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DIABETIC COMPLICATIONS AMONG ADULT DIABETIC PATIENTS; HALIBET REGIONAL REFERRAL HOSPITAL ZOBA MAEKEL, ASMARA, ERITREA

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ABSTRACT

Background: Diabetes Mellitus is common metabolic disease worldwide and its complications result to increased morbidity, disability and mortality. In Eritrea, the prevalence of the diabetic complications is not well studied so far. Thus, the aim of this study is to assess prevalence of diabetic complications and associated factors. **Methods:** Cross-sectional study was conducted in Asmara, Halibet regional hospital diabetic clinic of from July 01to July 31, 2016. All adult diabetic patients who visited every other day to the clinic during the study period were included. Data was collected through interview scheduled questionnaire and clinical card review. Presence of complications and the type of medications the patient took were identified through review of patient clinical records. Data were entered, cleaned and coded using an excel and exported to SPSS for Windows version 20.0. Descriptive statistics, chi-square tests and t- test were carried out to come across the itemize objective. **Results:** Larger proportion, 333 (84.9%) of patients had type II diabetes, and 293 (53.4%) of them were diabetic for more than 11years. Overall 300 (76.5%) of the patients were found affected by one or more of the diabetic complications. Complications were identified mainly among type II diabetic patients 269 (80.8%). The age of patients (*P* value-0.0001), type of diabetes (*P* value = 0.0001), medication used (P value = 0.022) and duration of diabetes (*P* value = 0.0001), were strongly associated with the occurrence of diabetic complication but sex, self-reported adherence and family history, were not associated with the presence of complication. Out of three hundred ninety two patients 300 (76.5%) experienced at least one of the following diabetic complications. Neuropathy 197 (50.3%), impotence 105 (48.2%), visual disturbance 163 (41.6%), hypertension 150 (38.3%), and foot ulceration 17 (4.3%), respectively. Age had statistically significant association with hypertension (P value = 0.0001) and impotence (P value = 0.0001).Type II diabetes was significantly associated with hypertension (P value = 0.0001) and impotence (P value = 0.0001). **Conclusion:** The prevalence of complications among diabetic patients in Halibet regional referral hospital diabetic clinic was found to be high. Majority of the patients were type II diabetics. Chronic complications were observed more commonly among type II diabetics. Increased occurrence of hypertension, impotence and neuropathy were observed. The study showed that age, type of diabetes, medication used and duration of diabetes were significantly associated with the increase of diabetic complications.

KEYWORDS

Diabetes mellitus, Chronic diabetic complications, Africa, Sub-Saharan Africa, East Africa, Zoba Maekel, and Halibet Hospital.

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INTRODUCTION

Diabetes mellitus is a metabolic disorder that has multiple causative factors. Diabetes mellitus creates long term and short term damage to various organs such as the eyes, nerves, heart, kidney, and blood vessels; Furthermore, untreated diabetes could

results in ketoacidos is or nonketotic hyperosmolar state which may finally lead to the development of stupor, coma and death. According to the World Health Organization (WHO) DM is classified based on the pathogenesis of the disease (WHO, 2010)[1]. Type I DM develops primarily due to destruction of the beta cells in the pancreases. The incidence of type 1 DM is seen in all age groups it peaks at the age of 11-14 years (American Diabetes Association, 2010)[2]. Type II DM is frequently undiagnosed for many years because hyperglycemia develops gradually and the earlier stage is not often not sever enough for the person to be aware of any classic symptoms of DM (Hall, Thomsen, Henriksen, and Lohse, 2011)[3]. It usually develops in people older than 40 years, recently however, it is also being more common in younger people. Type II diabetes constitutes about 85% to 95% of all diabetes in developed countries, and more prevalent and possesses even higher percentage in developing countries (IDF, 2003)[4]. In large parts of the developing world, DM is detected late, when patients need a wide range, intensive and expensive hospital care for severe acute or chronic complications (Venkat *et al*, 2006)[5].

Diabetes mellitus has become a cause of growing public health concern in developing low income countries, as it has been for a long time in the developed countries (Asmamaw, Asres, Negese, Fekadu, and Assefa, 2015)[6]. Type II diabetes is becoming a global public health problem growing in parallel with the worldwide rise of urbanization, nutrition transition, and increased sedentary lifestyle (Hu, 2011)[7]. The consequences of DM are devastating for societies and families economy, especially in poor, vulnerable and disadvantaged populations; people get sicker sooner and die earlier than their counterparts in wealthier societies (WHO, 2015)[8].

In Sub-Saharan Africa diabetes mellitus is increasing at an alarming rate and contributes significantly to the growing human and public health cost. The projected growth for Sub-Saharan Africa (SSA) is 98%, that is from 12.1 million in 2010 to 23.9 million in 2030 (Abebe, Berhane, Worku, and Assefa, 2014)[9]. Epidemiological studies that were conducted in Africa have demonstrated that DM is frequently undiagnosed in most cases; and it is one of the complications of diabetes that enforces the patient to attend to the health facility (Assayed, 2013)[10]. A hospital-based retrospective record review study from 2000-2009 in Ethiopia indicated an increase in DM cases from 112(2000) to 245(2009) having a total of 1553 in 2009 (Abebe *et al*, 2014)[9].

Eritrea as many developing countries of the world is facing the burden of non-communicable diseases as a result of the current epidemiological and nutritional transitions (Mufunda *et al*, 2005; Usman, 2006)[11, 12]. According to National Health Information System of Eritrea, diabetes mellitus is one of the leading causes of morbidity and mortality mainly in adults; a total of 78,686 new cases and 926 deaths of DM were reported from hospitals and health centers in the years 1998 - 2012. Moreover, 695 amputations due to DM were also reported between 2006- 2012 indicating that it is not only leading cause of morbidity but also a cause of disability (Ministry of Health Eritrea, 2012)[13]. Diabetes mellitus was accountable to 0.4% of morbidity and 2.7% of total reported deaths in 2012. Thus, the significance of this study arises from the impact of the increasing diabetes mellitus and it was aimed in determining the prevalence, of related complication and associated risk factors of diabetes mellitus, among adult diabetic patients at Halibet regional referral hospital diabetic clinic Zoba Maekel, Asmara, Eritrea.

MATERIAL AND METHODS

Study Setting and design

Cross-sectional study was conducted at Halibet regional referral hospital diabetic clinic, from July 01, to July 31; 2016. The hospital is a regional referral hospital situated within the capital city, Asmara. This diabetic follow-up clinic in the hospital is responsible for diabetic treatment and follow-up of diabetic patients coming to the hospital every day.

Study Participants and Study period

All diabetic patients who visited every other day to the adult diabetic clinic during the study period, from July 01 to July 31, 2016 were included.

Data collection

Data was collected using interview guided questionnaire and clinical card review. The collected data were cleared and checked at the end of each interview for completeness, reliability and consistency before data entry to excel.

Data Processing and Analysis

The study used quantitative data according to the variables that the research questions need to answer. Data were entered using an excel and exported to Statistical Package for Social Sciences (SPSS) for Windows version 20.0 for cleaning and analysis. Descriptive statistics, chi-square tests and t- test were carried out to meet the stated objective.

Ethical Consideration

The study obtained permission from MOH ethical and research committee, Clinical Service Division and Halibet regional referral hospital. Each participant was asked to participate in the study. The procedure of the study was very confidential code numbers were used for the participants that were included in the study, to maintain confidentiality of the information.

RESULTS AND DISCUSSION

Socio-demographic characteristics of diabetic patients at Halibet regional referral hospital diabetic clinic

A total of three hundred ninety two (392) adult diabetic patients who came for follow-up visit at Halibet regional referral hospital diabetic clinic during July 01, to July 31, 2016 were included in the study. The majority of the patients 358 (91.3%) live in urban area, mainly Asmara, Tigrigna by ethnic group 373 (95.2%) and Orthodox by religion 311 (79.3%). The majority of the respondents 218 (55.6 %) were males and 283 (72.2%) were married.

Majority of the respondents 75 percent were literate of which 67 (17.1%) had completed college, 108 (27.6%) secondary school, and 19 (30.3%) had completed primary and junior schools (Table No.1).

The mean age of the patients was 57 (SD$\pm$15) years and they were known as diabetic patients for the mean duration of 11 (SD$\pm$8) years. Based on the employment status most of the diabetic patients were classified as government employee (civil servant 24 % and military/national service 8.4 %) followed by house wives 21.7 percent (Table No.1).

Family history and type of diabetes

Out of three hundred ninety two diabetic patients the majority 333 (84.9%) were of type II with the remaining 59 (15.1%) being type I patients. The mean age duration of illness for patients with type I DM was 12 years where as for Type II DM was 10 years. Majority of the patients had no familial history 258 (65.8%) and 121 (30.9%) had familial history, whereas 13 (3.3%) didn't know whether they had familial history or not (Table No.2).

Others* includes students.

Others** includes religions which are out of the major religions in Eritrea.

Others***includes an Indian.

Regimen of diabetic drugs, adherence to medications and type of complication

The results indicated that majority of the patients 228 (58.2%) were using oral hypoglycemic agents for the treatment of diabetes and controlling their blood sugar level. The most commonly used medications were oral hypoglycemic agents; Glibenclamide and Metformin 131 (33.4%), 93 (23.7) Glibenclamide only and 4 (1.0%) Metformin only; Whereas 164 (41.6%) were using Insulin only (Table No.3). Self-reported drug adherence was reported as good for the majority 336 (85.7%) of the diabetic patients.

Type and frequency of chronic diabetic complications among diabetic patients at Halibet regional referral hospital diabetic clinic

Out of the 392 respondents the majority of the patients 300 (76.5%) had experienced at least one complication. The distribution and frequency of complications were, neuropathy 197 (50.3%), impotence 105 (48.2%), visual disturbance 163 (41.8%), hypertension 150 (38.3%), and foot ulceration 17 (4.3%), respectively (Table No.4).

Association of specific factors with the presence of complication among diabetic patients at Halibet regional referral hospital diabetic clinic

Age of the diabetic patients (P value = 0.0001) type of diabetes (P value = 0.0001), regimen and type of medications the diabetic patient were taking (P value

= 0.022) had a significant association with the presence of complications but it was noted that sex was not associated (P value = 0.969) with the presence of complications. Overall complications were 31 (52.5%) and 269 (80.8%) among type I and type II diabetes, respectively (Table No.5). The regimen of drugs used had an association (P value = 0.022) with the prevalence of complications (Table No.5).

Mean duration of diabetes with the presence/absence of complications among diabetic patients at Halibet regional referral hospital diabetic clinic

The study documented a significant association Mean duration of diabetes with the presence/absence of complications of complications (P=0.0001) (Table No.6).

Prevalence of diabetic complications among diabetic patients by Type of Complication at Halibet regional referral hospital diabetic clinic

The study documented significant association between age and some specific chronic complications; hypertension (P value = 0.0001) and impotence (P value = 0.0001). There were also significant association between sex and some of the chronic complications; hypertension (P value = 0.02), neuropathy (P value = 0.014) and foot ulceration (P value = 0.005). Type II diabetes was significantly associated with chronic complications, specifically hypertension (P value = 0.0001) and impotence (P value = 0.0001).

The study examined the socio - demographic characteristics, regimen of diabetic drugs, prevalence of type I and type II diabetes and diabetic complications among 392 adult diabetic patients who were attending the diabetic clinic in Halibet regional referral hospital.

The findings of the study highlighted that medications used for diabetes were 58.2 percent oral hypoglycemic agents and 41.8 percent insulin which is different from that of 2004 study that recorded 59 percent insulin therapy and 35 percent oral agents, and 6 percent nonpharmacologic treatment (Windus *et al*, 2007)[14]. However, many studies agree with the concept that states "for achieving glycemic control it is better to use insulin than oral hypoglycemic agents." A cross sectional study conducted in April 2013, at Addis Ababa Tertiary Care Teaching Hospital diabetes clinic for the assessment of drug therapy for type II diabetes mellitus documented that 56.3 percent of the diabetic were using insulin (Hawaze, Anshabo, Asfaw, and Mamo, 2014)[15].

However in this study it is noted that insulin was used in 164 (41.8%) for both type I and type II diabetes mellitus. Inline to this study most of the complications were observed to appear as more prevalent in patients who are using oral hypoglycemic agents (80.7%) which are mainly with type II diabetes (80.8%).

In this cross sectional study 76.5 percent of the diabetic patients reported at least one of the complications. This result is higher than similar cross sectional study conducted from April to May 31, 2013 in Dessie Referral Hospital, Northeast, Ethiopia that indicated a prevalence of 59.7 percent (Abejew, Belay, and Kerie, 2015)[16]. Among the 392 diabetic patients in this study, the majority (84.9%) were with type II diabetes, in parallel to this majority of the complications (80.8%) were also among type II patients which is higher than similar studies in Ethiopia, 50.2 percent for type II diabetes and 48.6 percent for the prevalence of complications (Abejew *et al*, 2015[16]; Worku, Hamza, and Woldemichael, 2010) [17].

In this study out of 392 patients 197 (50.3%) had Neuropathy and this finding is higher than similar cross sectional studies that were done in Jima University specialized hospital, Ethiopia in October 2008 and 2011 that documented a prevalence of 29.5 percent and 17.24 percent respectively. Visual disturbance was also recorded as a second most prevalent complication in 163 (41.6%) out of 392 diabetic patients.

A significant association between diabetes and hypertension was recorded. Hypertension was recorded as slightly higher (38.3%) than previous result (37%) that was documented at Halibet and Hazhaz hospital diabetic clinics Asmara, Eritrea in 2004 (Windus *et al*, 2007)[14]. Two similar cross sectional studies on patterns of diabetic complications that were done in Ethiopia, in October 2008, at Jimma University Specialized Hospital and from April to May 31, 2013 in Dessie Referral

Hospital, Northeast, Ethiopia , recorded hypertension with a prevalence of 24.9 percent (p value = 0.0001) and 43.3 percent (p value < 0.0001); ranking third and first of the complications indicating that there is a strong association between diabetes mellitus and hypertension (Abejew *et al*, 2015; Worku *et al*, 2010). So the above results indicate that there is a significant association between diabetes and hypertension which is similar to this study.

Among 218 male diabetic patients impotence was reported in 105 (48.2%) this much higher than a report from Ethiopia 6.8 percent prevalence (Worku *et al*, 2010). diabetic age and impotence were significantly associated (P=0.0001) as a similar study done in Ethiopia (Worku *et al*, 2010).

In the study foot ulceration was observed in seventeen diabetic patients with a prevalence of 4.3 percent which has similarity with other east African countries. Two similar cross sectional studies that conducted in two east African countries, one in 1999 at Kenyatta National Hospital, Nairobi for the prevalence of diabetic foot ulcers and its risk factors and a another one in Jima University specialized hospital, Ethiopia in October 2008, both documented the same result of 4.6 percent prevalence of diabetic foot ulcer (Nyamu, Otieno, Amayo, and McLigeyo, 2003[18]; Worku *et al*, 2010).

The study observed a significant association among hypertension (P=0.0001), impotence (P=0.0001) and diabetes. In this study age of patients (P=0.0001), type of diabetes (P=0.0001), antidiabetic drugs used (P=0.022) and the duration of diabetes (P=0.0001) were significantly associated with the prevalence of diabetic complications in Halibet hospital diabetic clinic (P=0.0001); this has similarity with other similar studies in Ethiopia (Abejew *et al*, 2015; Worku *et al*, 2010).

Table No.1: Distribution of the study participants; Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

S.No	Variable	Frequency	%
Residence			
1	Urban	358	91.3
2	Rural	34	8.7
Age Group			
3	0 – 9	1	0.3
4	10 - 19	4	1.0
5	20 - 29	15	3.8
6	30 - 39	23	5.9
7	40 - 49	67	17.1
8	50 - 59	81	20.7
9	60 - 69	114	29.1
10	70 - 79	63	16.1
11	80 - 89	23	5.9
12	90 - 99	1	0.3

Sex			
13	Male	218	55.6
14	Female	174	44.4
Marital Status			
15	Married	283	72.2
16	Widowed	54	13.8
17	Divorced	12	3.1
18	Separated	1	0.3
19	Single/Never Married	42	10.7
Literacy Status			
20	Illiterate	98	25.0
21	Primary School	64	16.3
22	Junior School	55	14.0
23	Secondary School	108	27.6
24	Collage and Above	67	17.1
Current Occupation			
25	Civil servant	94	24.0
26	Housewife	85	21.7
27	Self-employed	69	17.6
28	Unemployed	55	14.0
29	Military/National Service	33	8.4
30	Merchant	32	8.2
31	Farmer	12	3.1
32	Retired	5	1.3
33	Others*	7	1.8
Religion			
34	Orthodox	311	79.3
35	Catholic	27	6.9
36	Protestant	9	2.3
37	Muslim	43	11.0
38	Others**	2	.5
Ethnicity			
39	Bilen	3	.8
40	Saho	8	2.0
41	Tigre	7	1.8
42	Tigrigna	373	95.2
43	Others***	1	.3
Total		392	100.0

Others* includes students

Others** includes religions which are out of the major religions in Eritrea.

Others***includes an Indian

Table No.2: Prevalence of Type I and Type II diabetes and family history; Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

S.No	Variable	Frequency	%
Type of DM			
1	Type I	59	15.1
2	Type II	333	84.9
Family History			
3	Yes	121	30.9
4	No	258	65.8
5	Don't know	13	3.3
Total		392	100.0

Table No.3: Regimen of diabetic drugs used to manage diabetes mellitus and drug adherence in Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

S.No	Regimen	Frequency (%)
1	Oral hypoglycemic agents	228 (58.2)
2	Insulin	164 (41.8)
Specific Drugs		
3	Insulin	164 (41.8)
4	Glibenclamide and Metformin	131 (33.4)
5	Glibenclamide	93 (23.7)
6	Metformin	4 (1.0)
Adherence to Medications		
7	Good	336 (85.7)
8	Poor	56 (14.3)
Total		392 (100)

Table No.4: Type and frequency of chronic complication at Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

Is there complication				
S.No	**Presence/absence of Complication**	**Yes**	**No**	**Total**
		300 (76.5%)	92(23.5)	392
Type of Complication		**Yes**	**No**	**Total**
1	Neuropathy	197 (50.3%)	195 (49.7%)	392
2	Impotence	105 (48.2%)	113 (51.8%)	218
3	Visual Disturbance	163 (41.6%)	229 (58.4%)	392
4	Hypertension	150 (38.3%)	242 (61.7%)	392
5	Foot Ulceration	17 (4.3%)	375 (95.7%)	392

Table No.5: Association of specific factors with the presence of complication at Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

Is there complication					
S.No	**Variable**	**Yes**	**No**	**Total (100%)**	**P Value**
Age					
1	< 29	4 (21.1%)	15 (78.9%)	19	
2	30 – 44	43 (63.2%)	25 (36.8%)	68	0.0001
3	>44	253 (83.0%)	52 (17.0%)	305	
Sex					
4	Male	167 (76.6%)	51 (23.4%)	218	0.969
5	Female	133 (76.4%)	41 (23.6%)	174	
Type of diabetes					
6	Type I	31 (52.5%)	28 (47.5%)	59	0.0001
7	Type II	269 (80.8%)	64 (19.2%)	333	
Regimen					
8	Oral Hypoglycemic agents	184 (80.7%)	44 (19.3%)	228	0.022
9	Insulin	116 (70.7%)	48 (29.3%)	164	
Total				392 (100%)	

Table No.6: Association of Duration of diabetes with the in Halibet regional referral hospital diabetic clinic, July 01, to July 31, 2016

Is there complication				
S.No	**Variable**	**N**	**Mean duration of diabetes**	**P value**
Presence/absence of Complications				
1	Yes	293	11 years and 5 months	0.0001
2	No	89	8 years and 2 months	

Table No.7: Frequency of complications, by age group, sex and type of diabetes mellitus at Halibet regional referral hospital diabetic clinic; July 01, to July 31, 2016

Those who had Complications						
S.No	**Participants (N=392)**	**Hypertension**	**Visual disturbance**	**Neuropathy**	**Foot ulceration**	**Impotence**
		(n = 150) N (%)	(n= 163) N (%)	(n= 197) N (%)	(n= 17) N (%)	(n= 105) N (%)
Age Group						
1	15-34	0 (0.0)	7 (77.8)	5 (55.6)	0 (0.0)	1 (20.0)
2	35-44	8 (25.0)	20 (62.5)	20 (62.5)	3 (9.4)	9 (50.0)
3	45-54	22 (36.1)	31 (50.8)	40 (65.6)	4 (6.6)	15 (46.9)
4	≥55	120 (60.6)	105 (53.0)	132 (66.7)	10 (5.1)	80 (79.2)
P- Value		.0001	.349	.888	.661	.0001
Sex						
5	Male	73 (44.0)	85 (51.2)	99 (59.6)	15 (9.0)	105 (48.2)
6	Female	77 (57.5)	78 (58.2)	98 (73.1)	2 (1.5)	NA
P- Value		.02	.226	.014	.005	
Type of DM						
7	Type I	5 (16.1)	20 (64.5)	17 (54.8)	4 (12.9)	8 (38.1)
8	Type II	145 (53.9)	143 (53.2)	180 (66.9)	13 (4.8)	97 (71.9)
P- Value		.0001	.229	.180	.066	.002

CONCLUSION

The finding of the study indicated that the majority of the patients 84.9 percent were type II diabetes. Chronic complications with high frequency were observed more among type II diabetic patients. Hypertension and impotence were identified as chronic diabetic complications associated with type of diabetes, antidiabetic drugs used, duration of illness and age of the patients which are significantly associated with hypertension and impotence. Furthermore, the prevalence of type II diabetes and its complications in the country appears to increase fast and is going to become a leading cause of morbidity, disability and mortality. This increase can have an association with increases in urbanization and gradual life style change.

LIMITATIONS

The study was done based on self-reported information for some of the diabetic complications and it did not define severity of complications.

RECOMMENDATION

The diabetic complications are becoming common problems among different age groups. Some of the consequences of diabetic complications are increased direct and indirect patient costs, and burden to the health care system as a result of morbidity, disability and mortality. So a comprehensive study on the associated risk factors is crucial. A health promotion activity that creates an awareness focusing on the prevention of complication should be encouraged. National diabetes control program in collaboration with other sectors and stake holders should have to develop a strategy, policy, protocols and guideline for prevention and early management of complications.

AUTHORS' CONTRIBUTION

Elias Teages Adgoy was involved in the designing and proposal writing of the study, data collection and clinical record reviewing, data analysis, and interpretation of the study findings, report writing, report reviewing and final paper preparation.

Yemane Seyoum was involved in the designing and proposal writing of the study, data analysis, and interpretation of the study findings, report writing, report reviewing and final paper preparation.

Zecarias Andemariam Oqubasillase was involved in designing and proposal writing of the study, data analysis, and interpretation of the study findings, report reviewing, and final paper preparation.

Rezene Habtemariam was involved in proposal and final paper reviewing and final report writing.

Habte Gebremichael was involved in reviewing the proposal of the study.

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CONFLICT OF INTEREST

All authors of the study declare that they have no conflict of interest.

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