



DIABETES MELLITUS; MORBIDITY AND MORTALITY IN DIABETICS AT INDEPENDENT UNIVERSITY HOSPITAL, FAISALABAD, PAKISTAN

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ABSTRACT... Background: Diabetes mellitus is associated with significant morbidity and mortality worldwide and Pakistan is no exception. **Objectives:** To determine the morbidity and mortality in patients admitted with Diabetes Mellitus in a teaching hospital of Pakistan, through retrospective analysis of admission and patient file records. **Study Design:** Retrospectively analyzed. **Setting:** Independent University Hospital, a Teaching Hospital, Faisalabad. **Period:** 1st January 2016 to 31st December 2017. **Patients and Methods:** Data included age, gender, total numbers of admissions and those due to Diabetes Mellitus, the indications for admissions, presenting symptoms and method of diagnoses in diabetic patients, mortality rates and causes of death. Data obtained were analyzed using chi square. **Results:** Out of 10490 medical admissions, 5706 (54.4%) were males and 4784 (45.6%) females. Diabetes was detected in 1450 (13.8%) patients [810 (55.9%) males, 640 (44.13%) females]. The mean age of diabetic patients was 53.6±16.1 years (range 18 – 94 years). Poor glycemic control (29%) and diabetic foot syndrome (23.4%) were the most common reasons for admission in diabetic cases. The overall mortality rate among medical admissions was 21.8%, with diabetes accounting for 6.7% deaths. Within the cohort of diabetic cases, mortality was 15.9%, with significantly higher mortality in those aged > 65 years (p < 0.05). The most common causes of death in diabetic cases were cerebrovascular disease and complications associated with the diabetic foot syndrome, accounting for 26.1% and 21.7% of deaths respectively; the least common causes of death in diabetic patients were pulmonary tuberculosis, meningitis, malaria and hepatic encephalopathy accounting for 4.4% of deaths. **Conclusions:** Cerebrovascular disease was the most frequent cause of mortality among admitted diabetic patients with diabetic foot syndrome (a preventable complication) as the second most frequent cause of mortality. Increased screening for diabetes mellitus morbidities in the clinic and community settings and adequate health education is required to reduce morbidity and mortality associated with diabetes mellitus.

Key words: Cerebrovascular Disease, Diabetic Foot Syndrome, Diabetes Mellitus, Morbidity, Mortality.

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INTRODUCTION

Diabetes Mellitus is one of the major global health issues.^{1,2} In 2011, 366 million people had diabetes mellitus around the world and it is estimated that 552 million people would be suffering from this disease by 2030.³ According to WHO, 12.9 million people are diabetics in Pakistan and currently, Pakistan is on seventh position worldwide in terms of diabetes prevalence and it may become fourth on WHO list if preventive steps are not taken to control the disease.⁴ Diabetes Mellitus is a non-communicable, progressive disease^{1,5} characterized by hyperglycemia due to deficiency

of insulin synthesis or diminished effectiveness.

Diabetes, mellitus is a significant cause of morbidity and mortality worldwide and morbidity and mortality^{6,7} Diabetics are at increased risk of death from complications of diabetes such as diabetic ketoacidosis, diabetic nephropathy and hyperosmolar hyperglycemic state, ischemic heart disease, hypertensive heart disease, and from other causes, including infectious diseases.^{8,9}

According to World Health Organization diabetes

was responsible for 1.7% global mortality in the year 2002.¹⁰ Researchers¹¹⁻¹³ have predicted that the majority of world's diabetic population are living in developing countries (Pakistan inclusive) due to factors like increasing life expectancy, urbanization, aging population etc. Thus, with the increasing prevalence and incidence of diabetes globally, this mortality is expected to be much higher since diabetes is a chronic medical disorder.

This study was done to study the morbidity and mortality in diabetic patients admitted at the Independent University Hospital, Faisalabad, a teaching hospital, with a view to identify the most frequent precipitating causes and recommend steps to reduce the burden of disease.

PATIENTS AND METHODS

This retrospective study was carried out at the Independent University Hospital, a teaching hospital attached with Independent Medical College, Faisalabad. This hospital has a large catchment area from both urban and rural areas in the suburbs of Faisalabad. Admission Registers and Patient file records for all patients admitted in the medical wards (Medical 1,2 & 3) from 1st January 2016 to 31st December 2017 were analyzed. Data obtained and analyzed from these records included age, gender, indications for admission, presenting symptoms and diagnoses on admission, duration of diabetes, presence of co-morbidities, outcomes and documented cause of death. Diabetes mellitus was classified using the World Health Organization 1999 classification.¹⁴ Data Analysis was done using the Student's t-test and Chi-square test as appropriate.

RESULTS

There were a total of 10490 admissions in the medical wards of the hospital during the period under review. Of the total, 5706 (54.4%) were males and 4784 (45.6%) females with a male to female ratio of 1.1:1. There were a total of 1450 diabetic admissions, constituting 13.8% of all medical admissions. Of this number, there were 640(44.14%) females and 810(56%) males, giving a female: male ratio of 1:1.2.

The mean + SD age of the diabetic patients was 53.6 + 16.1 years, with a range of 18 – 94 years. The mean + SD age for males with diabetes was 53.8 + 14.1 years, while for their females it was 54.5 + 16.8 years ($p > 0.1$).

The mean duration of diabetes was 12.4 + 10.2 years (range 1 – 22 years). There were 70 cases with Type 1 diabetes and 1380 cases with Type 2 diabetes. These type 2 diabetic cases constituted 95.2% of all diabetic admissions.

The age and gender distribution of diabetic cases is shown in Table-I with largest number of cases seen between 50 – 59 years (46.9%), followed by the 40 – 49 years (16.6%). Lowest number of cases were seen in < 20 years (2.0%) age group but these differences were not statistically significant (Yates' corrected $X^2 = 4.6$, $df = 6$, $p > 0.2$).

Age Groups (years)	Diabetes Mellitus Persons		
	Males No. (%)	Females No. (%)	Total No. (%)
<20	10(0.7)	16 (1.10)	26 (1.7)
20 – 29	19 (1.3)	20(1.4)	39(2.8)
30 – 39	98 (6.7)	63 (4.27)	161 (11)
40 – 49	124 (8.5)	103 (7.1)	227 (15.6)
50– 59	398 (27.4)	280 (19.3)	678 (46.9)
60– 69	106 (7.3)	114(7.86)	220 (15.2)
>70	55 (3.7)	44 (3.03)	99 (6.5)
Total	810 (55.86)	640(44.1)	1450 (100)

Table-I. Age and gender distribution of admitted diabetes mellitus persons.

The indications for admission in diabetic cases are shown in Table-II. The most common indication was uncontrolled diabetes (29%) followed by Diabetic Foot Syndrome (23.4%), diabetic ketoacidosis (12.4%), while 10% were infections i.e. Malaria, Urinary tract infections, Lobar Pneumonia and Pulmonary tuberculosis. Uncontrolled hypertension was the indication for admission in 6.2% diabetics followed by Organ failure [i.e. Chronic Renal Failure, Congestive Cardiac Failure and Liver Failure] in 6.2% and Cerebrovascular accidents in 4.8%. Hyperosmolar Hyperglycemic state and Hypoglycemia accounted for 2.8% and 2.1% of all diabetic admissions respectively. The least common indications for admission in diabetic patients were Psychosis (1.4%), Peptic

Ulcer Disease (0.7%).

Indication for Admission	%
Uncontrolled Diabetes Mellitus	29.0
Diabetes Mellitus Foot Syndrome	23.4
Diabetic Ketoacidosis	12.4
Infections	10.3
Organ Failure	7.0
Uncontrolled Hypertension	6.2
Cerebrovascular Accidents	4.8
Hyperosmolar Non Ketotic Coma	2.8
Hypoglycemia	2.1

Table-II. Indication for admission among diabetes mellitus persons.

Table-III shows the presenting clinical features in diabetic patients were classical diabetic symptoms (i.e. polyuria, polydipsia and polyphagia 29%), foot ulcers (23.4%), metabolic decompensation (i.e. Diabetic Ketoacidosis and Hyperosmolar hyperglycemic state 15%) and features of infections (e.g. Malaria, urinary tract infections, Pneumonia 10.3%). Less common features were dyspepsia (0.7%), cardiac decompensation and hepatic encephalopathy in 1% each.

Features	%
Classical	26.0
Foot ulcers	23.4
Metabolic Decompensation	15.0
Infections	10.3
Severe Hypertension	8.0
Stroke	4.8
Anemia	3.6
Chronic Renal Failure	2.8
Hypoglycemia	2.0
Behavioral Disorder	1.4
Liver Failure	1.0
Cardiac Failure	1.0
Dyspepsia	0.7

Table-III. Clinical features on admission in diabetes mellitus persons.

Total number of deaths in the medical wards were 2286 accounting for overall 21.8% mortality in all medical admissions out of which 231 deaths were seen in diabetics. 111 (10.1%) males, 120 (18.8%) females, accounting for 10.1% of the total deaths, and a mortality rate of 15.9% amongst diabetic admissions. The mortality rate among diabetic admissions was significantly greater than among

non-diabetic admissions ($X^2 = 9.7$, $p < 0.01$) and mortality was higher among diabetics who were > 65 years ($p > 0.05$).

The most common causes of death included cerebrovascular accidents (26.1%), diabetic ketoacidosis (21.7%) and uncontrolled diabetes mellitus (13%). Other causes included diabetic foot ulcers, chronic renal failure and hypoglycemia, each accounting for 8.7% deaths. Meningitis, encephalitis, pulmonary kochs and hepatic encephalopathy each accounted for 4.4% deaths in diabetics

Table-IV. The differences noted in the proportions of the causes of deaths vis-à-vis the indication for admission were statistically significant ($X^2 = 48.5$, $df = 13$, $p < 0.001$).

Causes	No.	(%)
Cerebrovascular accident	60	(26.1)
Diabetic Ketoacidosis	51	(21.7)
Uncontrolled DM with Pneumonia	29	(13.0)
Diabetic Foot Ulcer	21	(8.7)
Chronic Renal Failure	20	(8.7)
Hypoglycemia	19	(8.7)
Meningitis / Encephalitis / Malaria	11	(4.4)
Tuberculosis	11	(4.4)
Hepatic Encephalopathy	10	(4.4)

Table-IV. Causes of deaths in diabetes mellitus patients.

DISCUSSION

Diabetes mellitus is a leading cause of morbidity and mortality worldwide and, with the increasing incidence and prevalence of the disease globally and these indices are bound to increase. Previous reports from within and outside Pakistan indicate that the main causes of morbidity and mortality in diabetics include acute metabolic complications, cardiovascular diseases, cerebrovascular disease, blindness, non-traumatic lower extremity amputation and end stage renal disease.^{14-16,17,31} The present study also shows similar results.

There were a total of 10490 admissions in the medical wards of the hospital during the period under review. Of the total, 5706 (54.4%) were males and 4784 (45.6%) females with a male to female ratio of 1.1:1. There were a total of 1450

diabetic admissions, constituting 9.3% of all medical admissions. Of this number, there were 640(44.14%) females and 810(56%) males, giving a female: male ratio of 1:1.2.

The mean age of 1450 diabetic subjects was 53.6 ± 16.1 years with 67.37% females (Table 1). This observation is similar to study of Sheraet al., (2004) in which 68% were females and mean age was 55.2 ± 10.6 years.¹⁵ However, in a study conducted by Chan et al. in 2012,¹⁶ the mean age was 68.98 ± 11.79 years. Similarly, Stolkeret al., (2011)¹⁸ and Narayana et al., (2015)¹⁹ showed mean age around 63-64 years in their results. This difference in age might be due to racial factors as these previous studies were carried out on white Caucasians.

Majority of the patients in the present study were Type 2 diabetics and this is similar to the global trend where Type 2 diabetes contributes to about 80 – 90% cases.¹² In the medical wards there were more male admissions than females, and this trend persisted in the diabetic admissions.²⁰

There was no significant difference in terms of gender. Similar gender predisposition was also noted by K Maryam et al. in a study conducted at Peshawar in KPK (67.37) Stolkeret al., (2011),¹⁸ Chan et al., (2012)²¹ and Kassaianet al., (2012)²² have also reported similar observations. In The male preponderance in medical admissions was also reported in previous studies from Ibadan, Nnewi and Calabar, all in Nigeria.²³⁻²⁵ Possible reasons for this gender discrimination include low priority given to females in Africa and South-east Asia, the low female education, literacy and empowerment, and limited access to and control over financial resources which limit the ability of females to access health care services.²⁶⁻²⁷

Uncontrolled diabetes mellitus accounted for 29% of the diabetic admissions. The main reason for this is noncompliance to medications followed by financial constraints, poor access to health care facilities and ignorance about the disease and its management.²⁸⁻³⁰ Adequate health education to patients and their relatives and caregivers is advocated to acquaint them with appropriate

information on the dangers of poor compliance/adherence to therapy, which could result in long term complications of disease and mortality.

Diabetic foot ulcer is a leading cause of non-traumatic amputation and contributes significantly to morbidity and mortality in Nigerians with diabetes.^{31,32} Our study also showed that diabetic foot syndrome (including ulcers) was the 2nd commonest morbidity/ indication for admission and 4th most common cause of death. The magnitude and impact of this potentially preventable Diabetes mellitus complication can be reduced by adequate education of the diabetic patients about foot care, re-emphasizing the same at subsequent visits at the clinics or in diabetes meetings. The diabetes care team should include a comprehensive examination of the feet at least once a year for all persons with diabetes.

Hyperglycemic emergencies (ketoacidosis and hyperosmolar hyperglycemic state) were seen in 15.2% diabetics admissions while 29% had uncontrolled diabetes indicating a clear reflection of the poor metabolic control in these patients and reinforces the need for adequate health education, monitoring and follow-up care, to reduce the morbidity associated with diabetes.

Pulmonary tuberculosis, pneumonia and meningitis were other infective complications listed as indications for admissions in diabetic patients (Table-IV). Diabetes mellitus is a risk factor for Pulmonary tuberculosis and other associated factors for its development include impaired cell mediated immunity these patients, poor nutrition, renal failure and small vessel damage to the lungs.³³ Leading causes of death in diabetes in the developing world include infections and acute metabolic complications, in contrast to coronary artery disease and cerebrovascular disease in the developed world.^{34,35} Malaria accounted for one death in our patient and this low malaria prevalence in diabetics is probably due to the fact that antimalarial therapy is readily purchased over-the-counter in our setting. This practice of self-medication is however fraught with potential dangers, especially in the light of multi-drug resistant malaria, therefore we advocate

enhanced health education on the prevention and appropriate treatment of malaria.

The mortality rate of 15.9% in the diabetics is similar to previous reports from other centers in Nigeria, which ranges from 8.8% – 17.2%.^{36,37} Ndububa and Erhabor³⁷ noted that the high mortality may have been due to chronic default from clinic, as well as ignorance about diabetic symptoms. Studies in Cameroon and Tunisia have shown limited knowledge about diabetes in patients suffering from the disease.^{28,29} These findings lead us to re-emphasize the need for health education of diabetic patients and their care-givers. Mortality was significantly higher in middle-aged/ elderly male patients and this may be due to the co-morbidities seen in these persons.

There were more male deaths than female deaths in the overall medical admissions, but more female diabetic patients died compared with their male counterparts. This is different from the reports from other centers in Nigeria where more male deaths were reported in diabetics.^{36,37} The reason(s) for this is/ are unclear. However, we believe it may be related to the difficulties that females face in accessing health services promptly.

Our study showed that mortality in diabetic admissions was significantly associated with the indications for admission. Six patients with cerebrovascular accidents died, giving a mortality rate of 85.7% among diabetic patients that were admitted with Cerebrovascular accidents. Majority of the deaths in diabetes are due to cardiovascular causes.³⁵ Diabetes mellitus is a risk factor for Cerebrovascular disease and in co-existence with other risk factors like hypertension, dyslipidemia and obesity increases the risk of Cerebrovascular disease in these patients. Efforts must be made to identify and adequately manage these risk factors to reduce the risk of Cerebrovascular disease and subsequent mortality in diabetic patients.

Diabetic ketoacidosis is an acute metabolic complication of diabetes mellitus and in the present study the mortality due to this complication

was 27.7% which is higher than the accepted mortality rate of 5-10%. The present figures are however similar to reports from other centers in Africa.³⁴⁻³⁷ Lack of access to insulin coupled with its high cost, delays in seeking medical attention, misdiagnosis and poor diabetes care are all contributory factors to this poor outcome.

Diabetes nephropathy is the leading cause of end stage renal disease in the United States.¹³ In the present study 8.7% deaths were due to nephropathy. Poor glycemic and blood pressure control in diabetic patients increase the risk of end stage renal disease. However, in a resource-poor setting like ours, where facilities for renal replacement therapy are not readily available and where available, are limited by its high costs, primary prevention should be the aim with good glycemic and blood pressure control and control of other attendant risk factors.

Approximately 8.7% deaths were due to complications related to diabetic foot ulcers. Possible aetiology includes peripheral neuropathy, vasculopathy, autonomic neuropathy and infections.^{16,32} Adequate health education and regular feet examination in diabetics can help in reduction of this diabetic morbidity.

Hypoglycemia is usually due to sulphonyl urea or insulin therapy in diabetes. Two patients in the present study died as a result of this complication. Precipitating factors for hypoglycemia include alcohol use, gastrointestinal upset and inappropriate treatment. In a similar study from Nigeria, hypoglycemia was responsible for 10.2% deaths in diabetic cases.²⁸ We advocate appropriate health education of all diabetic patients and their care providers on the early recognition and appropriate management of hypoglycemia to treat this potentially preventable cause of morbidity and mortality in diabetic patients.

Our study showed that diabetes mellitus was the major cause of morbidity and mortality in Benin City, Nigeria with uncontrolled diabetes being the most common cause of morbidity, followed by diabetes mellitus foot syndrome. Cerebrovascular

disease and diabetic ketoacidosis were the major causes of mortality in these patients. We recommend adequate health education especially with regards to foot care and complications of diabetes to improve the outcome in these cases. Treatment of diabetes should be subsidized and facilities provided in hospitals for adequate management of the disease. There is also need to ensure that the care and treatment of all aspects of diabetes mellitus is covered by the National Health Insurance Scheme. When implemented, these measures will impact significantly on the current unacceptably high morbidity and mortality rates associated with diabetes mellitus.

CONCLUSIONS

Cerebrovascular disease was the most frequent cause of mortality among admitted diabetic patients with diabetic foot syndrome (a preventable complication) as the second most frequent cause of mortality. Increased screening for diabetes mellitus morbidities in the clinic and community settings and adequate health education is required to reduce morbidity and mortality associated with diabetes mellitus.




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AUTHORSHIP AND CONTRIBUTION DECLARATION

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1	Arsalan Hafeez	Review of literature	
2	Kashif Rehman	Data collection and analysis	
3	Aqib Rehman	Review of literature	
4	Abdul Hafeez Ch	Drafting of script Discussion, Final review.	