International Journal of Innovative Research in Medical Science (IJIRMS)
Volume 07, Issue 07, July 2022,
https://doi.org/10.23958/ijirms/vol07-i07/1434

Original article

Comparison of High-Resolution Manometry in Patients Complaining of Dysphagia Among Patients with or without Diabetes Mellitus

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Received 19 June 2022; Accepted 02 July 2022; Published 07 July 2022

Abstract

Background: DM patients can have varying gastrointestinal symptoms. Assessment of esophageal dysmotility in diabetic patients using HRM has not been much evaluated. The aim of this study was to determine the motility pattern using HRM of Diabetics versus non-diabetics patients who presents with dysphagia. ***Methods:*** HRM of total 100 patients (48 diabetics and 52 non-diabetics) age and gender matched with dysphagia were included in this study. Patient's demographic data, medication usage were recorded for each patient. HRM for each patient was done and parameters were recorded. ***Results:*** Overall 56% of diabetic patients were found to have an esophageal motility disorder. Diabetic patients were more likely to have ineffective esophageal motility (29% vs 7.7%, p = 0.005) as compared to non-diabetics. There was a trend for Achalasia and major disorders of peristalsis seen more in Non-diabetics patients with dysphagia as compared to Diabetic patients. ***Conclusions:*** More than half of the diabetic patients with dysphagia have some type of an esophageal motility disorder. Diabetic patients need to be assessed by HRM for motility disorder and requires proper glycemic control to prevent progression of dysphagia.

Keywords: ***Diabetes, Esophageal motility disorders, High-resolution manometry, Dysphagia, Achalasia.***

Introduction

There can be various gastrointestinal symptoms caused by Diabetes mellitus(DM) and the frequency of it has been reported to be around 70% which includes heartburn (14%) and dysphagia (8-27%) [1,2]. Esophageal motility disorders were reported in DM patients by Mandelstam et al in 1967 [3]. Bytzer et al estimated that around 15% diabetic patients have symptoms like heartburn, dysphagia or both. Several underlying mechanisms have been proposed to explain the presence of esophageal motility disorders like acute hyperglycemia, abnormal functioning of Enteric nervous system and interstitial cells of Cajal, decreased nitric oxide synthase expression [4-9]. The esophageal motility disorders are clinically important because they may be associated with delayed transit of meals and medicines, and gastrointestinal symptoms decrease the patient's quality of life [10,11]. However, it is difficult to diagnose peristaltic disorders by upper gastrointestinal endoscopy, and therefore many cases go undiagnosed and did not get treated. A few studies by using conventional manometry have evaluated esophageal motility in DM patients. However, conventional manometry transmitted data through catheters containing pressure sensors at intervals of 5-7 cm, so the diagnostic accuracy was low and the procedure is not easy to perform either. High-resolution manometry (HRM) measures pressure at intervals of 1 cm through it sensors and can evaluate esophageal motility more accurately than the conventional manometry and also classifies esophageal motility disorders [12], which makes the diagnosis of esophageal disease easier. Aim of our study was to compare esophageal motor characteristics using HRM between diabetics with age and gender matched non-diabetic patients presenting with dysphagia.

Materials & Methods

Single-center prospective study involving patients with dysphagia within age group of 18 to 75years and providing informed consent were selected between October 2021 to March 2022. Subjects had undergone Upper GI endoscopy & HRM in the Medical Gastroenterology Department, RGGGH, Chennai. Subjects were divided into DM & Non-DM groups. The exclusion criteria were neoplastic disease detected by Upper GI endoscopy; a history of prior esophageal surgery, endoscopic therapy, chemotherapy, or radiation for aerodigestive tract diseases. Study data collection: HRM parameter & classification of Motility disorder were compared between DM & Non DM groups. HRM protocol & analysis: Calibration of the transducers was done before starting the procedure. Patients were asked to come for the procedure after with overnight fasting. Detailed history was taken about any medication taken 48 hours prior to the test, to exclude any possible influence of medication (prokinetic drugs, nitrates, anticholinergics, calcium channel antagonists) on the esophageal motility. To evaluate esophageal motility, 16 channel water perfusion based system manufactured by RMH Australia, Model: Kangaroo Jeff. The first few centimetres of the catheter was immersed in water to reduce friction during intubation and no local anaesthetic was used while passing the manometry catheter. Manometric assembly was passed trans-nasally & positioned to record from hypopharynx to stomach.

After catheters are positioned, esophageal motility will be evaluated by 10 sequential 5ml water swallows. This HRM data was analysed manually using the TRACE 1.3.3 software program according to Chicago classification version 3.0. For each swallow; Distal contractile integral(DCI), Integrated Relaxation Pressure(IRP), peristaltic breaks(PB), Distal latency(DL). Achalasia was diagnosed when there was no peristalsis, panesophageal pressurization, or premature contraction, and the value of IRP was ≥15mm Hg [17, 18].

Other esophageal manometry diagnoses were also evaluated, with the following cut-off value Contractile vigor was assessed using the DCI (a contraction with a DCI <100mm Hg-s-cm is failed contraction but >100 to ≤450mmHg-s-cm was weak, and a hypercontractile swallow was defined as a DCI ≥8,000 mm Hg-s-cm). A premature contraction was defined as the presence of a DL < 4.5sec.

Statistical Analysis

The prevalence of each factor was tested by the $\chi 2$ test or Fisher's exact test as appropriate. Age, body mass index (BMI), disease duration, HRM parameters were assessed by the Unpaired t test. Statistical analyses were performed using SPSS Statistics 24.0. The significance level was set at a 2-tailed p value <0.05.

Results

Among the 100 patients (¬ 36 females and 64males, 48 patients were diagnosed as type 2 DM. The baseline characteristics of the DM and non-DM patients showed no differences in age, sex distribution, BMI, or smoking history between the groups.

The prevalence of esophageal motility abnormalities is shown in Table 6. Majority of patients in both groups were on PPI and prokinetic drug therap. 46 out of 48 DM patients were on Oral Hypoglycemic agents as compared to only 2patients on Insulin therapy. Upper gastrointestinal endoscopy of the subjects showed that following abnormalities were noted in DM vs Non-DM patients like Hiatus hernia (38% vs 44%), Erosive Esophagitis(43% vs 52%), Atrophic gastritis(16% vs 25%), Dilated esophagus(04% vs 23%) respectively. The frequency of minor esophageal motility disorders, such as ineffective esophageal motility (IEM) was significantly higher in the DM group than in the non-DM group (29% vs 7.7% with p = 0.005). More number of patients in DM group had fragmented peristalsis as compared to Non-DM group(14.6% vs 5.8% with p = 0.12). There were 15 patients in Non-DM group found to have Achalasia cardia as compared to no patients in DM group. As compared to DM group, more patients in the non-DM group were diagnosed with major esophageal motility disorders (Jackhammer esophagus, absent contractility, and distal esophageal spasm) but there were no significant differences in the frequency of each classification. IRP and DCI values were found to be significantly low in DM patients as compared to Non-DM patients and Distal latency was found to be more in Diabetic patients as compared to Non-DM patients.

Table 1. Demographic characteristics of subjects:

	DM(n=48)	Non-DM(n=52)	p-value
Age years range)	57(32-75)	54(32-74)	0.28
Sex (M:F)	31:17	33: 19	0.537
Height (cm) (range)	162(143-184)	164(141-182)	0.123
Weight(kg)(range)	63.06(48-90)	61.3(50-89)	0.341
BMI, kg/m^2(range)	23.36(17-31)	23.22(18-32)	0.729
Smoker, n (%)	12(25)	6(11.5)	0.068

Table 2: Drug history of subjects

	DM(n=48)	Non-DM(n=52)	p-value
H2RA	06	06	0.562
PPI	18	11	0.122
Prokinetic agent	17	13	0.23
CCB	06	03	0.446
Nitrate	01	00	0.48

(H2RA: Histamine 2 receptor antagonist, PPI: Proton pump inhibitor, CCB: Calcium channel blockers)

Table 3: Anti-Diabetic drugs treatment for DM subjects

	Insulin	Metformin only	Metformin + Glimepiride
DM(n=48)	02	35	11

Table 4: Endoscopic findings of subjects

	DM(n=48)	Non-DM(n=52)	p-value
Normal	06	03	0.282
Hiatus hernia	23	18	0.494
Erosive Esophagitis	21	27	0.729
Grade A	12	16	
Grade B	06	09	
Grade C	03	02	
Grade D	00	00	
Atrophic gastritis	08	13	0.308
Dilated distal esophagus with/without Tight LES	02	12	0.078

Table 5: Comparison of HRM parameters among DM & Non-DM patients

Measure	DM	Non-DM	p-value
DCI mmHg-s-cm	871.25	1233	0.246
IRP mmHg	10.23	11.98	0.001
DL sec	5.17	4.58	0.044

(DCI: Distal contractile integral; IRP: Integrated residual pressure; PB: Peristaltic breaks; DL: Distal latency, Data are represented as mean)

Table 6: Comparison of HRM Diagnosis in DM and Non-DM patients

Esophageal Manomteric diagnosis	DM(n=48)	Non-DM(n=52)	p-value
Disorders with EGJOO			
1. Achalasia	00	15	0.0427
2. EGJOO	02	06	
Major disorders of peristalsis			
1. Distal esophaegal spasm	02	04	0.378
2. Jackhammer esophagus	01	02	0.53
3. Absent contractility	01	02	0.53
Minor disorders			
1. Ineffective esophageal motility	14	04	0.005
2. Fragmented peristalsis	07	03	0.128
Normal	21	16	0.166

Discussion

In our study, it was found that around 56% of DM patients with dysphagia had a definable esophageal motility disorder, as per Chicago Classification ver. 3.0. Similar results were found in study conducted by Muroi et al[13] and George et al[14] in which around 60% and 46% of DM patients were found to have esophageal motility disorder respectively. Moreover, the prevalence of minor disorders like ineffective esophageal motility was found to be high in DM patients with statistical significance. It was also found that fragmented peristalsis was seen more in DM patients as compared to Non-DM but it had no statistical significance. In the study conducted by Muroi et al[13], similar results were seen but fragmented peristalsis was significantly more seen in DM patients. It was also found in the present study that Non-DM patients had more number of EGJOO, whereas study by George et al had more of DM patients with EGJOO. Achalasia cardia was found to be significantly higher in Non-DM patients presenting with dysphagia as compared to Diabetic patients and had more severe dysphagia.

IEM and fragmented peristalsis are considered to be related to esophageal clearance and Distal esophageal spasm, Jackhammer esophagus, and absent contractility are recognized as esophageal movement disorders, on the basis of which it can be postulated that DM patients might have poor esophageal clearance as per the study results. It was found that in the Non-DM group, the median DCI and IRP values were higher than those in the DM group; which suggests that peristaltic velocity and the esophageal body pressure were decreased in DM patients which interferes with esophageal transport of food bolus. Another factor which plays a major role in esophageal motility disorders is Acid reflux [15]. The factors which leads to acid reflux include hiatal hernia and obesity, decreased lower esophageal sphincter pressure and autonomic neuropathy [16]. In our study it was found that DM patients had comparatively more hiatus hernia on endoscopy as compared to Non-DM. Previously, esophageal motility disorder has been mainly assessed by the doctors based on patient's complaints. Nowadays, HRM can be used for objective evaluation of a patient's symptoms, such as dysphagia. As per the results obtained from this study, minor disorders were seen more in DM patients with dysphagia.

Limitations to this study

First, this study was conducted with a relatively small cohort. Second, the present study did not include asymptomatic diabetic patients. We included only symptomatic patients but studies done previously have suggested that even asymptomatic DM patients may have silent esophageal motility disorders. [17,18].

Conclusion

More than half of Diabetic patients with dysphagia were noted to have some type of esophageal motility disorder. Diabetic patients were more likely to have ineffective esophageal motility than non-diabetics. As the number of DM patients continues to grow in the Indian population, so larger studies would be of significance to the physicians for better symptomatic management of the disease.

Statement of Ethics

This study was conducted after approval by the Institutional Ethics committee, Madras Medical College and performed in accordance with the Helsinki Declaration. Written informed consent was obtained from all subjects.

Financial support and sponsorship

Nil

Conflict of interest

None

References

[1] Monreal-Robles R, Remes-Troche JM. Diabetes and the esophagus. Curr Treat Options Gastroenterol. 2017 Dec;15(4):475–89.
[2] Feldman M, Schiller LR. Disorders of gastrointestinal motility associated with diabetes mellitus. Ann Intern Med. 1983 Mar;98(3):378–84.
[3] Mandelstam P, Siegel CI, Lieber A, Siegel M. The swallowing disorder in patients with diabetic neuropathy-gastroenteropathy. Gastroenterology. 1969 Jan;56(1):1–12.
[4] Gustafsson RJ, Littorin B, Berntorp K, et al. Esophageal dysmotility is more common than gastroparesis in diabetes mellitus and is associated with retinopathy. Rev Diabet Stud. 2011;8:268–275.
[5] Bytzer P, Talley NJ, Leemon M, et al. Prevalence of gastrointestinal symptoms associated with diabetes mellitus: a population-based survey of 15,000 adults. Arch Intern Med. 2001;161:1989–1996.
[6] De Boer SY, Masclee AD, Lam WF, et al. Effect of acute hyperglycemia on esophageal motility and lower esopahgeal sphincter pressure in humans. Gastroenterology. 1992;103:775–780.
[7] Park KS. Impact of myenteric plexus alterations in diabetes related gastrointestinal dysmotility. J Neurogastroenterol Motil. 2013;19:121–123
[8] Fokjaer JB, Brock C, Brun J, et al. Esopahgeal distension parameters as potential biomarkers of impaired gastrointestinal function in diabetes patients. Neurogastroenterol Motil. 2012;24:1016–e544.
[9] Botker HE, Moller N. ON NO—the continuing story of nitric oxide, diabetes and cardiovascular disease. Diabetes. 2013;62: 2645–2647.

[10] Goyal RK, Spiro HM. Gastrointestinal manifestations of diabetes mellitus. Med Clin North Am. 1971 Jul;55(4):1031–44.
[11] Kong MF, Horowitz M, Jones KL, Wishart JM, Harding PE. Natural history of diabetic gastroparesis. Diabetes Care. 1999 Mar;22(3):503–7.
[12] Kahrilas PJ, Bredenoord AJ, Fox M, Gyawali CP, Roman S, Smout AJ, et al. The Chicago classification of esophageal motility disorders, v3.0. Neurogastroenterol Motil. 2015 Feb;27(2):160–74.
[13] Koichi Muroi, Ryoji Miyahara, Kohei Funasaka, Kazuhiro Furukawa, Tsunaki Sawada et al. Comparison of High-Resolution Manometry in Patients Complaining of Dysphagia among Patients with or without Diabetes Mellitus. Digestion 2021;102,554-562.
[14] Nina S. George, Vikram Rangan, Zhuo Geng, Freeha Khan, Adam Kichler et al. Distribution of Esophageal Motor Disorders in Diabetic Patients With Dysphagia; J Clin Gastroenterol, November-December 2017-Volume 51-Issue 10- p890-895.
[15] Kahrilas PJ, Dodds WJ, Hogan WJ, Kern M, Arndorfer RC, Reece A. Esophageal peristaltic dysfunction in peptic esophagitis. Gastroenterology. 1986 Oct;91(4):897–904.
[16] De Boer SY, Masclee AA, Lam WF, Lamers CB. Effect of acute hyperglycemia on esophageal motility and lower esophageal sphincter pressure in humans. Gastroenterology. 1992 Sep;103(3):775–80.
[17] Rathmann W, Enck P, Frieling T, Gries FA. Visceral afferent neuropathy in diabetic gastroparesis. Diabetes Care. 1991 Nov;14(11): 1086–9.
[18] Frøkjaer JB, Andersen SD, Ejskaer N, Funch Jensen P, Arendt-Nielsen L, Gregersen H, et al. Gut sensations in diabetic autonomic neuropathy. Pain. 2007 Oct;131(3):320–9.