

Esophageal Motility Disorders in Diabetics

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Introduction

Esophageal manometric and radiographic abnormalities are common in patients suffering from diabetes mellitus and also having peripheral neuropathy.¹⁻⁹ The clinical significance of this fact is uncertain because most of these patients are asymptomatic. The pathophysiology of these abnormalities are thought to be the degenerative effects of diabetes mellitus on the autonomic nervous system, rather than smooth muscle dysfunction, as evidenced by histological^{10,11} and pharmacologic data.⁹

Manometric abnormalities were first described in 1969² where authors noted a decrease in the amplitude of peristalsis, decrease in primary peristalsis and a decrease in LES pressure in diabetics having autonomic neuropathy. Similar findings in diabetics with⁶ and without⁵ neuropathy were also noted by other workers. In a study of 50 diabetics with and without peripheral neuropathy, a decrease in primary peristalsis (greater than 10% absence of peristaltic response to a swallow), an increase in repetitive contractions (two or more contractions in greater than 25% of swallows) and an increase in spontaneous contractions (greater than 10 during a 35-minute study) was noted in diabetics with peripheral neuropathy. There was also a equipment in studies reported later. Regardless one can state that diabetics in general have a higher incidence of disordered esophageal peristalsis when compared to normal subjects. The abnormal peristalsis may manifest by minor findings such as occasional non-transmitted swallows and spontaneous activity, or be so marked as to resemble diffuse spasm.

Esophageal manometric findings in healthy controls have been reported by us earlier¹³, the present study was done to see the manometric findings of esophageal motility disorders in diabetic patients and compare them with controls.

Patients and Methods

Twenty-five non-insulin dependent adult patients suffering from diabetes mellitus admitted in Ziauddin

Hospital for control of diabetes were taken as patients. Twenty five age and sex matched healthy volunteers were taken as controls.

Exclusion Criteria

Patients with cerebrovascular accident, acute myocardial infarction, those on nasogastric feeding, hemodynamically unstable and who had esophageal surgery were excluded from the study. The age, gender, duration of disease, height, weight, random blood sugar, HbA1C were recorded on a proforma. Symptoms related to esophagus i.e. dysphagia, heartburn, regurgitation and retrosternal pain or any other symptoms were evaluated. All the steps of the procedures were explained in detail and a verbal informed consent was taken prior to the procedure.

Procedure

An eight lumen water perfused polyvinylchloride catheter described earlier was used.¹³

Calibration of the transducers was done before starting the procedure. Diabetic patients were studied 4 hours after breakfast. History was taken about medications taken 48 hours prior to the test, to exclude any influence of medication (prokinetic drugs, nitrates, anticholinergics, Calcium channel antagonists or sedatives) on the esophageal motility.

The catheter lumens were pre filled with sterile water and the lumens were capped to retain the fluid, which also helped to prevent saliva and food debris from filling the lumens. The catheter was introduced and the tracings obtained following the standard technique described earlier.¹³

Data Analysis

All tracings were analyzed and pressure recorded. Sphincter pressure was reported as the difference from gastric pressure. First the maximum respiratory oscillation of the sphincter pressure above the expiratory gastric baseline was measured which is called peak sphincter pressure. Mean pressure of each respiratory oscillation was calculated and the maximum height of this mean pressure above the expiratory gastric baseline was defined as the mean sphincter pressure. Similarly the peristaltic amplitude of the esophageal body was measured from the esophageal base line pressure. Mean was calculated from the individual peristaltic amplitude. Duration was calculated from the onset to the end of

peristaltic amplitude. Progression of the waves or velocity was calculated using the computer after the marking of commencement and end of the peristaltic waves.

Statistical Analysis

The computer package "Microsoft Excel" was used for data feeding and analysis was done by Epi-Info version 6.0.

Results

Demographic Parameters of the Diabetic Patients

Esophageal manometric studies were done in 25 patients suffering from Diabetes Mellitus. There were 15 males and 10 females whose ages ranged from 28 to 56 years with a mean age of 46.8 ± 6.4 years. Height of the patients varied from 138 cm to 177 cm, with a mean height of 159 ± 10.6 cm.

Weight ranged from 45 to 80 kg, with a mean of 62 ± 9.8 kg. Duration of disease was from 2 to 20 years, with a mean of 8.5 ± 5.1 years. Random blood sugar was between 130 and 430 mg/dl, with a mean of 240 ± 76.3 mg/dl. HbA1C ranged from 5.8 to 10.10, with a mean of 8.09 ± 2.08 . Demographic parameters of diabetic patients were similar to the controls with no significant difference, except for height and BMI, which was higher in diabetics. (Table 1).

Esophageal Manometric Readings

End Inspiratory pressure, mid Expiratory Pressure, end Expiratory Pressure and residual pressure of the lower esophageal sphincter was similar amongst diabetics and controls. (Table 2); but the percentage of relaxation was low in diabetics when compared to the controls ($P < 0.045$).

Relaxation of the lower esophageal sphincter was more than or equal to 90% in all controls and 15 diabetics, while it was less than 90 % in 10 diabetic cases.

The peristaltic amplitude and duration of contraction of the esophageal body, both for dry and wet swallows was not different in diabetics and controls. (Table 3). Peristaltic velocity was lower in diabetics as compared to the controls, both at the proximal and distal ends, with dry and wet

Table 1. Demographic data diabetic patients and controls.

Parameters		Diabetics (n=25)	Controls (n=25)	P-value
Sex	M/F	15/10	19/6	0.363
	Range	28-56	41.4 ± 16.5	
	Mean ± SD	46.8 ± 6.4		
Height (cms)	Range	138-177	124-179	0.036
	Mean ± SD	159.0 ± 10.6	165.7 ± 11.40	
Weight (kg)	Range	45-80	38-82	0.203
	Mean ± SD	62.0 ± 0.8	58.5 ± 10.08	
BMI	Mean ± SD	24.8 ± 4.6	21.6 ± 5.1	0.022

Table 2. Comparison of lower esophageal sphincter pressures in diabetics and controls.

Lower esophageal sphincter	Diabetics (n=25) Mean ± SD	Controls (n=25) Mean ± SD	P-value
End Inspiratory pressure (mmHg)	47.0 ± 20.2	40.95 ± 20.1	0.292
Mid Expiratory Pressure (mmHg)	30.4 ± 13.0	27.31 ± 13.23	0.586
End Expiratory Pressure (mmHg)	13.8 ± 7.4	13.55 ± 6.96	0.912
Residual Pressure (mmHg)	4.0 ± 4.1	0.74 ± 1.24	0.559
Percent of Relaxation (%)	88.5 ± 15.3	96.0 ± 4.1	0.045

In all statistical analysis, only p-values <0.05 are considered significant.

diabetics were not much different than controls. (Table 5).

Abnormal Peristalsis

Double peaked peristaltic waves were seen in 8 cases, aperistalsis in 2 cases and high amplitude and broad peristaltic waves were noted in 2 cases. Non-conduction of the peristaltic waves or absent of contraction was observed in 1 case. Hypertensive lower esophageal sphincter was present in 2 cases.

Table 3. Comparison of peristaltic amplitude and duration in diabetics and controls.

		Diabetics (n=25) Mean ± SD	Controls (n=25) Mean ± SD	P-value
Dry swallows	Amplitude at:			
	18 cm	47.6 ± 34.9	41.52 ± 22.6	0.522
	13 cm	45.9 ± 22.7	47.24 ± 25.7	0.840
	8 cm	55.0 ± 32.7	52.81 ± 18.7	0.764
	3 cm	47.2 ± 45.7	56.23 ± 27.9	0.594
Duration at:	DES	54.4 ± 35.2	54.18 ± 18.6	0.255
	18 cm	3.1 ± 0.9	3.48 ± 0.88	0.193
	13 cm	3.7 ± 0.7	3.98 ± 0.96	0.178
	8 cm	4.0 ± 0.6	4.19 ± 0.82	0.289
	3 cm	4.3 ± 1.1	4.43 ± 0.93	0.658
Wet swallows	DED	4.2 ± 0.8	4.28 ± 0.70	0.970
	Amplitude at:			
	18 cm	60.8 ± 40.2	54.79 ± 25.9	0.539
	13 cm	47.9 ± 28.5	49.0 ± 24.2	0.877
	8 cm	71.1 ± 35.3	67.38 ± 22.1	0.875
Duration at:	3 cm	58.2 ± 47.7	74.28 ± 35.8	0.181
	DES	63.7 ± 36.8	70.91 ± 24.3	0.206
	18 cm	3.23 ± 0.87	3.50 ± 1.3	0.591
	13 cm	3.63 ± 0.89	3.77 ± 0.82	0.564
	8 cm	4.20 ± 0.78	4.28 ± 0.91	0.748
	3 cm	4.93 ± 1.59	4.43 ± 0.83	0.164
	DED	4.09 ± 0.97	4.37 ± 0.84	0.940

In all statistical analysis, only p-values <0.05 are considered significant.

Table 4. Comparison of peristaltic velocity in diabetics and controls.

	Diabetics (n=25) Mean ± SD	Controls (n=25) Mean ± SD	P-value
Dry swallows			
Proximal esophagus (cm/s)	3.5 ± 1.93	3.41 ± 1.8	0.050
Distal esophagus (cm/s)	3.45 ± 1.86	3.87 ± 1.4	0.623
Wet swallows			
Proximal esophagus (cm/s)	1.35 ± 3.21	2.64 ± 1.3	0.065
Distal esophagus (cm/s)	2.46 ± 1.58	3.37 ± 1.6	0.046

In all statistical analysis, only p-values <0.05 are considered significant.

Discussion

This study was done to detect the presence of

Table 5. Upper esophageal sphincter pressures in diabetics and controls.

	Diabetics (n = 25) Mean ± SD	Controls (n = 25) Mean ± SD	M vs F P-value
Resting pressure (mmHg)	46.6 ± 16.4	49.84 ± 22.4	0.554
Residual pressure (mmHg)	2.33 ± 2.58	5.20 ± 9.3	0.229
Relaxation (m sec)	1.58 ± 0.68	1.32 ± 0.56	0.167
Duration (m sec)	3.81 ± 1.00	3.92 ± 1.3	0.724
Recovery (m sec)	2.23 ± 0.72	2.46 ± 0.84	0.308

esophageal motor disorders in diabetic patients and compare it with healthy controls. To achieve this goal base line data for esophageal manometry in healthy controls were established previously.¹³ Healthy subjects were selected on voluntary basis and 25 young adults

were studied irrespective of their age and gender. Mean age of diabetic patients and controls were almost similar ($P>0.67$). Males were heavier and taller than females, but the difference was not significant. Mean duration of the disease was longer amongst females i.e., 10.9 ± 5.2 years, as compared to males 6.9 ± 4.5 years. Control of diabetes was evaluated using serum HbA1C levels, mean values of HbA1C were similar (7.7 ± 1.2 and 8.1 ± 1.8 respectively).

The height of male diabetics were more than the females, therefore the length of the esophagus was also more in males when compared to the females, as has been reported earlier, showing that length of esophagus was longer in males as compared to females.¹⁴ The difference in height and the length of esophagus was statistically significant in the present series.

Manometric values of the lower esophageal sphincter i.e., end inspiratory pressure, mid expiratory pressure were higher in females as compared to males ($P<0.05$). The difference in residual pressure in both genders was statistically non significant. Minor differences in the lower esophageal sphincter pressure amongst diabetics and controls were noted. Percentage of relaxation of the lower esophageal sphincter was significantly low in diabetics as compared to controls, which signifies poor relaxation of the lower esophageal sphincter.

No difference was found in the peristaltic amplitude and duration of esophageal body peristalsis both for dry and wet swallows. The amplitude of the esophageal peristalsis and the duration of contraction were greater with wet swallows as compared with dry swallows, similar findings were reported earlier.¹⁵

Progression of the peristaltic waves (velocity) of esophageal body was slower amongst diabetics at the proximal and distal part of the esophagus when compared with controls both for dry and wet swallows; but it was significantly slow with dry swallows at the proximal part ($P<0.05$) and with wet swallows at the distal part only ($P<0.046$).

Mean lower esophageal sphincter pressures i.e. end inspiratory pressure, mid expiratory pressure and end expiratory pressures were higher in diabetics than controls, but the difference was not statistically significant, however, this observation is contradictory to the new classification of motility disorders, which shows low LES pressure in diabetics along with other groups of patients of scleroderma and GERD.¹⁶ Relaxation of the lower esophageal sphincter was less in diabetics than the controls and the difference was statistically significant ($P<0.045$). These observations indicate

incomplete or poor relaxation of the lower esophageal sphincter in diabetic patients.

Although there are minor differences in the esophageal peristaltic amplitude of the esophageal body at all levels i.e. 18, 13, 8 and 3 cms but none of these were statistically significant for dry and wet swallows. Similarly the differences in the duration of esophageal peristalsis amongst two groups at all levels were statistically not significant.

Progression of peristaltic waves (velocity) at the proximal esophagus was higher amongst controls with dry swallows as compared to diabetics ($P<0.050$). The peristaltic velocity at the distal end of the esophagus was significantly higher in controls when compared with diabetics, especially for wet swallows ($P<0.046$), which signifies poor esophageal peristaltic velocity in the diabetic patients.

The parameters of upper esophageal sphincter i.e., resting pressure, residual pressure, duration of relaxation, recovery and total duration of relaxation were not different in patients and controls.

Abnormal double peaked waves were found in 8 out of 25 controls and 8 out of 25 diabetic patients, the difference was not significant, which is in accordance to an earlier study¹² but contradictory to another study in which more than 95% of all peristaltic swallows were having double peak.⁹ Other abnormalities like aperistalsis of the esophageal body, non conducted waves or failed peristalsis, high amplitude and broad peristaltic waves and hypertensive lower esophageal sphincter was found in diabetics and not in controls.

The study concluded that motility disorders of the oesophagus are more common in people with diabetes. Poor relaxation of lower oesophageal sphincter, slow propulsive velocity and abnormal peristaltic waves were observed in more subjects with diabetes.

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Abstract

Objective: To see the presence of esophageal motor disorders in diabetic patients and compare it with controls at the Department of Medicine Ziauddin Medical University Hospital, Karachi.

Methods: Diabetic patients admitted at Ziauddin Medical University Hospital, Karachi were taken as study subjects, whereas age and sex matched healthy volunteers not suffering from any disease neither taking any medication for dyspepsia were taken as controls Esophageal manometry was done to see the motility disorders in diabetic patients and controls.

Results: Resting pressure of the lower esophageal sphincter in diabetics was similar to controls. Percentage of relaxation of the lower esophageal sphincter was low in diabetics. Amplitude of esophageal peristalsis and duration of contraction was similar in both the groups. Propulsive velocity of peristalsis was slower in diabetics. Parameters of upper esophageal sphincter were similar in diabetics and controls. Abnormal peristaltic waves like aperistalsis of the esophageal body, high amplitude and broader waves, absent contraction and hypertensive lower esophageal sphincter were seen in diabetics only.

Conclusion: Poor relaxation of the lower esophageal sphincter and slow propulsive velocity were noted in diabetics. Abnormal peristaltic waves like aperistalsis of the esophageal body, high amplitude and broader waves, absent contraction and hypertensive lower esophageal sphincter were seen in diabetics only (JPMA 54: 597;2004).