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Predictors and trends of macrovascular chronic complications among type-2 diabetes mellitus patients in Wachemo University Specialized Hospital, Hosanna, Ethiopia

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ABSTRACT

Background

Type-2 diabetes mellitus (DM) has rapidly become a significant global health problem. Patients with type-2 diabetes mellitus are more susceptible to different forms of short- and long-term complications. The magnitude of chronic complications increases within a population as a result of increasing diabetes cases and is a particular risk in individuals who practice poor self-management. This study aims to assess risk factors, trends and overall chronic complications among type-2 DM patients in Wachemo University Specialized Hospital in Hosanna, Ethiopia.

Methods

A retrospective cross-sectional study was used to review type-2 DM patient records from 2015 to 2019 for chronic complications. Records that fulfill inclusion criteria were extracted using a checklist. Data collectors were recruited, data were entered in EpiData and then transported to SPSS software to conduct all analyses.

Results

The majority of the patients (62%) were male, from the Hadiya ethnic group (80.1%) and Protestant Christian by religion (50.9%). The median age of the participants was 45 and 29.9% had a known family history of type-2 DM. Moreover, 13.4% of patients had known co-morbidities. The overall rate of chronic complications from such co-morbidities was 35.5%. Family history of DM (AOR=1.8(CI=1.113–2.814)), co-morbidity (AOR=4.7(CI=2.657–8.31)) and age at diagnosis were strongly associated with chronic complications. Other variables, including marital status, level of education and occupation were not associated with chronic complications in this study.

Conclusion

Overall, the rate of chronic complication was high in this study. Generally, trends of chronic complications were increasing throughout the study period. Hypertension was the leading chronic complication. Age of the patient, family history of DM and presence of co-morbidities were significantly associated with chronic complications.

Keywords: DM, Incidence, Prevalence, Trends, Complications

INTRODUCTION

Most of the food we eat is turned into glucose or sugar for our bodies to use for energy; this process is regulated by the hormone insulin. Diabetes mellitus (DM) occurs when the body fails to produce sufficient insulin. Under this condition, the body is unable to process glucose appropriately and, in turn, is unable to use food as energy.[1] Commonly, there are two types of diabetes mellitus, type-1 and type-2. Type-1 DM usually accounts for 5%-10% of all diagnosed cases of diabetes within a populations; and has poorly defined risk factors. Type-2 DM accounts for 90%-95% of all diagnosed cases and is thought to be caused by a

combination of genetic factors related to impaired insulin secretion and insulin resistance, and a number of environmental factors including obesity, poor diet, lack of exercise, stress and aging.[2,3]

Globally, the number of people living with diabetes rose from 108 million in 1980 to 422 million in 2014, the year immediately prior to the period covered by our study. Global prevalence of diabetes among adults over 18 years of age rose from 4.7% in 1980 to 8.5% in 2014 and its prevalence rose more rapidly in middle- and low-income countries.[4] The number of type-2 DM cases is increasing in many countries across the world, and 80% of DM patients now live in low- and middle-income countries.[5] An estimated 14.2 million adults aged 20-79 years have diabetes in the Africa region, representing a regional prevalence of 3.2%.[6] Figures are projected to increase further over the coming decades, with numbers expected to rise from 19.8 million in 2013 to 41.5 million in 2035, representing an absolute increase of 110%.[7] In Sub-Saharan Africa, prevalence and burden of type-2 DM is rising particularly quickly. Rapid uncontrolled urbanization and major changes in lifestyle are thought to be driving this increase. WHO estimates that the number of diabetics in Ethiopia was around 800,000 in 2000 but projects that it could increase to around 1.8 million by the year 2030 if the risk factors are not addressed.[8]

Type-2 DM patients are susceptible to a variety of short- and long-term complications. Short-term complications include hypoglycemia (low blood glucose) and hyperglycemia (high blood glucose). Long-term chronic complications include cardio-vascular conditions, cerebrovascular conditions, neuropathy, nephropathy, cataracts, blindness and retinopathy, and foot diseases such as ulcers and sores due to poor blood circulation. Foot conditions can lead to lower-leg amputation. As type-2 DM progresses, chronic complications reduce the patient's quality of life, incur heavy burdens on the healthcare system, and increase diabetic mortality.[2,3,9,10]

The morbidity and mortality caused by diabetes mellitus can be reduced by secondary prevention: through regular screening, early detection and appropriate treatment of chronic complications. By helping patients to adopt lifestyle changes such as weight control, increased physical exercise and smoking cessation, it is possible to reduce the risk of potential type-2 DM complications.[2] In the region chosen for our study, however, there is limited information regarding risk factors, trends and prevalence of type-2 DM chronic complications. This study therefore aimed to determine risk factors, map trends of the prevalence of chronic complications and record overall rates of type-2 DM in Wachemo University Specialized Hospital in Hosanna, Ethiopia.

METHOD AND MATERIALS

Study area and design

The study was conducted in Wachemo University Specialized Hospital, Hosanna, which was one of the earliest Government hospitals to be established in Ethiopia. It is located 232km from the capital, Addis Ababa. The hospital serves a population of more than 1.7 million people, and its services include the provision of chronic care and follow up to DM patients. The study period covers five years from 2015-2019, drawing on records of type-2 DM patients treated through the hospital. Quantitative data was collected through a retrospective cross-sectional study.

Study population

All type-2 diabetes mellitus patients who were under follow up care at Wachemo University Specialized Hospital and had complete documents from during the study period were included in the study.

Sample size and sampling technique

First, type-2 DM patient records were identified from all DM patent records; type-1 DM patients were excluded. Next, all type-2 DM patient records from 2015 to 2019 were checked for completeness, based on exclusion criteria. Based on this criteria, 782 type-2 DM patient records were identified. These records were included in the study. The review of the records was conducted based on consecutive sampling.

Data collection tools and techniques

Before data collection, type-2 DM patient records were identified based on age of the patient at diagnosis, and non-insulin anti-diabetic treatment or being managed without treatment. According to

these criteria, manual assignments were carried out to identify type-2 DM patients from the records. A checklist was used to review records on socio-demographic characteristics, type-2 DM chronic complications, drug history and other criteria.

Data quality assurance

To assure the quality of the data, the checklist was prepared using simple and easily understandable language. One-day training was provided for the data collectors and supervisors. The checklist was pre-tested and necessary amendments were made. During data collection, the supervisor was in overall control of all issues and appropriate adjustments were made on the spot. Data was checked again for its completeness and cleaned where appropriate.

Data processing and analysis

Data were entered and cleaned using EpiData version 3.1 software and were exported to SPSS version 20 data analysis software for analysis. Descriptive analyses such as frequency, mean, standard deviation and proportions were calculated. The results were presented in tables and charts (see this page and following pages). The overall and specific prevalence rates of common chronic complications of type-2 DM were calculated from these data. Binary logistic regression was used to identify dependent variables that had an association with outcome variables of chronic complications. Any variable that had a p-value of ≤0.25 in the bivariate analysis was identified as a candidate for the multivariate analysis. During multivariate analysis, any variable with a p-value of <0.05 was considered as statistically significant. Odds ratios and 95% CIs were used to check for the existence and strength of association between independent and outcome variables.

Ethical considerations

Ethical clearance was requested and approval was obtained from Wachemo University College of Medicine and Health Sciences. Permission was obtained from the Medical Director of Wachemo University Specialized Hospital before beginning the study. Data confidentially was maintained in all phases of the research activities.

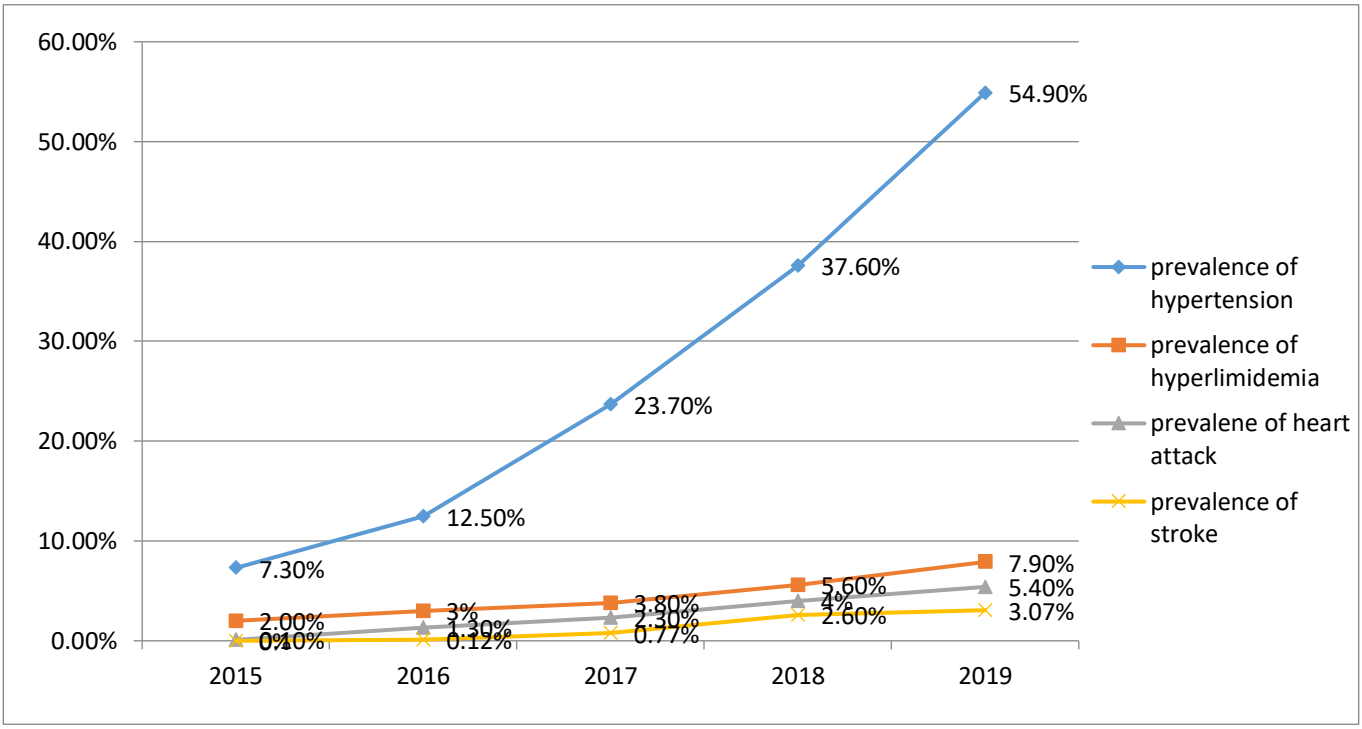

Fig 1: Trends of prevalence of chronic complications among type-2 diabetes mellitus patients from 2015-2019 in Wachemo University Specialized Hospital.

Table 1: Socio-demographic characteristics and chronic complications of type-2 DM from 2015 to 2019

Variables		Number(n)	Percentage (%)
Ethnicity	Hadiya	618	80.1
	Silte	50	6.5
	Kambata	42	5.4
	Amhara	20	2.6
	Gurage	16	2.1
	Other	36	4.7
Sex	Male	485	62
	Female	297	38
Age at diagnosis in years	20-39	152	22.7
	40-59	267	39.8
	60-79	129	19.2
	≥80	123	18.3
Religion	Protestant	398	50.9
	Orthodox Christian	140	17.9
	Muslim	78	10
	Catholic	4	0.5
Marital status	Single	74	9.5
	Married	524	67
	Divorced	14	1.8
	Widowed	22	2.8
Educational status	No education	210	26.9
	Primary school	136	17.4
	Secondary school	56	7.2
	Tertiary school	40	5.1
Occupation	Government employee	58	7.4
	Farmer	140	17.9
	Housewife	114	14.6
	Daily laborer	74	9.5
	Self-employee	92	11.8
	Other	12	1.5
Family history of DM	Yes	234	29.9
	No	548	70.1
Comorbidity	Yes	108	13.4
	No	512	65.5
Using insulin	Yes	618	79
	No	134	17.1
Chronic complication	Yes	278	35.5
	No	504	64.5
Type of chronic complication	Hypertension	265	33.89
	Hyperlipidemia	58	7.4
	Heart attack	30	3.8
	Stroke	4	0.5

Table 2: Multivariate logistic regression for variables associated with chronic complications

Variables		Chronic Complications		COR(95% CI)	AOR(95%CI)	P-Value
		Yes	No			
		n (%)	n (%)			
Age at diagnosis	20-39	53(22.4)	77(22.8)	0.32(0.181-0.556)	0.28(0.139-0.586)	0.000
	40-59	83(35)	152(45)	0.25(0.150-0.421)	0.22(0.116-0.430)	0.000
	60-79	38(16)	80(23.7)	0.22(0.122-0.392)	0.23(0.111-0.486)	0.000
	≥80	63(26.6)	29(8.6)		1.00	
Sex	Male	159(57.2)	245(62.5)	0.8(0.586-1.09)	*	
	Female	119(42.8)	147(37.5)		1.00	
Marital status	Married	184(88.5)	282(77)	0.89(0.567-1.032)	*	
	Unmarried	20(9.6)	52(14.2)	0.63(0.490-0.548)	*	
	Divorced	4(1.9)	10(2.7)	0.48(0.718-1.904)	*	
	Widowed	0(0)	22(6)		1.00	
Educational status	No education	34(37.8)	162(50.6)	0.42(0.191-0.921)	*	
	Primary education	24(26.7)	102(31.9)	0.47(0.207-1.072)	*	
	Secondary education	20(22.2)	32(10)	1.25(0.513-3.044)	*	
	Tertiary education	12(13.3)	24(7.5)		1.00	
Occupation	Govt employee	28(23.7)	26(7.6)	2.15(0.579-8.011)	*	
	Farmer	22(18.6)	110(32.4)	0.4(0.111-1.445)	*	
	Housewife	28(23.7)	70(20.6)	0.8(0.223-2.871)	*	
	Daily labourer	8(6.8)	64(18.2)	0.25(0.061-1.021)	*	
	Merchant/self-employee	4(3.4)	8(2.4)		1.00	
Family history of DM	Yes	104(47.7)	98(28)	2.3(1.647-3.341)	1.8(1.113-2.814)	0.016
	No	114(52.3)	252(72)		1.00	
Other comorbidity	Yes	64(31.7)	32(9.5)	4.4(2.773-7.092)	4.7(2.657-8.310)	0.000
	No	138(68.3)	306(90.5)		1.00	
Using insulin	Yes	228(85.7)	296(77.1)	1.8(1.175-2.709)	1.2(0.690-2.121)	0.507
	No	38(14.3)	88(22.9)		1.00	

non-significant in multivariate logistic regression

RESULTS

Sociodemographic characteristics and chronic complications of type-2 diabetes mellitus patients

There were 782 type-2 diabetes mellitus patient records included and reviewed in this study. The majority of the patients (62%) were male, from the Hadiya ethnic group (80.1%). Protestant Christian was the most common religion (50.9%). The median age of participants was 45 and 29.9% of those had a known family history of DM. Moreover, 13.4% of the type-2 DM patients had known co-morbidities. Overall, chronic complications were recorded in 278 patients, including 265 instances of hypertension (see table 1).

Trends of chronic complications as prevalence

Hypertension as a chronic complication of type-2 DM was recorded in 7.3% of cases in 2015 and this had increased to 54.9% by 2019. Generally, chronic complications among type-2 DM patients, including hypertension, heart attack and stroke, and hyperlipidemia all increased significantly across the study period (shown in fig 1).

Factors associated with chronic complications

Family history of DM (AOR=1.8(CI=1.113-2.814)), co-morbidity (AOR=4.7(CI=2.657-8.31)) and age of the participant at diagnosis were strongly associated with the presence of chronic complication. Sex, occupation and other characteristics such as marital status, level of education and occupation were not associated with the presence of chronic complications (table 2).

DISCUSSION

The results show that the overall prevalence of chronic complications among type-2 DM patients was high. Throughout the study period, the incidence of specific complications trended upwards and is continuing to rise. Out of a total of 782 patients, 35.5% had experienced at least one complication. The distribution of complications was particularly high (57.2%) among male patients. This is lower than the rates recorded in a study carried out at Jimma University Specialized Hospital, also in Ethopia,[11] and in a study from Ghana[12] where most of the chronic complications occurred in females: 77.3% in the Jimma University study and 76.8% in the Ghana study. These differences could be due to larger sample sizes or because the majority of the patients attending follow-up in the Wachemo hospital were males. Distribution of hypertension in our study was higher among males (62.4%) than females. This finding is inconsistent with a study conducted in Gabore, Botswana,[14] in which 64.4% of the hypertension distribution was in females; the difference might be due to larger number of males participating in the study.

Predominant chronic complications in our study included a number of cardiovascular complications. This is consistent with studies that have been conducted in rural areas of China[13] (30%) and India (76%).[16] In our study, patient age, family history of DM and existing co-morbidities were significantly associated with the occurrences of diabetic chronic complications in the hospital. Our results show that as the age of the participant increased, so too did the risk of developing chronic complications: i.e. patients in younger age groups were less likely to develop chronic complications in this study compared to the reference group. This finding is consistent with findings from southwest Ethiopia,[17] west Ethiopia[18] and Ghana, in which the occurrence of chronic complications also increases as the age of the participants increases. Patents who had a family history of DM were 1.8 times more likely to develop chronic complications compared to the patients with no family history. This finding is consistent with previous studies from West Ethiopia[18] and from the Kancheepuram district of Tamil Nadu in India.[19]

In our study, patients with a co-morbidity were 4.7 times as likely to develop chronic complications as were the patients without co-morbidities. Underlying comorbidity might have contributed to development of chronic complications among study subjects.

CONCLUSION AND RECOMMENDATIONS

Overall, the incidence of chronic complications was high in this study and the incidence of chronic complications trended upwards throughout the study period. The most frequently recorded chronic complication was hypertension. Patient age, family history of DM and existing co-morbidities were also significantly associated with chronic complications. We recommend that public health professionals plan appropriate health promotion programmes such as exercise, a healthy diet and appropriate DM self-management to prevent any further increase in chronic complications.

LIMITATIONS OF THE STUDY

1) Records failed to contain some pertinent variables.
2) Nature of cross-sectional study design.
3) Trend analysis gives us little insight as how or why the change occur or takes place.
4) Confounding factors may not be controlled since limited information was used or incomplete records were used.

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