

EVALUATION OF TREATMENT IN PROGRESS AND RATIONALE FOR HOSPITALIZATION OF DIABETES MELLITUS PATIENTS IN A TERTIARY CARE HOSPITAL IN HILLY STATE OF NORTH INDIA.

General Medicine

Joginder Singh Pathania

Resident doctor, Department of Internal Medicine, I.G.M.C Shimla,

Kiran Mokta

Associate Professor, Department of Microbiology, I.G.M.C Shimla

Ramesh

Assistant Professor, Department of Pharmacology, I.G.M.C Shimla

Jatinder Kumar Mokta*

Professor, Department of Internal Medicine, I.G.M.C Shimla. *Corresponding Author

ABSTRACT

BACKGROUND: Diabetes prevalence is increasing rapidly and the number is projected to almost double by 2030. India is projected to be home to 109 million individuals with diabetes by 2035. There are many drugs in pipeline but long term safety and efficacy has to be established. If the primary care is effectively delivered, hospitalizations can be prevented among diabetics.

OBJECTIVE: Present study was conducted to evaluate various drugs which are currently being used as monotherapy or as combination therapy in diabetics, and to delineate the reasons for hospitalization in diabetics in a tertiary care hospital.

METHOD: This was a tertiary care hospital based observational - prospective study.

RESULTS: Among 589 patients, 518 (87.8%) were of type 2 diabetes and 369 (71.4%) of them were using oral hypoglycemic, metformin being the commonest. Infection was the most common reason for hospital admission (23.1%), followed by chronic kidney disease and cardiovascular causes. Raised blood sugar level was reported as reason for admission in only 10% cases. Majority of patients had duration of hospitalization in the range of 6 to 10 days.

DISCUSSION: It was concluded that diabetic admissions constitute a major proportion of admissions in the medicine wards. Most of the patients were taking oral hypoglycaemic agents in various combinations and the numbers of patients taking insulin were less than expected. The peripheral (rural) health services in the management of diabetes need to be strengthened as most of the population in a hilly state like Himachal Pradesh belongs to rural area, if the disease is tackled properly at the initial stage, the need for hospitalizations can be reduced.

KEYWORDS

Diabetes Mellitus, Oral Hypoglycaemic Agents, Insulin,

INTRODUCTION

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Chronic hyperglycemia in diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels. Diabetes prevalence is increasing rapidly and the number is projected to almost double by 2030¹. Diabetes currently affects more than 62 million Indians, which is more than 7.2% of the adult population. Nearly 1 million Indians die due to diabetes every year. India is projected to be home to 109 million individuals with diabetes by 2035. American Diabetes Association has reported that India will see the greatest increase in people diagnosed with diabetes by 2030². The high incidence is attributed to a combination of genetic susceptibility plus adoption of a high-calorie, low-activity lifestyle by India's growing middle class³. An ideal treatment would reduce cardiovascular risk factors as well as control blood glucose levels. Goal of therapy should be to reduce diabetes related complications and achieve targeted HbA1c so that patient outcome can be improved. There are many drugs in pipeline but long term safety and efficacy has to be established. Hospitalizations of diabetic patients reflect how well the patients are managing their diabetes and quality of outpatient care. If the primary care is effectively delivered, these hospitalizations can be prevented. It needs timely diagnosis and effective treatment. Studies have shown that increasing patient knowledge regarding disease and its complications has significant benefit with regard to patient compliance to treatment and to decrease complications associated with the disease. In our present study, we emphasized to evaluate the various ongoing treatment options that are practiced and criteria for individual hospitalization among diabetic patients in tertiary care state hospital in Himachal Pradesh.

AIMS AND OBJECTIVES

1. To observe the clinical and demographic profile of hospitalized diabetic patients.
2. To observe the pattern of ongoing treatment and various reasons for hospitalization among patients of diabetes mellitus.
3. To observe the average duration of hospital stay in diabetes mellitus patients

Material and Methods

Study Design

This was a tertiary care hospital based observational - prospective study. It was conducted in five hundred and eighty nine (589) patients over a period of one year from 1st June 2018 to 31st May, 2019 in the indoor department of internal medicine of a medical college. The study was conducted after getting approval from the institutional ethical committee. Informed consent was obtained from all the patients.

Inclusion Criteria

All indoor diabetic patients > 18 years of age admitted in the medicine department, all the newly diagnosed indoor diabetic patients and patients ready to sign the informed consent form were enrolled.

Exclusion criteria

Patients with diabetes but, admitted in department other than Medicine, patients not ready to sign the informed consent form and all diabetic patients < 18 years of age were excluded.

Data Collection

Data was collected from all the diabetic patients admitted in the department of internal medicine. The patient information was collected according to the proforma. A detailed history about first time diagnosis, follow ups, recent medications and reasons for current admission and of past admission, if any was enquired. Patient profile was recorded. General physical examination and systemic examination of all patients were done. Complete haemogram, fasting blood glucose (FBG), postprandial blood glucose (PPBG), liver function test, renal function test, serum protein, lipid profile and urine tests of all the patients were carried out. Fundus examination, ECG, 2D-Echocardiography, chest X-ray, USG Abdomen and other relevant investigations were also done. The relevant previous treatment records were collected. Data regarding hospital stay was noted from admission file and from death record of patients who had succumbed to diabetes during their hospital stay.

Statistical Analysis

Descriptive statistics and frequency percentages were determined for categorical variables. Means and standard deviations were calculated for quantitative variables. Qualitative variables were analyzed using

Pearson's chi square test, ANOVA one way or paired-t test, whichever was applicable. p value less than 0.05 were considered significant. The statistical analysis was done using statistical software IBM SPSS statistics for Windows version 21.0

RESULTS

Demographic profile of diabetic patients

The mean age of the diabetic patients in this study was 56.23 ± 10.08 years. The patients presented in the range of 20 to 92 years. Mean age of the male and female patients was 56.32 ± 10.42 years and 55.12 ± 11.63 years respectively [Table 1]. Out of 589 patients enrolled, 318 (53.7%) were females and 271 (46.3 %) were males. Amongst all, 459 (77.9%) were from rural and 130 (22.1%) patients were from urban background.

Table 1: Distribution of patients according to age and sex

Age distribution	Male		Female		Total	
	N	%	N	%	N	%
<30	20	7.4	13	3.9	33	5.5
31-45	41	15.1	42	13.3	83	14.2
46-60	92	33.9	137	43.2	229	38.9
61-75	101	37.4	110	34.5	211	35.9
>75	17	6.2	16	5.1	33	5.5
Total	271	100	318	100	589	100

Type of diabetes

Out of 589 patients, 568 (96.4%) were Type 2 diabetic patients and 21 (3.6%) were having Type 1 diabetes. The mean age of onset of diabetes for all enrolled diabetic patients was 32.7 ± 6.4 years. It was 18.8 ± 4.6 years for Type-1 and 46.3 ± 9.4 years for Type-2 diabetes mellitus patients

Body mass index (bmi)

Mean BMI of the study group patients was 24.5 ± 2.7 Kg/m². It was 24.6 ± 3.3 Kg/m² for female patients and 24.4 ± 2.9 Kg/m² for male patients.

Pattern of glycemetic control

Mean RBG and HbA1c for all diabetic patients at admission were 245 ± 94.0 mg% and 10.5 ± 2.5 % respectively. Mean RBG and HbA1c of Type 1 diabetic patients were 380.5 ± 107.2 mg% and 13.3 ± 0.9 % respectively. Mean RBG and HbA1c of Type 2 diabetic patients were 240.6 ± 90.9 mg% and 10.4 ± 2.4 mg% respectively. The RBG of patients at admission ranged from 30 to 813mg%.

Duration of diabetes

Mean duration of diabetes in this study was 12.7 ± 6.9 years. Out of 589 diabetic patients, 50 (8.6%) patients were newly diagnosed on admission. 317 (53.9%) diabetic patients were admitted for the first time whereas, 272 (46.1%) patients had repeated diabetes related admissions. Duration of diabetes was <1 year in 25 (4.2%) patients and >16 years in 176 (29.8%) patients. Highest rate of admission was between 6-10 year duration [Table 2].

Table 2: Distribution of patients according to duration of diabetes

Duration (years)	Number of patients (n)	Percentage (%)
New	50	8.6%
<1	25	4.2%
1-5	88	15.0%
6-10	193	32.8%
11-15	57	9.6%
>16	176	29.8%
Total	589	100

Out of 539 known diabetic patients, 317(58.8%) patients were under regular follow up at one or other health institutions whereas, 222(41.2%) were not under regular follow up from any of the health facility. Out of 539 known diabetic patients, 323(60%) were compliant to the treatment whereas, 216 (40%) were not compliant to the treatment. 1.2% of known diabetic patients, who were not on regular follow up for their treatment, however revealed that they were taking antidiabetic treatment regularly prescribed during their first hospital visit.

Pattern of ongoing treatment

Out of 589 total diabetic patients, there were three groups of patients. 21(3.6%) patients were Type1 diabetics and were taking only insulin

injections while, 50(8.6%) patients were newly diagnosed as diabetics and were admitted for glucose control in the hospital. These patients were managed with insulin injections during their hospital stay. Third group constituted 518(87.8%) patients and were known Type 2 diabetics, their treatment pattern was recorded and analyzed. Out of 518 known Type 2 diabetics, 369 (71.4%) patients were taking oral hypoglycemic agents. 13(2.5%) patients were taking insulin alone and 67 (12.8%) patients were taking both insulin and oral hypoglycemic drug/drugs. (metformin/sulfonylurea/DPP4 inhibitor/ α -glucosidase inhibitor etc. either single or in combinations). 69(13.3%) patients were not taking any antidiabetic drug and were taking some alternate therapy (local, Ayurvedic, Unani etc [Figure 1].

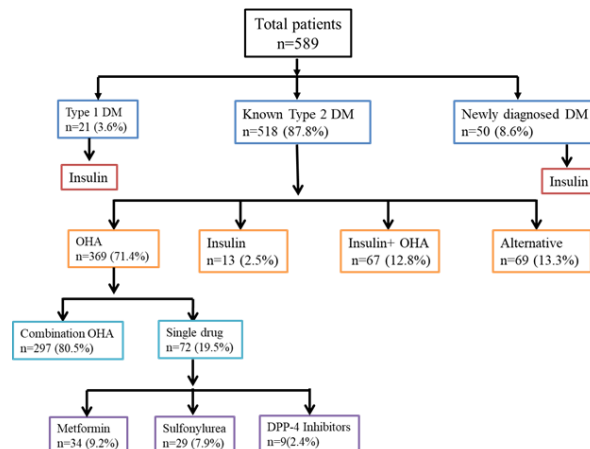


Fig. 1: Flow chart showing pattern of ongoing treatment

It was found that, premix form of insulin was used in all insulin monotherapy patients and those on combination therapy (insulin plus OHAs) were given long acting insulin (insulin analogues and insulin NPH) and premix form, to the extent of 60% and 40% respectively. Out of these patients who were on Insulin injections, it was further observed that, in 4 (5%) patients, the insulin injections were initiated before the development of chronic complications and in the remaining patients 76 (95%), it was initiated at the time when one or other chronic complication was detected.

Pattern of the causes of admission

The various reasons for admission of all diabetic patients have been compiled systematically [Table 3]. Infections were the most common cause of admission responsible for 136 (23.1%) of total admissions in diabetic patients (Frequency distribution of various infections are given in Figure 2).

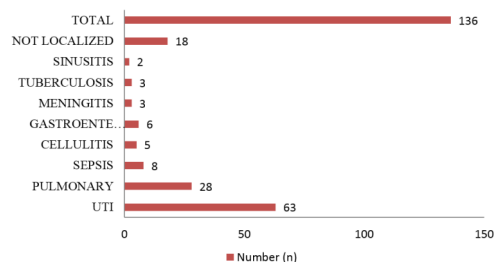


Fig. 2: Patients distribution according to type of infection

It was followed by chronic kidney disease (CKD) and acute on CKD in 130 (22.1%) patients [Figure 3].

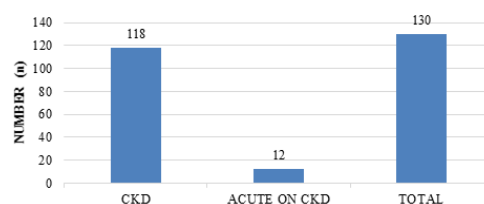


Fig. 3: Distribution of patients according to renal cause of admission.

Cardiovascular causes such as heart failure and coronary artery disease constitute 95 (16.1%) patients [Figure 4].

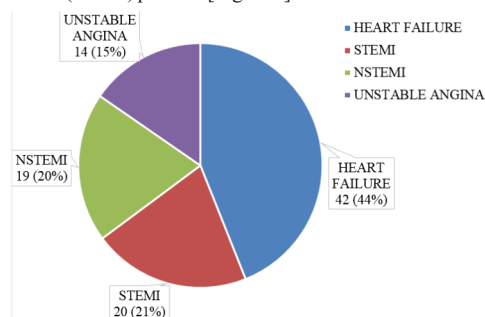


Fig. 4: Distribution of patients according to cardiovascular causes of admission

Among 89 (15.1%) patients with acute complications, ketoacidosis constituted 40% of patients followed by hypoglycemia (22%), metabolic acidosis in CKD patients (21%) and ketosis (increased sugar levels without ketones) in 17% of patients. A raised blood glucose level was reason for admission in 59 (10%) patient among all enrolled in our study. It was observed that 24(4%) patients were admitted due to stroke and 18(3.1%) were admitted with diabetic foot. Further, 38 (6.5%) patients were admitted with other non-diabetes related causes [Figure 5] such as COPD, asthma, seizure disorder, anemia, pulmonary thromboembolism and deep vein thrombosis etc. [Table 3].

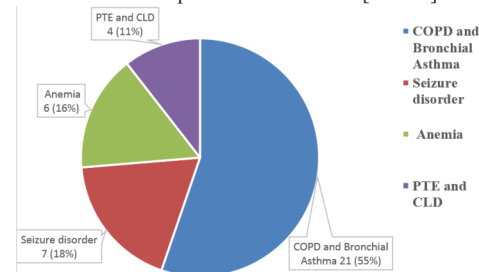


Fig. 5: Distribution of patients according to other cause of admission.

Table 3: Distribution of patients according to the cause of admission

variable	Male		Female		Total	
	N	%	N	%	N	%
Infections	60	22	76	24	136	23.1
CKD	58	21.5	72	22.7	130	22.1
Cardiovascular	48	18	47	15	95	16.1
Acute complications	38	14	51	16	89	15.1
↑Blood glucose	20	7.4	39	12.3	59	10
Stroke	14	5	10	3	24	4
Diabetic foot	11	4	7	2	18	3.1
Other causes	22	8	16	5	38	6.5
Total	271	100	318	100	589	100

The reason for admission in newly diagnosed with severe hyperglycaemia (n=50) and Type 1 diabetes (n=21) were reported as shown in [Figure 6 and Figure 7].

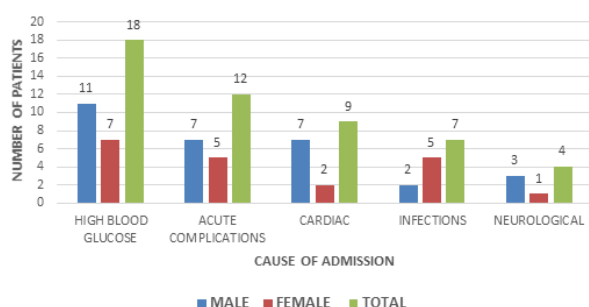


Fig. 6: Causes of admissions in newly diagnosed diabetic patients

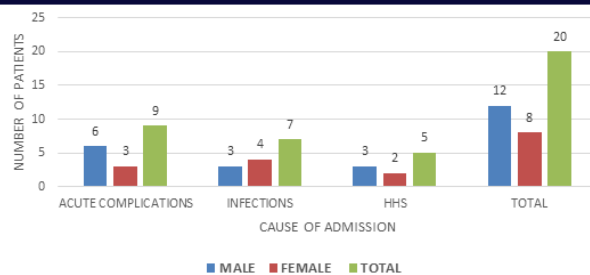


Fig. 7: Causes of admissions in Type 1 DM patients

Duration of stay of diabetic patients in hospital

Mean duration of stay of diabetic patients in hospital was 8.32 ± 2.7 days. Out of 589 patients, 106 (18 %) patients remained admitted in the hospital for <5 days while 395 (67%) patients remained hospitalized for 6-10 days. 88 (15%) patients had to remain admitted for >10 days [Table 4].

Table 4: Distribution of patients according to duration of hospital stay

Duration	Number (n)	Percentage (%)
<5 days	106	18
6-10 days	395	67
>10 days	88	15
Total	589	100

DISCUSSION

Hospitalizations related to diabetes account for a major portion of total expenditure on diabetes. However, a large proportion of hospitalizations for diabetes are preventable. Timely diagnosis, effective treatment and education can result in better management of diabetes. It can prevent the development or worsening of complications, and lead to low hospitalization rates. Hence, we conducted a prospective hospital based observational study to observe the pattern of ongoing treatment and hospitalizations in diabetic patients. The prevalence of diabetic admissions in our medicine wards in one year (study period) was 5.9%. It was higher from Tanzania⁴ and Nigeria⁵ studies, who reported 1% and 4.4% prevalence respectively. This reflects the higher incidence of diabetes and its complications in admitted patients in our region. However, this rate of diabetic admissions was lower than reported in studies conducted in Libya (22%)⁶, Jeddah (19.1%)⁷, Sudan (10%)⁸ and Multan (9.8%)⁹. Mean age of study population was 56.23 ± 10.08 years, 35.9% were in the age group of >60 years. This was lower than that reported from Kuwait (63.4%)¹⁰ but higher than that reported from Multan (21%)⁹. This probably reflects the regional differences in the diabetic admissions and improved survival of diabetic patients as a result of improvement in health services over a period of time. In our study females 318 (53.75%) outnumbered males 271 (46.25 %). Most of the studies reveal either female preponderance or equal distribution among both sexes. The results of our study were comparable to the studies carried out by Tarin et al⁹ who documented a total of 54.3% female patients in their study group. We reported more number of rural patients 459 (77.85%) than urban 130 (22.15%). In a study done by Ramachandran et al, the prevalence of diabetes in rural and urban areas of India was found to be 6.4% and 7.3% respectively¹¹. High proportion of rural patients in our study may be because of rural predominant population of Himachal Pradesh. Secondly, less availability of specialized services in the rural areas may be responsible for poor glycemic control, poor compliance and hence the presentation and admission due to different complications. It was observed that majority (96.4%) of patients were having Type 2 diabetes. This was comparable to the study done by Tarin et al in Multan⁹ and Al - Adsani et al in Kuwait¹⁰ who reported Type 2 diabetes to be in 92% and 97% patients respectively. Mean duration of diabetes in our study was 12.7 ± 6.9 years. This was much higher than reported by Tarin et al in Multan (7.36 years)⁹. This can be due to the better control of diabetes, longer survival and late appearance of complications in patients of our region. In our study, the mean age of onset of diabetes for all enrolled patients was 32.6 ± 6.4 years. Age of onset of diabetes mellitus in Type1 diabetics was 18.8 ± 6.4 years and in Type2 diabetics it was 46.3 ± 9.4 years. This was in consistent with the report published by the Centre for Disease Control (CDC) in 2017, that majority of new diabetes in the U.S are diagnosed between 45 and 64 years of age. In our study, the mean BMI of the study group patients was 24.5 ± 2.7 Kg/m². The

epidemiological studies in India reveal less prevalence of increased BMI when compared to our study. The reason for high BMI recorded in the hospitalized patients was that, these patients do not represent the BMI of community but high BMI in the patients presenting with complications are more in the overweight/obese patients.

The number of compliant patients 323(60%) in our study was more as compared to reported from Chennai (25%), Tamilnadu (39%), Saudi Arabia (30.1%) but lower than that reported from Uganda (71.1%). The good compliance of patients in our region may be due to a regular follow up, good rapport of treating physicians and awareness of advantage of good control of the disease. No difference in the compliance was found between male and female gender. In our study, the mean RBS at admission was $245 \pm 94.0 \text{ mg\%}$ for all patients. This was comparable to the study done by Tarin et al in Multan⁹ (224.12mg/dl). There was no difference in the rural and urban population with respect to control in diabetic status. Amongst all type 2 diabetics, 369 (71.4%) patients were on oral hypoglycemic agents (OHA), 297 (80.5%) of them were using combination OHAs. Metformin, sulfonylurea, DPP4 inhibitors, α -glucosidase inhibitors, SGLT2 inhibitors etc. were used in various combination regimens. In patients, on single drug 72 (19.5%) therapy, metformin was the most preferred 34 (9.2%), followed by sulfonylureas 29 (7.9%) and DPP-4 inhibitors in 9 (2.4%) patients. Combination of insulin and OHAs 67 (12.8%) were next to OHAs, followed by insulin alone in 13 (2.5%) patients. However, 69 (13.3%) patients were taking some alternative therapy (Local, Ayurvedic, Unani etc.) [Figure 1].

In a study done by R. B. Roaaid et al⁶ at Benghazi among patients with type 2 diabetes, 57.7% were taking OHAs, 39.9% were using insulin alone, 2.7% were on diet control and no patient was taking a combination of insulin and OHAs. Another study by Tarin et al⁹ from Multan also reported OHAs to be the most commonly used drug (72.8%) followed by insulin (24.7%) and dietary therapy (1.9%). They further reported sulfonylurea as the most common drug (45.7%) among OHAs, followed by sulfonylurea plus metformin (18.5%) and metformin alone in 8.6% cases. Our study was comparable to above studies with respect to the use of OHAs as the most commonly used drugs but differed in the use of individual drugs amongst OHAs. This may be due to the changing trends in the treatment approach to diabetes based upon recent guidelines and experience of physicians with different classes of drugs.

In our study, 80 (15.3%) patients among known type 2 diabetics were on insulin therapy, 13 (2.5%) of them were using insulin alone while, 67 (12.8 %) were using combination of insulin and OHAs. These findings were comparable with the studies done by R. B. Roaaid et al⁶ and Tarin et al⁹ as far as use of insulin injection is concerned. Further, all Type 1 diabetics 21 (3.6%) and all newly diagnosed diabetic patients 50 (8.6%) were also given insulin injections. It was found that, premix form of insulin was used in all insulin monotherapy patients however, patients on combination therapy (insulin plus OHAs) were given long acting insulin (insulin analogues and insulin NPH) and premix form, in the ratio of 60% and 40% respectively. In majority of the patients (95%), initiation of insulin was delayed till diabetic complications were detected. It has been concluded that earlier institution of insulin therapy may result in better glycemic control and delay in development of diabetes related complications. It was found that 438 (84.7%) known Type 2 diabetics patients were on OHAs and other alternative therapies. These patients revealed different reasons for not taking the insulin injections. In 72% patients, treating physician did not prescribe insulin injections despite the compelling indications of insulin use such as $\text{HbA1c} > 9\%$, inadequate control of blood glucose levels despite taking three or > three OHAs at their maximum doses. In 26% cases, patients refused for daily injections due to various apprehensions such as injection phobia, fear of habituation, storage problems, excuse of eyesight etc. In 2% cases, treating physicians refused for starting the insulin injections despite a request made by the patients based upon their knowledge. The probable reason for refusal could have been hesitancy on the part of treating physician regarding early initiation of insulin injections.

It has been observed in various studies that early initiation of insulin injection has a positive impact on good diabetes control. The various infections were the most common (23.1%) reasons responsible for admissions of diabetic patients. These results were not comparable with the findings reported by Tarin et al⁹ (29%) and Ahmad MA et al⁸. The lower rate of infections in our region may be due to better living

conditions, hygiene and nutritional status of people living in this part of world. Among the infections, the most common was UTI (47%) followed by Pulmonary infections (21%), sepsis (6%) and cellulitis (3.2%). Diabetics are more prone to recurrent urinary tract infections due to various factors such as decreased immunity and dysfunctional urinary bladder leading to stasis of urine and infection. The results of our study were comparable to study done by Janifer et al¹² in which prevalence of UTI was found to be 34.1% in females and 47% in males. In our study, the patients admitted with CKD for haemodialysis 130 (22.1%) were higher as compared to that observed by Tarin et al (9.9%). This may be due to the increased longevity of patients with increased availability of health resources. Out of 95 (16.1%) patients having cardiovascular cause of admission, heart failure patients constituted 42(44%) of admissions, followed by STEMI in 20(21%) and NSTEMI in 19(20%) patients. 14(15%) patients were admitted with unstable angina. The higher percentage of patients with heart failure (44%) may be because of availability of more effective drugs and improved life span of diabetic patients as compared to the past when fewer treatment options were available. In our study, 89 (15.1%) patients admitted with acute complications such as hypoglycemia, DKA and diabetic ketosis. These results were comparable to that observed by Tarin et al⁹, in which acute complications were responsible for 13.6% of admissions.

We reported various causes of admission in newly diagnosed diabetic patients [Figure 6] and found that, 24% of them were admitted with complications. This was comparable to the findings of Al-Adsani et al¹⁰ from Kuwait, who reported 26.7% patients admitted with various complications. In our study, acute complications in the form of ketosis (Raised blood glucose levels without raised ketones) and ketoacidosis was the most common cause of admission in 9 (45%) patients. Macro vascular complications were not seen in these patients as expected because of younger age group of patients and early detection of disease. In our study, the mean duration of stay was 8.3 ± 2.7 days. This was comparable to that observed by Green A et al¹³ (8.4 days) and Tarin et al⁹ (6.6 days). The average duration of stay was quite higher in studies done by E. A. Ajayi et al¹ (21 days) and Chuhwak et al¹⁴ (23.6 days). This variation may be due to the different causes of admission, severity of illness and availability of hospital facilities. Moreover, most of these admissions are preventable if proper care is taken and good compliance is ensured by health education of the diabetics as well as general population. The health resources can be diverted to unavoidable admissions.

CONCLUSION: It was concluded that diabetic admissions constitute a major proportion of admissions in the medicine wards. Maximum numbers of admissions were in the age group of 45-60 years, females more than males, more from rural background and the first time admissions were more than multiple admissions. Infections were the most common cause of admission responsible for 23.1% of total admissions in diabetic patients and UTI was the commonest infection. Most of the patients were taking OHAs in various combinations and the numbers of patients taking insulin were less than expected. Among insulin users, it was seen that majority of them got insulin prescription once they landed up with diabetes related complications. The peripheral (rural) health services in the management of diabetes need to be strengthened as most of the population in our area belongs to rural area and if the disease is tackled properly at the initial stage, the need for hospitalizations can be reduced. A long term, consistent and good glycaemic control should be emphasized. This intervention will directly affect the quality of life of diabetics and will definitely reduce the number of hospitalizations and mortality in diabetes patients.

REFERENCES:

1. Wild S, Roglic G, Green A, Sicree R, King H (2004). "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030". *Diabetes Care*. 27(5):1047-53.
2. Wild S, Roglic G, Green A, Sicree R, King H. "Global Prevalence of Diabetes." *Diabetes Care*. American Diabetes Association, 26 Jan. 2004. Web. 22 Apr. 2014
3. Kleinfeld, N. R. (September 13, 2006). "Modern Ways Open India's Doors to Diabetes". *New York Times*. Retrieved 8 June 2012
4. Ahren B. Diabetes mellitus at a rural hospital in Northeastern Tanzania. *Trop Geog Med* 1984;36:237-47.
5. Ajayi EA, Ajayi AO. Pattern and outcome of Diabetic admissions in federal medical center: A 5 year review. *Annals of African Medicine*. 2009;8(4):271-275.
6. Roaaid RB, Kablan AA. Profile of diabetic healthcare at Benghazi Diabetes Centre, Libyan Arab Jamahiriya. *East Mediterr Health J* 2007; 13(1):168-176.
7. Akbar DH, Mushtaq M. Changing patterns of diabetic admissions in Jeddah, Saudi Arabia. *Diabetes International* 2000; 10(3):84-5.
8. Ahmed MA, Ahmed HA. Hospitalization patterns of diabetic patients in Sudan. *Diab Int* 2000;10(1):18-9.
9. Tarin SMA, Khan MI. Pattern of diabetic admissions in medical ward. *Pak J Med Res* 2004;43(4):26-34.
10. Al-Adsani AMS, Abdulla KA, Reasons for hospitalizations in adults with diabetes in

- Kuwait. Int J Diab Mellitus (2011) doi:10.1016/j.ijdm.2011.01.008
11. Ramachandran A, Snehalatha C, Kapur A. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia* 2001;44:1094-1101.
 12. Jenifer J, Geethalakshmi. Prevalence of lower urinary tract infection in South Indian Type2 diabetic subjects. *Indian Journal of Nephrology* 2009 19:107.
 13. Green A, Solander F. Epidemiological study of diabetes mellitus in Denmark. Use of hospital services by insulin treated diabetic patients. *Diabetologia* 1984;6:195-8.
 14. Chuhwak EK, Puepet FH, Malu OA, Ohwovoriole AE. Morbidity and mortality study of diabetic admissions in Jos University Teaching Hospital. *Diabetes International* 1999;9:76-7.