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Correlation of HbA1c with microalbuminuria of type-2 diabetes mellitus patients

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Abstract
Introduction: It is a common clinical condition-encountered by the otorhinolaryngologist. Key clinical areas of epistaxis are the Little's area and the 'Woodruff's plexus. Little's area lies in the anteroinferior part of septum; a common site of anterior epistaxis in children and young adults [2]. Woodruff s plexus lies just inferior to the posterior end of inferior turbinate; gives rise to posterior, epistaxis in adults [3].
The causes of epistaxis are numerous which can be divided into local and general causes. Common local causes are Trauma, Infections, Foreign bodies, Deviated nasal septum, Neoplasms. General causes are Hypertension, Blood dyscrasias, Chronic liver disorders, Chronic kidney diseases, Overuse of salicylates and anticoagulants.
Aim: To study the etiopathogenesis, age and sex distribution of epistaxis.
Materials and Methods: This study was conducted in the ENT department of Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari district in a time period from January 2020 to September 2020. Fifty patients of both sexes and all age groups presenting with epistaxis are included in this study. The study was conducted after obtaining the clearance from Institutional Human Ethical Committee.
Study Design: Prospective descriptive study.

Keywords: Otorhinolaryngologist, woodruff's plexus, diabetes mellitus

Introduction

1. Introduction to Diabetes mellitus: Diabetes mellitus is a heterogeneous group of diseases characterized by chronic elevation of glucose in the blood. It arises because the body is unable to produce enough insulin for its own needs, either because of impaired insulin secretion, impaired insulin action, or both. Diabetes affects some 300 million people world-wide, and is on the increase. Chronic exposure to high blood glucose is a leading cause of renal failure, visual loss and a range of other types of tissue damage. The diagnostic criterion for diabetes is fasting plasma glucose ≥ 7.0 mmol/L (126 mg/dl) – a diagnostic point selected on the basis of micro-vascular complications.

2. Risk factors for type 2 diabetes: There are so many factores ie; age, obesity, ethinicity, socioeconomic ststus, physical activity, diet, stress, genetics which can affect he prevalence of diabetes I society.

3. Clinical presentation of diabetres mellitus: Diabetes may present acutely, with the three classic symptoms of thirst, polyuria and weight loss. Type 2 diabetes, present less dramatically then type -I. Increased thirst and polyuria may not be noticed because they develop slowly, and weight loss may be welcomed by those who are trying to diet.

4. Complications: Complications due to diabetes are a major cause of disability, reduced quality of life, and death. Diabetes Association, heart disease is the leading cause of death in women with diabetes (www.diabetes.org/living-with-diabetes). Diabetes can affect every part of the body, including the feet, the eyes and the skin.

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Aims and objectives
- To find out correlation of HbA1c with diabetic patients having microalbuminuria.

Review of literature

Diabetes mellitus is not a single disease entity but rather a group of metabolic disorders sharing the common underlying feature of hyperglycemia. Chronic hyperglycemia and attendant metabolic dysregulation of diabetes mellitus may be associated with secondary damage in multiple organ systems, especially kidneys, eyes, nerves and blood vessels (1).

Diabetes mellitus tends to run in families. It is associated with dyslipidemia, atherosclerosis and predispose to certain specific microvascular abnormality including retinopathy, nephropathy and neuropathy. It increases the risk of stroke, myocardial infarction, peripheral vascular diseases. It also decreases the resistance to infection, especially if diabetes is poorly controlled. Type 2 Diabetes mellitus is due to insulin resistance and dysfunctional β cells. It is classified as Obese, Non-obese, and Maturity onset diabetes of young.

Glycated hemoglobin: It is one of the best index of long term control of blood glucose level. When there is hyperglycemia proteins in the body undergo glycation. Normal level of glycated hemoglobin (HbA1c) is about 4-7%. Elevated glycated hemoglobin indicates poor control of diabetes mellitus. HbA1c level reveals mean glucose level over previous 8-10 weeks.

Blood Sugar Level

Fasting blood glucose (3): FBS is directly proportional to the severity of diabetes mellitus and the most commonly used marker for DM. In general FBS levels greater than 126mg/ dl on more than one occasion are diagnostic of diabetes mellitus, provided that drugs such as glucocorticoids are not being administered.

Postprandial blood glucose: Two consecutive post prandial tests are recommended for diagnosis. Blood is drawn at 2 hrs after ingestion of the meal or glucose load. Two post prandial tests with glucose levels of 200 mg/dl or higher at 2 hours are suggestive of diabetes.

Microalbuminuria (4): Microalbuminuria is defined as the excretion of 30 to 300 mg of albumin per day in urine. It is not a different form or fraction of albumin but just a very small amount of albumin. Albumin molecule is relatively small and it is often the first protein to enter the urine after the kidney is damaged.

Normoalbuminuria: < 30 mg/24 hrs or <20 µg/min
Microalbuminuria: 30-300 mg/24 hrs or 20-200 µg/min
Macroalbuminuria: >300 mg/24 hrs or >200 µg/min

Material and method
Criteria for study
Inclusion criteria: All patients of type 2 diabetes mellitus 45 years and above.

Exclusion criteria: Pregnancy.
We have planned to select approximately 100 diabetic patients from OPD as well as IPD of Surgery department. All the patients will go through the investigations for microalbuminuria and HbA1c.

Sample Size Calculation
The present study is conducted from January 2019 to November 2021 in a tertiary health care hospital located in Jhalawar, Rajasthan. Our hospital is a tertiary care center with 800 admissions per month in the department of Surgery, out of which 15 are diabetic patients. All patients getting admitted in the hospital and full filling the criteria to participate in the study were included in the study, 100 patients were included in the study. Our study includes all the known case of type 2 diabetes mellitus patients of age group of 45 years and above (according to American diabetes association). All the patients were fully informed about the purpose, the procedures and the hazards of the study. After taking voluntary informed consent, all the subjects were screened for the inclusion criteria.

Observations and results
1. Age wise classification of patients: In our study, out of 100 patients, there were 30 patients having age group of 40 to 50 years of age. 39 patients were in between 51 to 60 years of age whereas 23 patients were 61 to 70 years of age. And 8 patients have age more than 70 years of age.

1. Comparison of HbA1c with age group of patients
It was found that 15 patients had HbA1c less than 6.5% whereas 85 had more than 6.5%

Table 1: Comparison of HbA1c with age group of patients

HbA1c	Age				Total
	40-50	**51-60**	**61-70**	**More than 71**	
Less than 6.5%	3 (10%)	8 (20.5%)	4(17.4%)	0 (0%)	15
More than 6.5%	27 (90%)	31 (79.4%)	19 (82.6%)	8 (100%)	85
Total	30	39	23	8	100

2. Sex wise classification: 53% were female and 47% were male participated in study.

3. Duration of Diabetes: 67 patients had history of DM with duration of less than 5 years whereas 24 patients had duration of DM more than 5 years but less than 10 years. 9 patients has history of DM more then 10 years.

4. Sugar level of patients: Out of 100 patients, 49 had random blood sugar level less than 200 mg/dl whereas 51 had more than 200mg/dl. 27 had fasting blood sugar level below 126 mg/dl and 73 had more than 126 mg/dl. The Post prandial blood glucose level, less than 200 mg/dl was found in 20 patients and in 80 patients it is more then 200mg/dl. HbA1c level was less than 6.5% in 15 patients and more then 6.5% in 85 patients.

Table 2: Sugar level and HbA1c level

Sugar level	Number of patients
1) Random blood Suger level	
Less than 200 mg/dl	49
More than 200 mg/dl	51
2) Fasting blood sugar level	
Less than 126 mg/dl	27
More than 126 mg/dl	73
3) Post Prandial Level	
Less than 200 mg/dl	20
More than 200 mg/dl	80
4) HbA1c	
Less than 6.5%	15
More than 6.5%	85

Urinary albumin and sugar level
69 had microalbumin level in urine less than 30 mg/dl whereas 31 had more than 30 mg/dl Urinary sugar level was grade 1+ in 26 patients and grade 2+ in 34 patients. It is grade 3+ in 21 patients and grade 4+ in 14 patients. 5 patients had grade 5+.

Table 3: Urinary microalbumin and sugar level

Urinary albumin level	
Less than 30	69
More than 30	31
Urinary sugar level	
1+	26
2+	34
3+	21
4+	14
5+	5

3. HbA1c with microalbuminuria

Table 4: Comparison of HbA1c with microalbuminuria

HbA1c	U.alb		Total
	<30	**>30**	
Less than 6.5%	14 (20.2%)	1 (3%)	15
More than 6.5%	55 (79.7%)	30 (96%)	85
Total	69	31	100

Urinary albumin level less than 30 mg/dl was found in 14 (20.2%) patients in which HbA1c was less than 6.5% and in 55 (79.7%) patients in which HbA1c was more than 6.5%.
Urinary albumin level more than 30 mg/dl was seen in 1 (3%) in whom HbA1c was less than 6.5% and 30 (96%) in whom it was.

Discussion
1. In our study, out of 100 patients, the mean age group was 57.5 years of age with minimum age group was 45 and maximum age was 80 years of age. There were 30 patients having age group of 40 to 50 years of age. 39 were in between 51 to 60 years of age whereas 33 were 61 to 70 years of age. 8 patients have age more than 70 years of age. There was no statistical significant difference between age of patients and the glycosylated haemoglobin. There is no much difference in either sex m:f= 47:53. And glycated hemoglobin was also not related with sex rather than duration of diabetes.
   These results can be compared with the study conducted by Gupta M *et al.* in which the mean age of study cohort was 52.4±15.2 years. Most of the patients belong to age group of 40-59 years [32 (42.67%)] followed by 28 (37.3%) patients who belong to age group of ≥ 60 years. Out of 75 patients, 44 (58.67%) were male and 31 (41.33%) were female (14) One more study conducted by Khan P *et al.* shows that, out of 122 patients 58 (47.54%) were male and 64 (52.46%) female with a ratio of 1:1.03.
2. Mean duration of DM was 4.8 years. It was found that 67 out of 100 patients had diabetes for less than 5 years of duration. In theses 67 patients, HbA1c was less than 6.5% in 7 whereas in 60 it was more than 6.5%.
3. Total 69 patients had Urinary albumin level less than 30 mg/dl out of which HbA1c was less than 6.5% in 20.2% of patients and 79.7% of patients had HbA1c more than 6.5%.

Total 31 patients had Urinary albumin level more than 30 mg/dl out of which only 3% had HbA1c value less than 6.5% whereas 96% had HbA1c value more than 6.5%. This result shows that urinary microalbuminuria increase with HbA1c. This results can be compared with the study conducted by Mishra *et al.* in which patients of DM having HbA1c ≤ 7% had mean urinary microalbumin level of 40.27 mg/24hrs and the patients of DM having HbA1c >7% had mean urinary microalbumin level of 67.95 mg/24 hrs (p ≤0.03). This is statistically significant. The patients of DM having HbA1c ≤ 7% had mean serum microalbumin level of 1.7 mg/dl and the patients of DM having HbA1c >7% had mean serum microalbumin level of 1.64 mg/dl (p ≤0.53) [16].
One more study conducted by Alamdari *et al.* on risk factors for microalbuminuria in T2DM patients and reported 30.5% prevalence of microalbuminuria. Alamdari *et al.* also reported significantly high HbA1c levels in patients with microalbuminuria [17].

Summary
Diabetes mellitus is a group of metabolic disorders .Depending on the aetiology of diabetes mellitus, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production.
Objectives of the article was to find out correlation of HbA1c with diabetic patients having microalbuminuria and to explore the correlation of HbA1c. 100 patients were entered in the study after taking consent and following results were obtained It was found the correlation between random blood glucose, fasting blood glucose level and post prandial level as well as urinary sugar level was found to be associated statistically significant with glycosylated haemoglobin.
In our study, Duration of DM, age and sex of the patients was not found significantly associated with HbA1c.but HbA1c is strongly associated with increase urinary microalbuminuria.

Master Chert

Sr.No	Name	Age	Gender	Duration	RBS	FBS	PPBS	HbA1c	U.alb	U.sugar
1	Kanwar Lal	60	M	4yrs	217.34	152	260	9.2	nil	1+
2	Shiwani Kanwar	62	F	5yr	152	120	210	8.5	nil	nil
3	Jyoti	47	F	2 yr	192	154	310	10.4	nil	1++
4	Tej Kanwar	70	F	9yrs	168	150	464	10.81	50mg	1+++

5	Kavita	70	F	6yrs	192	141	220	8.7	nil	1+
6	Jyoti	45	F	4yrs	195	127	230	8.5	nil	1+
7	Akhilashwar	45	M	6mth	340	161	280	11.8	nil	1++
8	Rakesh	62	M	10yrs	140	110	171	5.9	nil	nil
9	Alphaiz	55	M	8yrs	388	288	355	8.2	30mg	1+++
10	Chaina	45	F	1mth	205	131	240	6.5	nil	1+
11	Megha	50	F	3yrs	245	168	230	10.4	nil	1+
12	Ayush	60	M	9yrs	116	90	148	6	nil	nil
13	Krishna	70	M	5yrs	226	180	450	13.8	nil	1++++
14	Laxmi	52	F	6mth	103	161	471	7.8	nil	1++
15	Mahesh	70	M	5yrs	314	212	541	13.4	nil	1++++
16	Kavita	75	F	7yrs	402	246	255	10.6	30mg	1+++
17	Reena	60	F	2yrs	327	102	138	11.4	nil	1+
18	Himat Singh	45	M	4yrs	221	92	137	7.8	nil	1+
19	Shobha	69	F	4yrs	210	125	179	7.6	nil	nil
20	Sangeeta	52	F	3yrs	168	100	151	5.8	nil	nil
21	Deshraj	60	M	20yrs	275	201	332	11.5	100mg	1+++
22	Madan Lal	60	M	4yrs	243	110	170	6.2	nil	1+
23	Narendra	60	M	1mth	175	130	210	6.8	nil	1+
24	Shanti Bai	76	F	9yrs	195	161	237	8.7	30mg	1+
25	Anita	64	F	3yr	105	131	210	6.2	nil	nil
26	Amrat	45	M	4yrs	288	211	562	18.2	nil	1++++
27	Shahin	60	F	10yrs	118	102	188	6.2	30mg	1+
28	Dev Karan	45	M	2yrs	105	78	148	5.6	nil	nil
29	Raghav	65	M	20yrs	159	130	218	7.8	30mg	1+
30	Maya	45	F	8yrs	128	116	206	6.2	nil	1+
31	Vidhya	45	F	5mth	168	140	220	7.8	nil	nil
32	Seema	58	F	10yrs	205	168	260	9.2	150mg	1++
33	Bulbul	45	F	new diag.	155	130	226	7.2	30mg	1+
34	Salim Ji	60	M	8yrs	178	125	305	5.7	nil	1+
35	Rabiya	63	F	7mth	210	173	241	8.1	nil	1++
36	Hemkanwar	50	F	6yrs	178	132	231	8	nil	1++
37	Raziya	61	F	3yrs	152	129	208	7.3	nil	1+
38	Duli Chand Ji	45	M	1yr	157	110	182	7.6	nil	nil
39	Rukshar	50	M	1yr	204	168	334	8.9	nil	1++
40	Himmat Singh Ji	53	M	8yrs	165	140	280	7.8	30mg	1+
41	Raveena	60	F	15yrs	210	130	180	6.5	nil	nil
42	Duli Chand	70	M	6yrs	165	150	205	6.2	nil	nil
43	Sangeeta	45	F	2yr	132	98	204	6.1	nil	nil
44	Sheeba	45	F	4yrs	234	140	298	6.9	nil	1++
45	Ram Lal	54	M	7yrs	282	131	250	6.3	nil	1+
46	Shiv Bai	50	M	8yrs	285	190	380	12	100mg	1+++
47	Safique Khan	55	M	2.5yrs	298	210	458	12.8	nil	1+++
48	Safiquik	57	M	3yrs	115	132	205	6	nil	nil
49	Laxman Sahu	60	M	6mth	185	140	239	7.7	nil	1+
50	Seema	50	F	new diag.	195	151	230	8.2	nil	1+
51	Sona	50	F	5yrs	232	151	284	10.4	nil	1++
52	Jamna Bai	60	F	6mth	102	90	146	6.5	nil	nil
53	Shimla	60	F	6yrs	137	97	181	6.6	nil	nil
54	Uma	60	F	12yrs	124	91	168	6.2	nil	nil
55	Seema	52	F	10yrs	180	157	249	8.2	30mg	1++
56	Sitara	61	F	5yrs	193	141	239	8.7	nil	1+
57	Rahila	53	F	1yr	375	214	412	13.8	nil	1+++
58	Ramesh Chand Garg	69	M	1mth	335	221	410	12.8	nil	1+++
59	Sushila	62	F	10yr	182	160	304	8.7	30mg	1++
60	Abdul Salam	65	M	1yr	212	166	301	9.2	nil	nil
61	Rasid Khan	60	M	2yr	103	92	180	7.6	nil	nil
62	Radheshyam	60	M	5yrs	126	163	280	11	nil	nil
63	Samser Begam	75	F	1yr	158	121	190	6.5	nil	nil
64	Atika Bee	62	F	4.5yrs	280	183	408	9.1	nil	nil
65	Vishnu	80	M	15yrs	203	164	276	7.8	30mg	1++

66	Shehnaz	60	F	13yrs	248	171	296	9.2	nil	1++
67	Noram Bai	60	F	1yr	185	128	208	8.2	nil	1+
68	Sunita	70	F	5yrs	285	201	413	11.2	120mg	1+++
69	Boori Bai	50	F	1yr	150	168	240	9.3	nil	1+
70	Bhihari	51	M	8yrs	160	140	218	7.3	30mg	1+
71	Meena	45	F	2mth	339	282	486	13.6	80mg	1+++
72	Sanjida	60	F	new diag.	285	125	247	11.7	nil	1++
73	Akhileshwar	66	M	15yrs	235	151	319	9.9	30mg	1++
74	Amna Katun	55	F	8yr	140	90	151	6.6	nil	nil
75	Naval Kishor	65	M	4mth	185	136	241	8.2	nil	1+
76	Pooja	70	F	5yr	135	84	162	6.5	nil	nil
77	Safik Khan	80	M	5yrs	182	129	243	8	30mg	1+
78	Sanjay	45	M	1mth	240	189	396	15.6	90mg	1+++
79	Ramesh	60	M	new diag.	452	230	472	16.8	100mg	1+++
80	Reena	45	F	5yrs	402	174	431	11.8	130mg	1++++
81	Govind	58	M	7yrs	209	155	341	9	30mg	1++
82	Suresh Agrwal	58	M	10yrs	195	135	228	8.8	30mg	1+
83	Archana	45	F	new diag.	165	139	231	6.9	nil	1+
84	Ghansi Lal	46	M	new diag.	415	201	382	15.8	130mg	1++
85	Akina	45	F	6mth	390	240	452	14.6	80mg	1++++
86	Raziya	53	F	15.8yrs	334	143	270	12.3	60mg	1++
87	Banshilal	52	M	3mth	204	136	261	8.9	nil	nil
88	Hariballabh Soni	52	M	2yrs	205	152	263	9.2	30mg	1+
89	Duli Bai	78	F	5mth	388	361	432	13.8	160mg	1+++
90	Birdi Lal	55	M	10yrs	285	161	367	11.2	80mg	1++
91	Mangla Triwedi	65	M	2yrs	240	90	138	6.8	nil	nil
92	Raziya	45	F	3mth	165	102	180	7.2	nil	nil
93	Mathari	55	F	15yrs	180	93	212	8.2	30mg	1+
94	Shila Bai	50	F	2yr	230	140	270	9.2	nil	1+
95	Radhe Shyam	60	F	3yrs	258	161	283	10.2	nil	1++
96	Shiv Lal	50	M	2yrs	387	220	458	15.2	nil	1++
97	Banshi Lal	70	M	3.5yrs	245	158	281	10.2	nil	1+
98	Mathara Bai	45	F	7mth	392	210	403	14.4	nil	1+++
99	Duli Chand	72	M	5yrs	190	110	204	8.7	nil	1+
100	Badri Bai	71	M	6mth	218	123	274	9	nil	1+

Conclusion
In hour study following conclusion was found.
1. Patients having microalbuminuria were associated with high level of glycosylated haemoglobin.
2. It was found strong association between HbA1c with urinary sugar.
3. In our study, Mean duration of DM, sex and age of the patients was not found significantly associated with HbA1c.

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