The cut-off was: serum cholesterol  $>200$ mg/dl, HDL  $<40$ md/dl, LDL $>150$ mg/dl and triglyceride  $>150$ mg.dl.<sup>(16)</sup>. HBA1c  $< 7\%$  was taken to indicate adequate blood glycemic control

Macro-vascular complications was diagnosed if the patient having a history of diabetes mellitus with clinical and paraclinical (laboratory & radiological) evidences of macro-vascular insults. CVD was diagnosed based on presence of definitive myocardial infarction, positive ECG and echocardiography changes and positive coronary arteries catheterization with stent or CABG. CVD was considered if the patient had a history of transient ischemic attack (TIA), or cerebral stroke evidenced with CT scan of cerebral ischemia or cerebral hemorrhage .

Peripheral vascular disease was ascertained if patient having history of intermittent claudication, ulcers or amputation secondary to diabetes or clinical examination revealed peripheral pulse deficit and confirmed by peripheral vascular Doppler.

## Statistical Analysis :

The collected data were analyzed of the data by Statistical Package for Social Sciences (SPSS) soft ware (version 20). For determination of quantitative data, mean and standard deviation were used. In bivariate analysis, chi- square tests were used to ascertain the association between types of diabetes and clinical variables. Student t-test was used to determine the significance of observed difference between the means of clinical parameters. Multivariate analysis was conducted by logistic regression to determine the association between macrovascular complication and demographic and clinical variables.  $P < 0.05$  was considered significant.

## Results :

### Table 1: Demographic, laboratory & Clinical characteristics of the patients:

In this study there were 132 patients with DM. 79 were male (59.8%) and 53 were female (40.2%). Most of them, 108 (81.8%) were of non- insulin dependent type of DM. The age ranged between 12-76 years with a mean of 48.2 (SD 14.2) . The duration of DM ranged between 1-23 years, with mean of 8.3(SD 5,4). BMI varied between 16-35 Kg/m<sup>2</sup> with a mean of 22.5 (SD 4.6) kg/m<sup>2</sup>.The prevalence of underweight among the patients were ((9.8 %), overweight (36.4 %) and (9.1 %) were obsess, while those with normal weight were (44.7 %).

Of the total patients, 24 (18.2%) were being on insulin treatment while 108(81.8%) were using oral hypoglycemic drugs. 26 of the patients had HBA1C within controlled range (<7%) and 106 showed un-controlled DM, with 19.7% and 80.3% respectively. Arterial hypertension was present in 42 (31.8%). Dyslipidemia indicated by abnormal of any one of lipid profile tests was present in 37 (28%). Of the total patient 44 (33.3%) had family history of DM while 66.7% were haven't.

Macro-vascular diseases (MVD) were present among 44 (33.3%) of the patients. coronary heart diseases (CAD) was present in 24 (18.2%) while 12 (9.1%) and 8 (6.1%) had peripheral

vascular disease (PVD) and cerebrovascular disease (CVD) respectively. One patient had all 3 types of macrovascular complications, two had CVA and CAD, two had PVD and CAD and one patient had PVD and CVA.

**Table 1: Clinical, demographic & laboratory characteristics of all the patients:**

Variables	Range	Mean	SD
Age (Year)	12-76	48.19	14.183
Duration of DM (Year)	1-23	8.27	5.38
BMI (kg/m <sup>2</sup> )	16 -35	22.55	4.609
Variables		No	%
Gender	Male	79	59.8
	Female	53	40.2
HBA <sub>1c</sub>	Controlled	26	19.7
	Un-controlled	106	80.3
Type of DM	Insulin dependent	24	18.2
	Non-Insulin dependent	108	81.8
BMI (kg/m <sup>2</sup> )	Underweight(<18)	13	9.8
	Normal weight (18-24.9)	59	44.7
	Overweight (25-29.9)	48	36.4
	Obese	12	9.1
Dyslipidemia	Present	37	28
	Absent	95	72
Macrovascular diseases	PVD	12	9.1
	CAD	24	18.2
	CVD	8	6.1
Hypertension	Present	42	31.8
	Absent	90	68.2
Family history	Present	44	33.3
	Absent	88	66.7
Total		132	100%

**Table 2: Characteristics of the patients according to type of DM**

**(n=132):**

Type of DM Variable	Insulin dependent		Non-Insulin dependent		p value
	Mean	SD	Mean	SD	
Age (Year)	38.96	14.91	50.24	13.23	0.005
Duration of DM (Year)	5.29	3.03	8.94	5.57	0.300
BMI (kg/m <sup>2</sup> )	23.71	4.54	22.29	4.60	0.283

Variable		No	%	No	%	P
Gender	Male	14	58.30%	65	60.20%	0.867
	Female	10	41.70%	43	39.80%	
HbA1C	Controlled	7	29.20%	19	17.60%	0.197
	Uncontrolled	17	70.8%	89	82.40%	
Dyslipidemia	Present	6	25.00%	31	28.70%	0.715
	Absent	18	75.00%	77	71.30%	
Macrovascular Disease	PDV	2	8.30%	10	9.30%	0.887
	CHD	3	12.50%	21	19.40%	0.425
	CVD	2	8.30%	6	5.60%	0.606
Hypertension	Present	4	16.70%	38	35.20%	0.078
	Absent	20	83.3%	70	64.80%	
Family History	Present	4	16.70%	40	37.00%	0.056
	Absent	20	83.30%	68	63.00%	

Table 2 shows the characteristics according to type of DM. the mean age of the patients with NIDDM was significantly longer than IDDM ( $p < 0.05$ ). Most of the patients with longer duration of DM were of NIDDM though was not statistically significant ( $p > 0.05$ ).

The table shows that NIDDM were more among male than female. Abnormal HbA1c, presence of family history, hypertension, dyslipidemia, were more among NIDDM. Macrovascular diseases were present more among NIDDM than IDDM. 27(34.3%) and 7 (29.1%) respectively

**Table 3 : Macro-vascular diseases among DM patients in association with demographic and clinical characteristics (n=132):**

Variable	B	OR	P value	OR 95% CI
Age (Year)	0.008	1.008	0.683	0.97- 1.047
Duration of DM > 10 Years	1.941	6.968	0.001	2.235- 21.727
Obesity/ overweight	-1.642	0.194	0.004	0.063- 0.597
Male gender	1.327	3.769	0.015	1.292- 10.992
Poor glycemic control	-1.134	0.322	0.052	0.102- 1.011
Dyslipidemia	0.958	2.607	0.093	0.851- 7.981
Insulin dependent DM	1.509	4.523	0.037	1.039- 18.711
Hypertension	1.448	4.253	0.007	1.493- 12.121
Family History of DM	1.099	3.000	0.047	1.017- 8.850

Table 6: In this study macro-vascular diseases (MVD) were statistically significantly associated with long duration of DM, male

gender, insulin dependency, hypertension, and positive family history of DM ( $p= 0.001, 0.015, 0.037, 0.007, \text{ and } 0.047$  respectively). Absence of obesity and overweight was a factor related to MVD disease ( $p=0.004$ ). The risk of developing MVD complications is approximately 7 times (CI 2.235- 21.727) among patients with DM for more than 10 years in comparison with shorter duration, about 4 times among males compared with females (CI 1.292- 10.992), 4.5 times with insulin dependent in comparison with non-insulin dependent DM (CI 1.039- 18.711) and 4.2 among hypertensive patient compared with non-hypertensive (CI 1.493- 12.121). Participants with positive family history of DM compared with others are 3 times (CI 1.017- 8.850) more likely to have MVD complications.

**Table 4: Risk factors for different types of macro-vascular diseases in the patients of DM (n=132):**

Variable	CAD			CVA			PVD		
	B	OR	P value	B	OR	P value	B	OR	P value
Age(Year)	0.015	1.015	0.508	0.006	1.007	0.862	0.032	1.032	0.272
Male gender	2.008	7.445	0.008	0.697	2.008	0.479	0.886	2.426	0.267
Duration > 10 years	2.127	8.392	0.001	1.582	4.863	0.178	-0.383	0.682	0.644
Obesity/overweight	-0.853	0.426	0.178	-0.274	0.760	0.767	-1.812	0.163	0.031
Poor glycemic control	-1.690	0.184	0.012	-1.568	0.208	0.110	-0.273	0.761	0.768
Dyslipidemia	0.544	1.723	0.400	1.321	3.748	0.165	0.003	1.003	0.998
Insulin dependent DM	-1.001	0.368	0.259	-1.265	0.282	0.312	-1.091	0.336	0.315
Hypertension	1.661	5.266	0.009	0.429	1.536	0.694	1.783	5.948	0.019
Family history of DM	0.144	1.155	0.824	-1.149	0.317	0.331	1.327	3.769	0.081
CAD	-	-	-	-0.515	0.597	0.663	-0.089	0.914	0.928
CVA	0.060	0.579	0.559	-	-	-	1.685	5.392	0.141
PVD	-0.546	1.062	0.952	1.226	3.407	0.274	-	-	-

Table 4: shows the comparison between each subgroup of MVD –CAD, CVA and PVD. The significant factor for developing CAD among diabetic patients were male gender ( $p= 0.008$ ), the long

duration of the disease ( $p = 0.001$ ), poor glycemic control ( $p = 0.012$ ) and associated presence of hypertension ( $p = 0.009$ ). The significant predictive risk factor for PAD were absence of obesity and overweight ( $p = 0.031$ ), and hypertension ( $p = 0.019$ ). No variable significantly predicted CVA among diabetics.

## Discussion:

In this study we investigated the prevalence and risk factors of macro-vascular disease among sample of diabetic patient attended a diabetes specialist clinic in Mukalla city. The patients were from different region of Hadhramout governorate. The prevalence of diabetes mellitus in Hadhramout is not known. In a study from northern part of Yemen, it was found that the prevalence of DM was 4.6% (7.4% in males and 2.0% in female) (20). Our study revealed that DM is associated with macro-vascular complications. The overall prevalence of MVD among our patients were 44 out of 132 (33.3%): CAD was present in 24 (18.2%), CVA in 8(6.1%) and 12 (9.1%) had PVD. The prevalence of MVD in our study is almost close to that in a study from Sana'a city which revealed that 25.4% of DM had MVD: 17.8% CAD, 5.8% CVA and 9.1% had PVD<sup>(17)</sup> and much less than that in a study from Aden city in which MVD was (65.7) : 39.9% had CAD, (26.3%) had CVA and (5.5%) had PVD<sup>(18)</sup>. The prevalence of CAD in our study is in consistent with a study from Saudi Arabia which was (23.1%), while the rate of stroke was higher( 10%) and PVD is lesser than that in our study (10% & 6.2% ) respectively<sup>(19)</sup>. A study from United Arab Emirates showed that overall rates of MVD, CAD, was less than that in to our study 29.5%: 14.4% had CAD, and CVA was almost half (3.5%) , while PVD was higher (11.6%) than the finding in our study<sup>(20)</sup>. In a study from United States of America, after follow up of 13 years, the prevalence rate of CAD among diabetic patients was (48.1%), almost 3 folds higher than the prevalence in our study and CVA was 4 folds higher than our rate (25.6%)<sup>(21)</sup>. The difference in rate of our study of MVD complication and in different regional and international rates may be explained by the different study designs, the duration of study, difference in sample size and the difference of life style.

Regarding the risk factors, our study showed that, age of the patients, long duration of DM for more than 10 years, Obesity/overweight, hypertension and poorly controlled diabetes were significant factors for overall MVD complications. CAD were statistically significant associated with the age of the patients, duration of DM, hypertension, dyslipidemia, male sex and poorly control of DM, while CVA is high among patients with poorly controlled diabetes and dyslipidemia. Hypertension found to be the only significant risk factor for PVD but not for CVA. High body mass index, type of treatment either insulin or oral hypoglycemic agent and family history although were important risk factors but were not found statistically significant in our study. These results in our study were consistent with finding in studies done in Yemen, Sana'a, Aden and in some neighboring countries, Saudi Arabia, UAE, Bahrain<sup>(17, 18, 19,20,22)</sup>. Our study showed that patient with diabetes and CAD is more associated with hypertension, dyslipidemia and to be a male sex and long duration of DM. while is not associated with increased age, BMI and insulin treatment which were strongly associated in a study from Islamic Republic of Iran<sup>(23)</sup>.

In our study there was strong association between poor glycemic control reflected by abnormal HbA1c and MVD, mainly CAD and CVA which was the same as a study from Pakistan which demonstrated strong association between MVD with increase duration of disease and uncontrolled diabetes<sup>(24)</sup> but that was not the same in some other studies which were unable to identify this correlation between MVD and glycemic control (3). In Saudi Arabia, a study to determine the frequency of cardiovascular risk factors in Saudi and non-Saudi showed that hypertension, dyslipidemia and poor glycemic control were common CAD risk factors which was the same in our study<sup>(25)</sup>.

Overweight/ obesity was not demonstrated to be a risk factor for MVD in our study compared to other studies from the region because obesity and overweight is lower than the prevalence found in other regional countries<sup>(24,26)</sup>.

## Conclusion:

Macro-vascular diseases were more frequent among diabetic patients. (CAD) and (CVD) were more present than peripheral vascular diseases (PVD) . In general, the risk factors for CVD in our study were long duration of DM, male sex, poor glycemic control, dyslipidemia and hypertension while there was significant association between un-controlled diabetes and dyslipidemia and CVA and hypertension was the significant risk factor for PVD. Proper control of blood sugar, maintain adequate cholesterol control, regular follow up of hypertension to be within normal range will decrease the incidence of macro-vascular complication among diabetic patients

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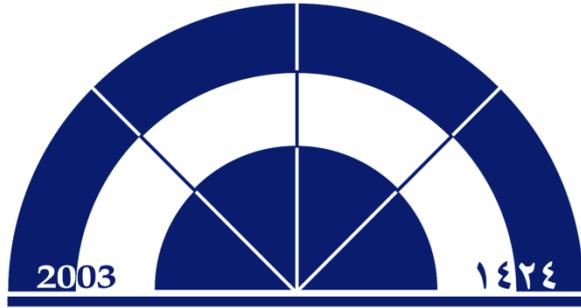
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