



RESEARCH ARTICLE

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PATTERN OF DIABETES MANAGEMENT FOR PATIENTS IN OUTPATIENT DEPARTMENT OF A TERTIARY HOSPITAL OF BANGLADESH

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ABSTRACT

Background: Glycemic control is the key to preventing acute and chronic complications of diabetes mellitus. Change in life style and medication are the way to achieve control and prevent complications. Numbers of drug including insulin developed till date. These drugs are effective when lifestyle is changed. Numerous guidelines developed for judicious use of these drugs based on evidence in clinical trials. Both physician's and patient's factors found to be responsible for overall poor control of diabetes. **Objective:** In this study, we intend to find out the pattern of diabetes management in outpatient department in a specialized diabetic center and to identify the factors associated with poor glycemic control. **Material and Method:** This retrospective cohort study was done at outpatient Department of BIRDEM, during the period of March 2015 to April 2016. Among the diabetic patients attending the outpatient department, adult subjects were selected by random sampling. Socio-demographic, clinical and biochemical data were collected from these patients. Statistical analysis was done with SPSS version 22.0. **Result:** Among 522 patients, 53% were male. Mean age 47.33±13.98 years, 90% were Muslim. Most (73%) of them were from urban area, 80% were educated up to SSC or more and 65% were sedentary. Their knowledge about diet plan, exercise, SMBG, foot care, and sick day management were present in 89%, 76%, 35%, 17%, and 10% respectively but their practice of this knowledge was 68% in diet plan, 63% in exercise. Most of them had type-2 diabetes and presented asymptomatic(73%). Hypertension was present in 52% patient and complications related to diabetes in 43%. Most (66%) were overweight or obese. Positive smoking history in 27% of patients, either current or ex-smoker. Among microvascular complications retinopathy and macrovascular complications, IHD were most frequent both at diagnosis and follow up. Most common (46.5%) treatment modality was combination of oral anti-diabetic drug especially Metformin with secretagogues. Most common pattern of insulin use was premixed or split-mixed regimen. Only 18% of cases HbA1c target achieved but treatment regimen escalated only in 20.5% cases. HbA1c is infrequently used in follow up (35%). We observed the glycemic burden for prolong period of time with treatment modalities. We found, average HbA1c%, average FBS and average duration of changing regimen were 8.37±0.76%, 8.9±0.98 mmol/L for 20.45±7.48 months; 9.4±0.61%, 9.76 ± 1.25 mmol/L for 39.22±12.04 months, 9.67± 0.91%, 10.48 ± 0.70 mmol/L for 46.0±15.22 months in lifestyle change only, monotherapy with OAD and combination oral drug regimen respectively, in escalating to higher regimens. **Conclusion:** The present study identifies that patient inadequate knowledge regarding diabetes self-management reluctance in practice of knowledge are important factors in poor control of diabetes. Clinical inertia to change the regimen or use of insulin on patient's request or physician's reluctance is responsible.

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INTRODUCTION

Diabetes mellitus poses a major global health threat, especially in the developed and developing countries. The increasing trend of type 2 diabetes is common in the developing nations

and most common in Southeast Asian countries (Wild, 2004). Recent epidemiologic studies have shown an increased prevalence of diabetes in India (11.6%), Pakistan (11.1%), Hawaii (20.4%), and Turkey (7.2%) (Ramachandran, 1997). It has been suggested that the increase in prevalence of diabetes

among Asian is due to ageing of the population, urbanization and increasing prevalence of obesity and physical inactivity (Marguerite, 2004). Some population-based studies conducted in Bangladesh at different times have revealed an increasing trend of diabetes prevalence ranging from 1.0 to 3.8% in rural population and 1.5 to 8.0% in urban population (Sayeed, 1997). Bangladeshis are more at risk to develop diabetes, hyperinsulinemia and coronary heart disease compared with other South Asian migrants settled in the UK (McIntyre, 2010). Diabetes mellitus is a chronic illness, which requires continuous medical care, patient self-management and education to prevent acute complications and to reduce the risk of long-term complications. Acute life-threatening consequences of DM are hyperglycemia with Diabetic ketoacidosis or the Hyperglycemic Hyperosmolar State. Long-term complications of DM include retinopathy, nephropathy, neuropathy, stroke, ischemic heart disease, and diabetic foot. The United Kingdom Prospective Diabetes Study (UKPDS) showed intensive blood glucose control by either sulfonylureas or insulin substantially decreased the risk of microvascular complications. Monitoring of glycemic status is considered a cornerstone of care in diabetes.

Results of monitoring are used to assess the efficacy of therapy and to guide the adjustment in medical nutrition therapy (MNT), exercise, and medications to achieve the best possible blood glucose control (Grandinetti, 1998). American Diabetes Association (ADA) recommends blood glucose testing by patients through self-monitoring of blood glucose (SMBG) and by health care providers for routine outpatient management of DM. Recently SMBG has revolutionized management of DM as it helps to achieve and maintain specific glycemic goals. Measurement of glycosylated hemoglobin (HbA1c) can quantify average glycemia over weeks and months, thereby complimenting day-to-day testing. Various classes of anti-diabetic drugs including insulin and oral hypoglycemic agents (OHA) are currently used in the treatment of diabetes, which acts by different mechanisms to reduce the blood glucose levels to maintain optimal glycemic control. The currently used anti-diabetic drugs are very effective, however because of lack of patient compliance, clinical inertia, insulin resistance, lack of exercise and lack of dietary control leads to unsatisfactory control of hyperglycemia. In Bangladesh, limited studies have focused on diabetes care and provide an insight into the current profile of patients and their management. More than 50% of people with diabetes have poor glycemic control, uncontrolled hypertension and dyslipidemia, and a large percentage have diabetic vascular complications (Raheja, 2001). In that context our study was carried out to find the current management pattern of diabetes and efficacy of management in adequate glycemic control in diabetic patients attending a tertiary care hospital.

METHODS

This was a retrospective cohort study done in the outpatient department (medical) of a specialized diabetic care hospital (BIRDEM General Hospital) during a study period of one year from March 2015 to April 2016. Using a precision-based calculation, minimum sample size required at 5% level of significance and 95% confidence level calculated sample size required was 2267. But due to time constrain 522 patients were finally included in the study. This study involved collection of both primary and secondary data. Primary data was collected by face to face interview of the patients by the researcher at

health care facility during the period of hospital visits upon their consent and convenience. Socioeconomic and personal information was recorded from patient through interview and their guidebook (provided from the BIRDEM hospital) record, with a semi structured pre-tested questionnaire. Data about the previous treatment was collected from the diabetic guide book.

Diabetic population of adult age group (≥ 18 years) of all socioeconomic strata attending outpatient department of BIRDEM General Hospital, Dhaka. Each day two rooms were selected by lottery among 13 medical OPD rooms. One in every three patients was approached to be included in this study after fulfilling the inclusion and exclusion criteria. Patients attending outpatient departments of BIRDEM General Hospital and those suffering from diabetes mellitus, after being confirmed by registered physician, patients willing to participate in the study, patients who were registered in BIRDEM OPD from first visit and came in subsequent follow up, age ≥ 18 years were included in the study and patients unwilling to participate in this study and patients in whom treatment modality had been changed within three months of initiation were excluded in the study. After collection data were compiled and analyzed by SPSS-20.

RESULTS

Table 1. Distribution of the patients according to Socio-demographic characteristics. (n=522)

Characteristics	Distribution	Frequency (n)	Percent (%)
Age	< 31 years	71	14
	31-40	104	20
	41-50	129	25
	51-60	112	21
	61-70	83	16
Sex	>71	23	4
	Male	276	53
Area of residence	Female	246	47
	Rural	140	27
Religion	Urban	382	73
	Muslim	471	90
	Hindu	34	7
	Christian	4	1
Physical activity	Buddhist	13	2
	Sedentary	339	65
	Light worker	131	25
	Moderate worker	41	8
	Heavy worker	11	2

Table 2. Baseline characteristics of study population regarding the knowledge and practice of DSME (Diabetes Self-Management and Education). (n=522)

DSME characteristics	Knowledge or practice of DSME		Total
	Yes N(%)	No N(%)	
Health education received	440(84%)	82(16%)	522
Knowledge about diet plan	466(89%)	56(11%)	522
Follow the diet plan	316(68%)	150(32%)	466
Knowledge about exercise	395(76%)	127(24%)	522
Perform regular exercise	248(63%)	147(37%)	395
Have glucometer	269(52%)	253(48%)	522
Can interpret SMBG	95(35%)	174(65%)	269
Knowledge about foot care	90(17%)	432(83%)	522
Knowledge about sick day management	52(10%)	470(90%)	522
Inject insulin correctly	131(63%)	77(27%)	208

Table 3. Baseline clinical characteristics of the study subjects (n=522)

Clinical characteristics	Distribution	Frequency	Percent
Type of Diabetes	Type -1	6	1
	Type-2	401	77
	Uncertain	115	22
Mode of presentation	Typical symptoms	86	16.4
	Atypical symptoms	54	10.4
	Asymptomatic	382	73.2
Hypertension	Present	271	52
	Absent	251	48
Complication at presentation	Present	224	43
	Absent	298	57
BMI	<18.5	42	8
	18.5-22.9	134	26
	23-24.9	203	39
	>25	143	27
Smoking status	Smoker	76	15
	Non-smoker	381	73
	Ex-smoker	65	12
Family history of diabetes	Known	248	48
	Unknown	274	52

Table 4. Baseline others characteristics of the patients at 1st visit. (n=522)

Others Characteristics	Distribution	Frequency	Percent
Glycemic parameter used	HbA1c	212	40
	FPG only	16	3
	OGTT	303	58
	FPG +PG-2HABF	203	39
	Lifestyle change only	29	6
Treatment modality started	Monotherapy	112	22
	Combination oral drugs	243	46
	Oral drug + insulin	54	10
	Only insulin	84	16
Follow up advise	Written	506	97
	Not written	16	3
Advised to come in follow up after	One month	214	43
	Two month	172	34
	Three months	120	23
Fundoscopy	Done	243	47
	Not done	279	53
Guide book	Filled up	162	31
	Not filled up properly	360	69

Table 5. Treatment modality started and basis of choice (n=522)

Treatment modality	N	Basis of choice of treatment modality			
		Glycemic status	Complication	Infection	Surgery
Only lifestyle change	29	100%	0	0	0
Monotherapy	112	100%	0	0	0
Combination oral drugs	243	100%	0	0	0
Oral drug + insulin	54	30%	59%	4%	7%
Only insulin	84	36%	51%	6%	7%
Total	522	83%	14%	1%	2%

Table 6. Treatment modalities chosen at first visit and their relation with HbA1c. (n=212)

Treatment modality started	HbA _{1c} % at first visit(N)			Total
	<8%	8-10%	>10%	
Only lifestyle change	3	1	0	4
Monotherapy	29	32	0	61
Combination oral drugs	6	93	13	112
Oral drug + insulin	0	3	11	14
Only insulin	0	2	19	21
Total	38	131	43	212

Table 7. Treatment modalities chosen at first visit and their glycemic basis

Initial Treatment modality	HbA _{1c} %	FPG	2HAOG	PG-2HABF
	Mean ± SD(N)	Mean ± SD(N)	Mean ± SD(N)	Mean ± SD(N)
Lifestyle change	8.05±0.44(4)	8.94±1.46(29)	13.50±1.36(21)	13.50±1.36(8)
Monotherapy	8.15±0.57(61)	9.34±1.43(112)	14.05±1.29(92)	12.96± 2.03(20)
Combined oral drugs	9.22±0.65(112)	11.44±1.32(343)	15.57±1.10(133)	14.83± 1.27(93)
Oral drug + insulin	11.65±2.0(14)	15.15±2.29(54)	21.74±3.75(23)	20.50± 3.73(31)
Only insulin	11.76±1.45(21)	15.33±2.58(84)	21.05±3.49(33)	21.21± 3.77(49)

Table 8. Treatment modalities chosen at first visit and their relation with complication (n=224)

Treatment modalities	Complication at first visit(N)						Total
	Neuropathy	Nephropathy	Retinopathy	IHD	PVD	Stoke	
Only lifestyle change	3	0	0	2	0	0	5
Monotherapy	3	4	14	13	0	1	35
Combination oral drugs	11	4	47	29	0	13	104
Oral drug + insulin	3	1	3	4	1	17	29
Only insulin	11	5	8	24	2	1	51
Total	31	14	72	72	3	32	224

Table 9. Drug chosen in relation to HbA_{1c}% at initial visit

Drugs used	HbA _{1c} %			Total	
	<8%	8-10%	>10%		
Monotherapy	Metformin	10	12	0	22
	Secretagogue	13	15	0	28
	DPP-4 inhibitors	2	5	0	7
	Glitazone	4	0	0	4
Combined oral drug	Metformin+Secretagogue	3	45	7	55
	Metformin+DPP-4 inhibitors	2	19	2	23
	Metformin+Glitazone	1	6	1	8
	Secretagogue+Glitazone	0	13	3	16
	Metformin+Secretagogue+DPP-4 inhibitors	0	3	0	3
	Metformin+Secretagogue +Glitazone	0	7	0	7
	Insulin +	Metformin	0	1	7
Metformin+DPP-4 inhibitors	0	1	0	1	
DPP-4 inhibitors	0	1	2	3	
Glitazone	0	0	1	1	
Only insulin	0	2	20	22	

Table 10. Characteristics of patients in follow up visit (n=522)

Characteristics	Distribution	Frequency	Percent	
Patients came in follow up	3-6 months	256	49	
	6-12months	152	29	
	>12months	114	22	
Glycemic parameter used	HbA _{1c}	184	35	
	FPG	504	97	
	PG-2HABF	470	58	
	Neuropathy	10	24	
New Complications in follow up visit	Nephropathy	3	7	
	Retinopathy	7	18	
	IHD	14	34	
	PVD	1	2	
	Stroke	6	15	
	Step up	107	20	
	Step down	76	15	
Changes in the regimens	No change	339	65	
	Only lifestyle change	15	3	
	Treatment modality	Monotherapy	91	17
		Combination oral drugs	332	64
Oral drug + insulin		17	3	
Only insulin		67	13	

Table 11. Distribution of pattern of change in the prescription whom treatment modality was not changed. (n=339)

Pattern of change	Frequency	Percent
Same prescription	115	34
Increase dose of same drug	151	45
Decrease dose of same drug	45	13
Change to another molecule of same group	20	6
Change in brand name	8	2
Total	339	100

Table 12. Distribution of the patients according to glycemic target achievement whom prescription was same at initial and follow up visit

Glycemic parameter	Distribution	Frequency	Percent
HbA _{1c} %	≤7%	30	46
	>7%	35	56
FPG (mmol/L)	≤7.2	71	40
	>7.2	104	60
PPPG (mmol/L)	≤10.00	69	46
	>10	80	54

Table 13. Drugs in follow up in relation with HbA1c in follow up

Drug in the follow up		HbA _{1c} % in follow up				Total
		<7%	7-7.9%	8-10%	>10%	
Monotherapy	Metformin	3	6	6	0	15
	Secretagogue	3	2	2	1	8
	DPP-4 inhibitors	2	0	1	0	3
	Glitazone	1	0	2	0	3
Combination oral drug	Metformin +Secretagogue	1	16	20	6	43
	Metformin+ DPP-4 inhibitors	0	1	7	3	11
	Metformin+ Glitazone	0	1	3	0	4
	Secretagogue + Glitazone	0	3	6	1	10
	Metformin + Secretagogue + DPP-4 inhibitors	2	1	2	4	9
	Metformin + Secretagogue + Glitazone	3	2	4	3	12
	Metformin +DPP-4 inhibitors	0	0	2	2	4
	Metformin + Secretagogue +insulin	0	0	1	0	1
Insulin +	Metformin +insulin	1	4	4	3	12
	insulin	13	4	10	8	35
	DPP-4	0	0	1	2	3
	Metformin + Glitazone	0	1	0	1	2
	Metformin + Secretagogue	0	0	0	1	1
	Only insulin	13	4	10	8	35

Table 14. Glycemic burden before changing the treatment regimens

Initial treatment regimen	Glycemic status				Duration
	HbA _{1c} %		FPG		(months)
	N	Mean ±SD	N	Mean ±SD	Mean ±SD
Life style change	4	8.37±0.76	10	8.9±0.98	20.45±7.48
Monotherapy	28	9.4±0.61	48	9.67± 0.91	39.22±12.04
Combined oral Drug	52	9.76 ± 1.25	91	10.48 ±0.70	46.0±15.22

DISCUSSION

Mean age of our patients is 47.33±13.98 years, ranging from 18 to 78 years. Most frequent number 129(24.70%) is in the age group 41-50 years. 58.20% patients are below 50 years of age. Rahman et al⁸ in a study in urbanizing rural community of Bangladesh found that risk of diabetes mellitus is more in age group 31-40 years. Imam (Imam, 2012) found diabetes prevalence is more than twice higher (71%) in age group more than 40 years compare to age group less than 40 years in BIRDEM. In our study subjects more than 40 years age is more (64.5%) which also suggest similar result. Acharya et al¹⁰ in a study in tertiary teaching hospital, India found that majority (36%) of the patient was in 51-60 years age group, which is not similar to our study. Among the study subjects 276(52.9%) are male and 246(47.1%) female. In the study of Imam (Imam, 2012) in BIRDEM, found 56.25% were male that is similar to our study. Biswas et al (Biswas, 2016) in a review found that prevalence of diabetes mellitus is higher in male compare to female in urban area where vice-versa in rural area. Rahman et al (Rahman, 2007) in an urbanizing area of Bangladesh found, among diabetic patients 31% male and 69% female, that is different from our study. Male predominance in present study may be due to fact that in our society, male seek medical attention more commonly than female. Among the patients most 382(73.2%) reside in urban area and (26.8%) in rural area. Roben blatt et al (Rossi, 2010) found in a study 29% of diabetic patients are from rural area which is similar to our study. Imam (2012) in a study in BIRDEM found 36% of the patients were from rural area of Bangladesh, which is also similar to our study. Among 522 patients 248(47.5%) has known family history of diabetes mellitus in first-degree relatives. In 52.5%, family history of diabetes is not known. In Imam (2012), study 5.54% patients had either one or both parent's diabetes. However, 23.06% was unaware about parents' diabetes status. Gautam et al (Gautam, 2015) in Nepal found positive family history in 36.1% cases.

Gupta et al (Gupta, 2015) in India found positive family history in 41.73% patients. Result of our study is much higher than above-mentioned study. Majority of our patients 440(84.29%) received diabetic health education. Rafique et al¹⁵ in a study in Karachi, Pakistan found 38% participants received diabetic education at clinic. Al-Maskari et al (Al-Maskari, 2003) in UAE found 89% had seen a diabetic educator since their diagnosis. Study results are different in different study. Among 522 patients 466(89.2) has knowledge about their diet plan, 10.8% has no or poor knowledge of diet. Gupta et al (Gupta, 2015) in a study in northern India found knowledge about diet is present in 90% patients that are same to our study. Similar result was found in the study of Saleh et al¹⁷ in Bangladesh (82%). But Islam et al (2014) found very limited knowledge of diabetes in rural area of Bangladesh. Among 466 patients who have knowledge about diet plan 316 (67.80%), practice their knowledge in diet control. Gupta et al (Gupta, 2015) in a study in India found only 53.91% patients follow the diet. Rafique et al¹⁵ in their study in Karachi found 58.8% has knowledge of exercise and 29% practice their knowledge of exercise. Gupta et al¹⁴ in India found 90% has knowledge of exercise but only 29% of them do regular exercise. Therefore, knowledge, attitude and practice are poor in different studies. 51.54% of our patients has glucometer in their family but knowledge of interpretation of thier glucometer reading in blood sugar management is poor(35.3%). Rafique et al (Rafique, 2006) found 29.6% of participant were able to self monitor their blood sugar. Badruddinet al (Badruddin, 2002) in Pakistan found 69% patients had glucometer but only 20% do SMBG. Foot care knowledge is very poor among our patients (17.2%). Whereas only 14% respondents had good practices for foot care, 54% had satisfactory practices and 32% had poor practices. George et al (2013) in a study in southern india found about 75% had good knowledge score and 67% had good foot care practice score. Our patient has much lower knowledge about foot care

in comparison to above studies. Only 9.9% of our patients have knowledge about mild to moderate sick day management. 39.8% of study subjects are using insulin at present. Agarwal et al¹⁹ in Mumbai found 43.6% of the patients are on insulin in a cross-sectional study. Johnson et al (Jonathon, 2004) stated that a study from Spain, 25.3% patients were prescribed insulin. This difference is due to difference in presentation of patients in different studies. Regarding insulin injection technique 63% patient follow the right technique. Rafique et al (Rafique, 2006) found 73% injecting insulin at 90 degree. 47% were injecting insulin Subcutaneously other (53%) injecting intramuscular or intra-dermal. Knowledge about injection technique is similar with our study. In our study, type-1 diabetes was 1%, type-2 was 77% and 22% subjects, type of diabetes not written in guidebook. At initial presentation, sometimes type of Diabetes cannot diagnose clinically. That may be the reason diagnosis not written in 22% book. Most of the patients were asymptomatic (73.2%) at first presentation. Typical symptoms were present in 16.4% and atypical symptom in 38.6%. Complication related to Diabetes mellitus was present at first visit in 202 (38.7%) patients.

In our study, 271 (51.9%) subjects were hypertensive at first visit, which is higher than Aisha (2003) in Saudi Arabia (41%). Acharya et al¹⁰ found hypertension is a common association with diabetes. Majority 203 (38.8%) of the patient's BMI is 23-24.9 which is overweight according to definition for our population (WHO, 2000). Normal BMI in 25.6% patients, low BMI 8% and obese 27.3%. In Imam (Imam, 2012) found 16.7% had BMI <18, 33.7% more than 25 and 49% in between BMI 18 to 25 Kg/M², finding is similar to our result. Rahman et al⁸ found BMI 20.48±3.20 Kg in /M² male and 20.48±3.44 Kg in /M² in female in an urbanizing rural community in Bangladesh which is lower than our result. In our study, 76 (14.6%) patients are smoker, 381 (73%) non-smoker and 65 (12.4%) ex-smoker. According to World Bank (2009) prevalence smoking in male 46.36% and in female 1.96% in Bangladesh. In our study among male 27.1% are smoker, which is much lower than general population. Aishya (Aisha, 2004) in Saudi Arabia found 7.7% of diabetic patients were smoker. Ganz et al (2014) in USA found among diabetic patients 49% never smoked, 29.8% former smoker, 17.8% current smoker. Present smoking status similar to our study. Most common complication was diabetic retinopathy and Ischemic Heart Disease 72 (13.7%). Fundoscopy at first visit done in 47% patients, out of them 30% had retinopathy. Sayeed MA (2001) found diabetic retinopathy in 36.2% of diabetic patients in BIRDEM.

Retinopathy was the most common microvascular complication followed by nephropathy. Macrovascular complication was much less common than microvascular complication. In our study macrovascular complications especially IHD was equally common as retinopathy but other macrovascular complication was less common. In UKPDS retinopathy at the time of diagnosis found in 25% cases, which is similar to our result. Neuropathy based on the symptom/sign or drug used for symptoms of neuropathy found in 31 (5.9%) patient where in UKPDS neuropathy at first diagnosis was found in 9% of the patients this difference may be due to difference in the sensitivity of the tool we used to detect neuropathy. 14 (2.8%) were labeled as having nephropathy at initial visit. In UKPDS nephropathy was found in 8% of the patients which is much higher than our finding. This is probably due to sensitive test like ACR not done in screening

in our study people. Among 522 patients 72 (13.7%) was labeled as having IHD. 3 (0.57%) patients presented with peripheral vascular disease and 32 (6.1%) patients presented with stroke. Among study subjects pattern of treatment modalities started at first visit were only lifestyle change in 29 (5.6%), monotherapy with single oral anti-diabetic drug in 112 (21.5%), combination of oral anti-diabetic drug in 243 (46.6%), insulin with oral anti-diabetic drug in 54 (10.3%) and only insulin in 84 (16.1%) cases. In our study, insulin started in 26.4% of the patients and oral anti-diabetic drug in 68.1% and with life style modification in 5.6% of the patients. Aisha (2003) found 39% with insulin, 57% with oral anti-diabetic drug and 4% with lifestyle change only. Agarwal et al (2014) found 43.6% with insulin and 56.4% with oral anti-diabetic drug. Acharya (2013) found 11.3% with insulin and 88.7% with oral medication. Johnson et al found 25.3% with insulin. So picture is different in different study may be due to difference in population and presentation. Most common reason behind the selection of treatment regimen was glycemic status in the term of HbA1c or OGTT or FPG with plasma glucose 2 Hours after breakfast. In 75 case complications were the influencing factor, infection in 7 and surgery in 10 cases. HbA1c done in 212 (40.6%) patients but HbA1c in the most significant parameter used for choosing the treatment modalities and to see the glycemic improvement in all guidelines. Treatment modality were not chosen as per guidelines. 13 patients HbA1c were more than 10% managed with oral drug but were indicated for insulin (ADA 2016).

Most common single drug used was Metformin (45%), this finding is similar to Acharya et al (40.45%) second most common was secretagogue (37%). Most common combination oral drug was Metformin and secretagogue combination (51%) which is also similar to Acharya¹⁰ which also suggest combination of Metformin and sulfonylureas was most frequently used combination and most effective one. Most commonly practiced insulin regimen was premixed human insulin 48.50% followed by free mixed human insulin (35%). Basal bolus regimen with analogue insulin was in 7%. Only short acting insulin 4.5% and only basal insulin including NPH and analog basal in 5.1% of the cases. Agarwal et al (2014) found 72.13% short acting, 8.2% intermediate acting insulin and mixed insulin in 4.9%, which is different from our study finding. Machaon et al (2010) in America found 85% (15255) of insulin naïve patients was started with basal insulin among them 88.1% started with insulin analogue. Insulin selection pattern varies extremely from population to population. Among 298 patients whom complication related to diabetes was not evident in initial visit, 41 present with complication in follow up visit. Out of them 24 patients came into follow up after 12 months from first visit. In follow up visit 339 (65%) patients treatment regimen didn't changed but their drug dose increased in 151 cases. Treatment regimen were stepped up in 107 (20.5%) patients mostly from monotherapy to combination oral drugs (26 cases) as glycemic target not achieved (41.5%). In 76 patients regimen were relaxed by stepping down mostly (59 cases) from insulin to oral medication as glycemic target achieved (21 cases) and patients request (16 cases). In our study we found that HbA1c done in 184 (34.80%) of the patients in follow up visit. Aisha (2003) found only 49% case HbA1c done in a study in Saudi Arabia. It may be explained by lack of request for the investigation by the physicians, or could have been requested but was not carried out due to ignorance of the patient. According to ADA guideline, Ideally HbA1c should be

checked every 3 months to determine whether a patient's metabolic control has been achieved and maintained within the target range. HbA_{1c} is <7% only in 34(18.4%) cases, >10% in 36(19.8%) cases, between 7—7.9% in 42(22.82%) and 8-10% in 72(39.13%) patients. Poor glycaemic control based on HbA_{1c} is similar to Aisha(2003) study 77%. Agarwal et al¹⁹ found 41% cases A_{1c} control and 61% inadequate control with anti-diabetic drugs. We observed the glycaemic burden for prolong period with different treatment modalities. Only with lifestyle change average time of changing regimen to next one was 20.45±7.48 months with an average HbA_{1c}% 8.37±0.76 and average FPG 8.9±0.98 mmol/L. Similar picture was found with monotherapy and combination oral drug. In monotherapy group average duration was 39.22±12.04 months where HbA_{1c}% 9.4±0.61; FPG 9.67±0.91. In combination oral drug group for 46.0±15.22 months, HbA_{1c}% was 9.76 ±1.25 and FPG 10.48 ± 0.70mmol/L before changing the regimen.

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