Coexistence of Chronic Complications among Diabetic Patients at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia

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Abstract

Background: Chronic complications reduce quality of life, increases diabetes related mortality and overburden the public health services. This study aims to assess the prevalence of chronic complications and its associated factors among diabetic patients at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia. Method and Materials: We conducted a hospital based cross-sectional study. A simple random sampling technique was used to select 266 participants from the follow up clinic of the hospital. Data were collected using semi structured questionnaire, weight, height, waist and hip circumference measurements and patients chart review. Descriptive statistics was used to describe the study variable. Bivariate and multivariate logistic regression analysis was used to identify factors associated with chronic diabetic complications. Result: Out of 247 diabetic subjects, 114 (46.2%) were found to have at least one chronic complication that included, hypertension 59 (23.9%), diabetes related eye disease 29 (11.7%), neuropathy 25 (10.1%) and nephropathy 16 (6.5%). Compared to age group 15 - 29 there was higher risk of chronic complications for those who were in age groups 45 - 64, [AOR = 2.50, (95% CI): (1.20, 5.22)] and ≥65 years, [AOR = 7.18, (95% CI): (2.10, 24.87)]. Duration of diabetes > 10 years [AOR = 2.87, (95% CI): (1.20, 6.88)], and not performing self-monitoring of blood glucose, [AOR = 15.22, (95% CI): (3.07, 75.48)] were also strongly associated with chronic complications of diabetes mellitus. Conclusion and Recommendation: Considerable number of diabetic participants in this study area had at least one chronic complication. Attention should be given to older diabetic patients and longer diabetic duration. Diabetic education should focus on health benefit of self-monitoring of blood glucose.

Keywords

Diabetes Mellitus, Chronic Complication, Risk Factors

Subject Areas: Public Health

1. Introduction

The worldwide prevalence of diabetes mellitus (DM) estimated to grow to 366 million to 440 million by 2030, with three-quarters of patients with diabetes living in low-income countries and the greatest relative increases will occur in the Middle Eastern Crescent, sub-Saharan Africa (SSA), and India [1]. In 2010, 12.1 million people were estimated to be living with diabetes in Africa, and this is projected to increase to 23.9 million by 2030 [2]. The incidence and prevalence of diabetes mellitus in general Ethiopian population is unknown [3]. However, limited studies have shown the rise in prevalence of diabetes.

The chronic complications of diabetes mellitus affect many organ systems and are responsible for majority of morbidity and mortality associated with the disease [4]. In Sub Saharan Africa, proportions of patients with chronic diabetic complications ranged from 7% - 63% for retinopathy, 27% - 66% for neuropathy and 10% - 83% for micro albuminuria [5]. In Ethiopia also higher proportion of diabetic patients has been shown to be affected by chronic complications [6]-[11].

Consequently, the total cost to manage chronic complications in diabetics far outweighs the cost of effective primary and secondary prevention [12]. In addition, chronic complications affect working-age diabetes which leads to low productivity and then contribute to poverty [13]. In a country with lowest per capita income like Ethiopia, chronic complications pose even worse threat from economic standpoint [12].

Various factors including type II diabetes mellitus [8], duration of diabetes [14], poorly controlled cases and dyslipidemia [13] have been known to increase the risk of chronic complications. In China the prevalence of chronic diabetic complications have been reported to increase with age [14] [15]. Different studies indicated that Being female [16] and overweight, obesity [14] and central obesity [17] are risk factors for chronic complications. Thus management of these risk factors could reduce the risk of chronic complications. Furthermore, continuous medical care and ongoing self-management education are required to prevent and control diabetic complications [5].

At Nigist Eleni Mohammed Memorial Hospital, South Ethiopia (*i.e.* the study area) chronic complication of diabetes and its associated factors were not studied. The hospital 2013 nine month report showed that DM is the six leading causes of admission and ten top cause of chronic disease morbidity [18]. Thus, the rising prevalence of diabetes may increase the prevalence of chronic complications. Subsequently, chronic complication of diabetes results in increase diabetes mortality, permanent disability and incur heavy burden to health care system [12] [19]. A study conducted in Yekatit 12 hospital showed that chronic complications were responsible for 60.6% of diabetic death [19] and in Tikur anbesa and St. Paul's hospitals 28% of deaths among diabetic admission were attributed to chronic complications [20].

The combined effects of diabetes and its chronic complication place further strain on the patient, family and overburden public health services. Therefore, we aimed to assess the prevalence of chronic complications and its associated factors among diabetic patients attending chronic care follow up clinic of Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia.

2. Methods and Materials

2.1. Study Design and Setting

This hospital based cross sectional study was conducted from October 7-November 5/2013 at Nigist Eleni Mohammed Memorial Hospital, which is located in Hossana town, South Ethiopia. The Hospital serves for about 1,506,733 million populations. The chronic care follow up clinic of the hospital provide services for a total of481 diabetic patients and to congestive heart failure, hypertensive and asthmatic patients for five days a week (*i.e.* Monday to Friday). On a monthly interval insulin is provided free of charge for insulin treated diabetic patients and the follow up service is provided by medical doctors.

2.2. Selection of the Study Participants

The source populations were all diabetic patients registered and has a follow up visit in the hospital chronic care clinic. The study population were diabetic patients whose age is >15 years. The sample size was calculated using single population proportion with finite correction formula, considering the proportion of diabetic patients with chronic complication to be 52.5% [8], a precision of 5% and with 95% confidence level. After adding 20% for non-response, an overall sample size of 266 was obtained. The study participants were selected using computer

generated simple random sampling technique based on the patients' card number.

2.3. Data Collection

Data was collected using semi structured questionnaire, weight, height, hip and waist circumference measurements and patient chart review. The questionnaire was initially prepared in English and it was translated to Amharic for the purpose of data collection. Then the Amharic questionnaire was back translated to English to check for any inconsistency in the meaning of the words and/or concepts. Before data collection training was provided for data collectors and supervisor on the objective, process of data collection and how to take anthropometric measurements. Pretesting of the instrument was made before the commencement of the actual data collection. Data were collected from selected diabetic patients during the follow up visit to the clinic (*i.e.* Exit interview) in a separate room. The data collectors were supervised on daily basis for completeness and consistency of the filled questionnaire.

Weight was measured two times with minimum clothing and no shoe using Seca electronic weighing scale in kilogram (kg) to the nearest 0.1 kg. The weight scale was checked against zero reading before weighing every diabetic participant. Height was measured in a standing position in centimeter to the nearest 1 centimeter (cm). Waist circumference was measured at a level midway between lower rib margin and iliac crest on a horizontal plane around the body [21]. Tape meter was used to measure both waist and hip circumference. Patient's chart was reviewed for chronic diabetic complications, fasting blood sugar and types of diabetes. Two trained nurses and one supervisor were involved in the data collection.

2.4. Measurements

Diabetes self-care practice was assessed using Summary Diabetes Self-Care Activity (SDSCA) measure [22] which contains 11 items on diet, exercise, medication, self-monitoring of blood glucose, foot care and cigarette smoking. Each question measures diabetes self-care activity during last seven days on a continuous scale from 0 to 7 days. Dietary adequacy was measured based on a response to four diet questions and calculated out of 7. When the participants has an average of 4 - 7 days to dietary questions were coded as having adequate dietary practice and <4 day was coded as inadequate dietary practice. Exercise was considered adequate if the participants participate in at least 30 minutes of physical activity for 3 or more days or participate in a specific exercise session during last seven days otherwise it was classified as inadequate exercise. Participants who were performed Self-Monitoring of Blood glucose at his/her home at least once during last seven days were coded "Yes". Medication adequacy was assessed as follows. When participants were taking all his recommended insulin injections or diabetes pills during last 7 days was considered adequate medication intake otherwise inadequate. Concerning foot care, participants who has an average of 4 - 7 days to foot care questions was coded adequate foot care and <4 days was considered inadequate foot care.

Participants whose waist to hip circumference ratio ≥ 90 centimeter for male and ≥85 centimeter for female were considered centrally obese [21]. Body mass index of the participants were calculated by dividing the participants weight to height square. And it was coded underweight when the body mass index was <18.5 kg/m^2, overweight 25 - 29.9 kg/m^2, Obese ≥ 30 kg/m^2 and normal body mass index 18.5 - 24.9 kg/m^2.

A diabetic patient with at least one microvascular complication (*i.e.* Retinopathy, neuropathy and nephropathy) or macro vascular complication (*i.e.* coronary heart disease, peripheral vascular disease and hypertension) or non-vascular complication (*i.e.* skin infection, foot ulcer and impotence) was coded as having chronic complication. A diabetic patient who had no any documented chronic complications listed above was coded "No chronic complication".

2.5. Data Analysis

After data collection each questionnaire was checked for completeness. Data was entered in to and analyzed using SPSS version 16 computer software. Descriptive statistics like frequency tables, graphs and descriptive summaries were used to describe the study variables. Chi-square test was used to see the existence of association between dependent and each independent variable. Those variables with p-value of <0.25 in bivariate analysis were entered in to backward multiple binary logistic regression model. P-value < 0.05 was considered statistically significant. Interactions between variables were checked.

2.6. Ethical Consideration

Before data collection, ethical clearance was obtained from ethical clearance committee of Jimma University, college of public health and medical science. A formal letter of cooperation was submitted to Nigist Eleni Mohammed Memorial Hospital. Verbal informed consent was obtained from each study participants.

3. Result

Out of 266 sampled subjects, 247 participated making the response rate 92.9%. The rest 19 (7.1%) were excluded because they gave incomplete information. Of all participants, 147 (59.5%) were male. Mean age (±SD) was 43.5 (±13.5) years ranging between 17 and 71 years. Majority of the participants 111 (44.9%) were in the age range of 45 - 64 years. More than three fourth 188 (76.1%) were Hadiya by ethnicity, 170 (70.9%) were married and 70 (28.3%) were illiterate. Urban residence accounted for 155 (62.8%) and 88 (35.6%) of the patient were employed (**Table 1**).

3.1. Diabetic Self-Care Practice

Two hundred and fourteen (86.6%) were found to have adequate dietary practice. Majority 191 (77.3%) and 56 (22.7) had inadequate exercise and medication intake respectively. Only 17 (6.9%) were performed self-monitoring of blood glucose and 237 (96%) had inadequate foot care practice. Cigarette smoking accounted for 6 (2.4%) of diabetic participants (**Table 2**).

3.2. Blood Glucose and Anthropometric Measurements

Of the participants, 159 (64.4%) were found to have uncontrolled glycemic level. Normal waist to hip ratio were found in 81 (32.8%) and the rest were centrally obese. Of all diabetic participants 121 (49%) had normal body mass index and the rest 20 (8.1%), 94 (38.1%) and 12 (4.8%) were underweight, overweight and obese respectively (**Table 3**).

3.3. Prevalence of Chronic Complications

Of the total 247 diabetic participants, more than half 133 (53.8%) had no documented chronic complications and 114 (46.2%) had at least one chronic complications.

Regarding the type of complications, proportion of diabetic eye disease, neuropathy and nephropathy were 29 (11.7%), 25 (10.1%) and 16 (6.5%) respectively. Out of the total participants 59 (23.9%) had hypertension. Impotence was documented in 3 (1.2%) of diabetic patients. One (0.4%) of the participants had Foot ulcer (**Figure 1**).

Of the factors entered into multivariable logistic regression model only patient's age, duration of diabetes and self-monitoring of blood glucose (SMBG) showed significant association with chronic complications among diabetic patients.

Diabetic patients between age 45 - 64 were 2.50 times more likely [AOR = 2.50, 95% CI: (1.20, 5.20)] to have chronic complications than age 15 - 29. Diabetic patients with age ≥ 65 years were 7.18 times more likely [AOR = 7.18, 95% CI: (2.10, 24.87)] to have chronic complications than those between age 15 - 29. Diabetics with >10 year duration of diabetes were 2.87 times more likely to have chronic complications [AOR = 2.87, 95% CI: (1.20, 6.88)] than <5 years duration of diabetes. Additionally, Diabetic patients who did not monitored their blood sugar level were 15.22 times more likely [AOR = 15.22, 95% CI: (3.07, 75.48)] having chronic complications than those who monitored their blood sugar level (**Table 4**).

4. Discussions

This study demonstrated that the overall prevalence of chronic complications among diabetic patients was 46.2%. Our finding is lower than a study done in Jimma University Hospital, Ethiopia 52.5% [8], while the prevalence of chronic complications obtained in this study was higher than other studies conducted in Menilik II hospital, Ethiopia 37.45% [23], Netherland 20.9% [24] and USA 19.7% [25]. The possible explanation for this discrepancy might be associated with quality of care, difference in sample size, study area and/or purpose of the study.

Table 1. Background characteristics of diabetic participants by chronic complication at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia, 2013.

Characteristics		Chronic complication			
		Yes N (%)	No N (%)	Total N (%)	COR" (95% CI)
Sex					
	Male	67 (45.6)	80 (54.4)	147 (59.5)	1
	Female	47 (47)	53 (53)	100 (40.5)	1.06 (0.64, 1.76)
Age					
	15 - 29	17 (32.1)	36 (67.9)	53 (21.7)	1
	30 - 44	11 (20.4)	43 (79.6)	54 (21.9)	0.54 (0.23, 1.30)
	45 - 64	63 (56.8)	48 (43.2)	111 (44.9)	2.78 (1.40, 5.53)[‡]
	≥65	23 (79.3)	6 (20.7)	29 (11.7)	8.12 (2.79, 23.61)[‡]
Ethnicity					
	Hadiya	87 (46.3)	101 (53.7)	188 (76.1)	1
	Others[*]	27 (45.8)	32 (54.2)	59 (23.9)	0.98 (0.55, 1.76)
Marital status					
	Married	34 (47.2)	38 (52.8)	175 (70.9)	1
	Not married[**]	80 (45.7)	95 (54.3)	72 (29.1)	0.94 (0.54, 1.63)
Educational status					
	Illiterate	36 (51.4)	34 (48.6)	70 (28.3)	1
	Elementary	27 (39.7)	41 (60.3)	68 (27.3)	0.62 (0.31, 1.22)
	Secondary+[***]	51(46.8)	58 (53.2)	109 (44.1)	0.83 (0.46, 1.56)
Place of residence					
	Urban	74 (47.7)	81 (52.3)	155 (62.8)	1
	Rural	40 (43.5)	52 (56.5)	92 (37.2)	0.84 (0.50, 1.42)
Occupation					
	Employed	43 (48.9)	45 (51.1)	88 (35.6)	1
	Housewife	23 (53.5)	20 (46.5)	43 (17.1)	0.83 (0.40, 1.73)
	Student	18 (64.3)	10 (35.7)	28 (11.3)	0.53 (0.22, 1.28)
	Merchant	19 (65.5)	10 (34.5)	29 (11.7)	0.50 (0.21, 1.20)
	Farmer	24 (57.1)	18 (42.9)	42 (17)	0.72 (0.34, 1.50)
	Daily worker	6 (35.3)	11 (61.7)	17 (6.9)	1.75 (0.59, 5.15)
Family history					
	Yes	30 (48.4)	32 (51.6)	62 (25.1)	1
	No	103 (55.7)	82 (44.3)	185 (74.9)	1.34 (0.72, 2.48)
Duration of diabetes (In year)					
	<5	52 (34.7)	98 (65.3)	150 (60.7)	1
	5 - 10	32 (57.1)	24 (42.9)	56 (22.7)	2.51 (1.34, 4.70)[‡]
	>10	30 (73.2)	11 (26.8)	41 (16.6)	5.14 (2.38, 11.08)[‡]
Type of diabetes					
	Type I	19 (33.9)	37 (66.1)	56 (22.7)	1
	Type II	95 (49.7)	96 (50.3)	191 (77.3)	1.93 (1.04, 3.59)[‡]

[*]Amhara, Guraghe, Kembata, Silte, Wolayta and/or Tigre; [***]7 - 12 grade, diploma and/or degree; [‡]P-Value < 0.05; ["]Crude odd ratio.

Table 2. Self-care practice characteristics of diabetic participants at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia, 2013.

Characteristics		Chronic complication			
		Yes N (%)	No N (%)	Total N (%)	COR[**] (95%CI)
Diet					
	Adequate	113 (52.8)	101 (47.2)	214 (86.6)	1
	Inadequate	20 (60.6)	13 (39.4)	33 (14.4)	1.38 (0.65, 2.91)
Exercise					
	Adequate	38 (67.9)	18 (32.1)	56 (22.7)	1
	Inadequate	95 (49.7)	96 (50.3)	191 (77.3)	0.27 (0.24, 0.92)[*]
SMBG					
	Yes	2 (11.8)	15 (88.2)	17 (6.9)	1
	No	112 (48.7)	118 (51.3)	230 (93.1)	7.12 (1.59, 31.84)[*]
Medication					
	Adequate	122 (53.7)	105 (46.3)	227 (91.9)	1
	Inadequate	11 (55.0)	9 (45.0)	20 (8.1)	1.05 (0.42, 2.64)
Foot care					
	Adequate	6 (60)	4 (40)	10 (4)	1
	Inadequate	127 (53.6)	110 (46.4)	237 (96)	0.77 (0.21, 2.79)
Smoking					
	Yes	3 (50)	3 (50)	6 (2.4)	1
	No	111 (46.1)	130 (53.9)	241 (97.6)	0.85 (0.17, 4.32)

[*]P-value < 0.05; [**]Crude odd ratio.

Table 3. Blood glucose and anthropometric measurements of diabetic participants at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia, 2013.

Measurement		Chronic complication			
		Yes N (%)	No N (%)	Total N (%)	COR[*] (95%CI)
Fasting blood sugar					
	<126 mg/dl	39 (44.3)	49 (55.7)	88 (35.6)	1
	≥126 mg/dl	75 (47.2)	84 (52.8)	159 (64.4)	1.12 (0.67, 1.89)
Waist to hip ratio					
	Normal	32 (39.5)	49 (60.5)	81 (32.8)	1
	Central obesity	32 (39.5)	84 (50.6)	166 (67.2)	1.49 (0.87, 2.56)
Body mass index					
	Underweight	11 (55)	9 (45)	20 (8.1)	1.74 (0.67, 4.49)
	Normal	50 (41.3)	71 (58.7)	121 (49.0)	1
	Overweight	45 (47.9)	49 (52.1)	94 (38.1)	1.30 (0.76, 2.24)
	Obese	8 (66.7)	4 (33.3)	12 (4.8)	2.84 (0.81, 9.95)

[*]Crude odd ratio.

Table 4. Multivariable logistic regression model predicting chronic complications among diabetic patients at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia, 2013.

Chronic complications			
Factors	Yes N (%)	No N (%)	AOR** (95%CI)
Age			
15 - 29	17 (32.1)	36 (67.9)	1
30 - 44	11 (20.4)	43 (79.6)	0.56 (0.23, 1.39)
45 - 64	63 (56.8)	48 (43.2)	2.50 (1.20, 5.22)*
≥65	23 (79.3)	6 (20.7)	7.18 (2.10, 24.87)*
Duration of DM (Year)			
<5	52 (34.7)	98 (65.3)	1
5 - 10	32 (57.1)	24 (42.9)	1.94 (0.94, 4.0)
>10	30 (73.2)	11 (26.8)	2.87 (1.20, 6.88)*
Exercise			
Adequate	18 (31.6)	39 (68.40)	1
Inadequate	96 (50.5)	94 (49.5)	1.83 (0.91, 3.69)
SMBG			
Yes	2 (11.8)	15 (88.2)	1
No	112 (48.7)	118 (51.3)	15.22 (3.07, 75.48)*

*P-value < 0.05; **Adjusted odd ratio.
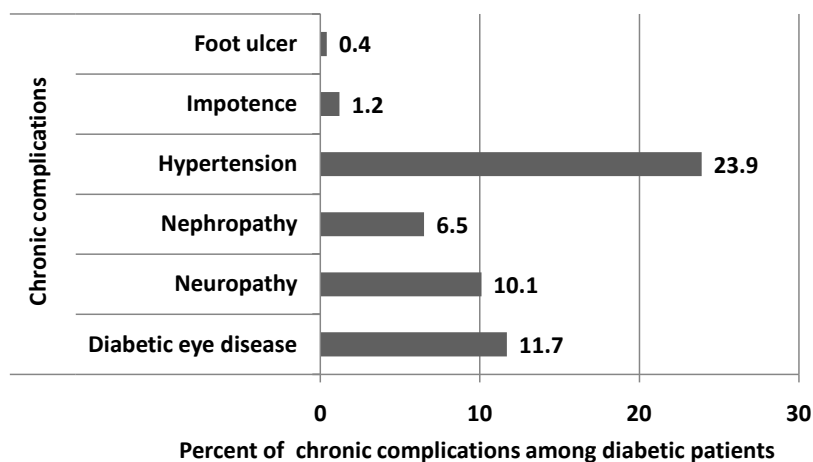
Figure 1. Proportion of chronic complications among diabetic patients at Nigist Eleni Mohammed Memorial Hospital, Hossana, South Ethiopia, 2013.

Hypertension was found in 23.9% of diabetic patients. Similar finding was reported from Hawassa and Jimma University Hospitals, Ethiopia [8] [27]. But different from another study conducted in Jimma University hospital, Ethiopia 64.1% [11]. This might be to the fact that our study was based on patient chart review and the other used primary data.

The proportion of neuropathy 10.1% and nephropathy 6.5% obtained in this study were in agreement with a study done at yekatit 12 hospital, Ethiopia [19]. Similar finding for neuropathy was also reported from a study done at Tikur anbesa and St. Paul's hospitals, Ethiopia 12.4% [20].

Diabetic eye disease was documented among 11.7% of diabetic patients. This finding was less compared to studies done in Jimma, which was 33.8% [8] and Menilik II hospital 31.4% [23]. However in Africa the preva-

lence of retinopathy ranged from 7% in Kenya to 63% in South Africa [2]. The lower prevalence in this study could be due to the difference in duration of diabetes. Majority of the participants had <5 year duration of diabetes in the current study. It was indicated that microvascular complications of diabetes are less common in the first five years of diabetes duration [4].

Compared to age group of 15 - 29 year diabetics there was higher risk of chronic complications for those who were in age groups of 45 - 64 and ≥65 year diabetics. This finding is congruent with studies done in china, Libya and camerone [13]-[15]. And this study showed, diabetic patient with >10 year duration since the time of diabetes diagnosis were 2.87 times more likely to develop chronic complications than those <5 years duration of diabetes. The increase in visceral adiposity with age is associated with the rise in insulin resistance [4]. Thus it results in uncontrolled glycemia which is responsible for diabetes related complications [14]. However, in our study neither fasting blood sugar nor central obesity which measure visceral adiposity by waist to hip circumference ratio was significantly associated with chronic complications and none of the participants in this study had Glycosylated hemoglobin (HbA$_{Ic}$) determination even if it is recommended by American diabetes association (ADA) two times a year [27].

The current study revealed that diabetic patients who did not perform self-monitoring of blood glucose were 15.22 times more likely to have chronic complication than those who performed self-monitoring of blood glucose. A retrospective cohort study conducted in Germany has shown similar finding, in which diabetic patients in non-SMBG subgroup were associated with chronic complications [26]. According to the American diabetes association, Self-monitoring of blood glucose (SMBG) have a key role in maintaining specific glycemic goals and recommends daily self-monitoring of blood glucose [27]. Various studies also support this recommendation, in which SMBG has been shown to be associated with better glycemic control, improved medication compliance and increased frequency of visit to health institution [26]. However, controversial result was reported from Italy where SMBG frequency ≥ 1 time per day has been shown significantly associated with higher Glycosylated hemoglobin (HbA$_{Ic}$), distress, worries and depressive symptoms in non-insulin treated diabetic patient [28]. In fact our study participants perform SMBG once per week and most of them were insulin treated diabetic patients. Despite small sample size of this study, our finding suggests that not performing SMBG is a risk factor for chronic complication after controlling for non-insulin and insulin treated diabetic patients.

Our study has some limitation and hence interpretation of the results needs certain consideration. Chronic complications, type of diabetes and fasting blood sugar data's were collected retrospectively and incompleteness of patent charts was one of the short coming of this study. Most diabetic patients particularly type II diabetics develop chronic complication before the time of diabetes diagnosis and we can't relate duration of diabetes and chronic complication because of lead time bias. But the result suggests that long history of diabetes duration is risk factor for chronic complication. Self-care practice was measured using Summary diabetes self-care activity measurement tool which has acceptable reliability and validity. However not validated locally might lead to misclassification and subjected to subjective response and recall bias.

5. Conclusion

Overall, about 46.2% of diabetic patients had chronic complications. Hypertension, diabetes related eye disease, neuropathy and nephropathy were the major chronic complications among diabetic patients. Age between 45 - 64 and ≥65 years, >10 year duration of diabetes and not performing self-monitoring of blood glucose were strongly associated with chronic complications. Prevention and management of chronic complications in diabetic patients should primary target age groups of 45 - 64 and ≥65 years and those with >10 year duration of diabetes through strengthening early diagnosis and improving case management. Diabetes education should focus on health benefit of self-monitoring of blood glucose and improving diabetes education strategy on self-monitoring of blood glucose needs special warrant.

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