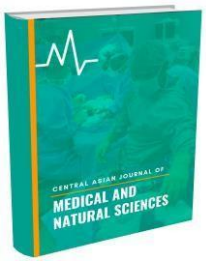

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Article

Functional Dyspepsia in Patients with Type 2 Diabetes Mellitus: Modern Approaches to Diagnosis and Management (A Clinical Observational Study)

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Abstract: One of the most prevalent functional gastrointestinal disorders found in patients with type 2 diabetes mellitus (T2DM) is functional dyspepsia (FD), which has a great impact on quality of life and clinical outcomes. The aim of the study was to conduct research on the clinical characteristics, diagnostic methods, and treatment of functional dyspepsia in patients with T2DM in real clinical practice. An observational study was planned to be conducted during the year 2024-2025, involving 145 patients with type 2 diabetes mellitus. It was conducted at the Andijan State Medical Institute, the Endocrinology Department of the Andijan City Hospital, ASMI Clinic Diagnostic Department, and Zam-Zam Diagnostic Center. The diagnosis of functional dyspepsia was made based on Rome IV criteria after the elimination of organic gastrointestinal pathology by esophagogastroduodenoscopy and abdominal ultrasonography. Laboratory indicators and clinical symptoms, such as fasting blood glucose and HbA1c, were assessed. The findings indicated that functional dyspepsia was very common among T2DM patients. Postprandial fullness (82.7%), early satiety (74.5%), abdominal bloating (68.9%), and epigastric pain (63.4%) were the most frequent symptoms. The average level of HbA1c was 8.2 +1.3, which shows that there is inadequate glycemic control. It was evident that there was a correlation between elevated HbA1c levels and the severity of dyspeptic symptoms. After complex therapy such as glycemic optimization, prokinetic therapy and dietary modification, 71.0% of the patients showed significant clinical improvement.

Keywords: Type 2 Diabetes Mellitus, Functional Dyspepsia, Gastrointestinal Disorders, Glycemic Control, Rome IV Criteria, Autonomic Neuropathy, Gastroparesis, Metabolic Complications, Prokinetic Therapy.

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1. Introduction

One of the most common chronic metabolic diseases, T2DM is a significant burden on healthcare systems with its long-term complications and multisystem involvement. Although microvascular and macrovascular complications are well known, gastrointestinal (GI) manifestations-especially functional disorders are not well diagnosed and addressed in clinical practice. One of the most frequent and also the most complicated disorders that afflict patients with T2DM is functional dyspepsia (FD).Functional dyspepsia is a condition of chronic or recurrent upper abdominal pain, such as postprandial fullness, early fullness, pains in the epigastric area and burning, without any structural abnormalities detected on routine diagnostic tests. The Rome IV criteria

categorize FD into postprandial distress syndrome (PDS) and epigastric pain syndrome (EPS), which can both be present in diabetic patients. The occurrence of FD in patients with T2DM has been stated to be much greater than in the general population, indicating that there is a close pathophysiological association between chronic hyperglycemia and gastrointestinal dysfunction [1].

The pathophysiological processes of functional dyspepsia in T2DM are complex. The condition of diabetic autonomic neuropathy is one of the key causes, resulting in poor control of gastric motility and secretion. Persistent hyperglycemia impairs the vagus nerve and enteric nervous system leading to delayed gastrointestinal emptying (gastroparesis), gastric accommodation, and abnormal visceral sensitivity. These physiological disruptions are directly related to the emergence of dyspeptic symptoms [2]. Moreover, changes in blood glucose levels were also demonstrated to affect gastric motor functions acutely further complicating the clinical picture.The role of low-grade inflammation, oxidative stress, and changes in gut microbiota in the pathogenesis of functional gastrointestinal disorders in diabetic patients is also emerging. These can contribute to the disruption of the gut–brain axis and the increase of visceral hypersensitivity, thus worsening the severity of the symptoms [3].

Anxiety and depression, which are psychological comorbidities, are equally more frequently seen in patients with T2DM and have been demonstrated to have a great impact on the perception and reporting of dyspeptic symptoms. The symptoms associated with functional dyspepsia diagnosis in patients with T2DM are similar to other diabetic complications, including gastroparesis and gastroesophageal reflux disease, making the diagnosis of functional dyspepsia challenging. Hence, a thorough diagnostic strategy is needed. The identification of validated symptom-based criteria (Rome IV) and the use of instrumental diagnostic methods, including esophagogastroduodenoscopy (EGD), abdominal ultrasonography, and, where possible, gastric emptying studies, are part of modern strategies. Laboratory tests play a crucial role in evaluating glycemic control and diagnosing metabolic defects that can lead to the appearance of the symptoms [4].The treatment of FD in T2DM patients should be done on a case-by-case basis. Glycemic control optimization is a primary requirement, since a better metabolic condition can be of significant help in reducing gastrointestinal symptoms. Pharmacological therapy usually comprises prokinetic drugs, proton pump inhibitors, and, in some instances, neuromodulators. Lifestyle changes and dietary interventions are also important in managing symptoms. Although some progress has been made in understanding and treatment, there is yet to be a region-specific clinical data especially among Central Asian populations. Thus, the proposed study is intended to assess the clinical presentation, diagnostic features, and treatment results of functional dyspepsia among patients with type 2 diabetes mellitus according to the real-world data that will be carried out in the period of 2024-2025 within the specialized medical institutions.

2. Materials and Methods

It is a prospective observational clinical study that will be carried out in 2024-2025 on the basis of clinical data presented in Andijan State Medical Institute, the Endocrinology Department of Andijan City Hospital, the Diagnostic Department of the ASMI Clinic, and the Zam-Zam Diagnostic Center. The number of patients in the study was 145 with a diagnosis of type 2 diabetes mellitus (T2DM). All of them were thoroughly clinically and diagnosthetically examined in accordance with the latest principles of the assessment of functional gastrointestinal disorders [5].

T2DM diagnosis was made using internationally recognized criteria, such as fasting plasma glucose and glycated hemoglobin (HbA1c) measurements, guaranteeing uniform and dependable diagnosis of diabetic patients [6].

Clinical evaluation involved a comprehensive history taking with the focus on the duration of the disease, its glycemic control, medication, and lifestyle. The study included patients who reported persistent dyspeptic symptoms including postprandial fullness, early satiety, abdominal pain, nausea and bloating lasting three months or longer. The diagnosis of functional dyspepsia was based on the Rome IV criteria, which characterize symptomatic functional gastrointestinal disorders, without structural pathology [7].To rule out organic gastrointestinal disease, esophagogastroduodenoscopy (EGD) was performed on all patients and this allowed direct observation of the upper gastrointestinal tract and the elimination of peptic ulcer disease, erosive lesions and malignancy. Abdominal ultrasonography was also done to assess hepatobiliary and pancreatic structures, which could lead to or replicate dyspeptic symptoms [8].

Laboratory tests were performed in accredited diagnostic laboratories and covered: fasting blood glucose, HbA1c, complete blood count, liver function tests, and lipid profile. These parameters were employed to measure the metabolic status and its correlation with gastrointestinal symptoms since impaired glycemic control is related to a disturbed gastric motility and severity of dyspeptic symptoms in diabetic patients [9].

The patients with functional dyspeptica were all treated thoroughly according to the existing clinical guidelines. Optimization of glycemic control with individualized antidiabetic therapy was the primary form of therapy. Pharmacological treatment involved prokinetic agents to enhance the motility of the stomach, and proton pump inhibitors in patients with epigastric pain that is predominant. All patients were advised to make dietary and lifestyle changes, such as eating small frequent meals and avoiding foods that cause symptoms. Outcomes were evaluated using the changes in the severity of symptoms before and after therapy that lasted between four and eight weeks according to the response of an individual. The intensity and frequency of symptoms were measured using a standardized scoring system. The statistical analysis was done according to the general procedures and the level of significance used was $p < 0.05$.

3. Results

A total of 145 patients with type 2 diabetes mellitus (T2DM) were evaluated during the study period (2024-2025). Functional dyspepsia was identified in all included patients based on Rome IV criteria after exclusion of organic gastrointestinal pathology through endoscopic and imaging studies. The mean age of participants was 56.4 ± 9.8 years, with a predominance of female patients (58.6%). The average duration of diabetes was 8.7 ± 4.1 years. Glycemic control was generally suboptimal, with a mean HbA1c level of 8.2 ± 1.3%.

Table 1. Clinical and metabolic characteristics of patients (n = 145).

Parameter	Value
Age (years)	56.4 ± 9.8
Female (%)	58.6%
Duration of T2DM (years)	8.7 ± 4.1
HbA1c (%)	8.2 ± 1.3
Fasting glucose (mmol/L)	9.6 ± 2.4
BMI (kg/m²)	29.1 ± 3.8

Interpretationof Table 1:

The clinical characteristics indicate that functional dyspepsia in T2DM predominantly affects middle-aged patients with long-standing diabetes and inadequate glycemic control. Elevated HbA1c levels suggest chronic hyperglycemia, which contributes to autonomic neuropathy and impaired gastrointestinal motility. Increased BMI reflects the high prevalence of overweight and obesity, which further worsens insulin resistance and delays gastric emptying. These metabolic disturbances collectively support the strong association between poorly controlled diabetes and functional gastrointestinal disorders, consistent with previously reported clinical evidence [10].

Table 2. Prevalence of dyspeptic symptoms in T2DM patients.

Symptom	Prevalence (%)
Postprandial fullness	82.7%
Early satiety	74.5%
Epigastric pain	63.4%
Abdominal bloating	68.9%
Nausea	41.2%

Interpretationof Table 2:

The symptom profile shows that postprandial fullness and early satiety are the most common manifestations of functional dyspepsia in patients with T2DM. These symptoms are typically associated with delayed gastric emptying and impaired gastric accommodation, which are common in diabetic autonomic neuropathy. Abdominal bloating and epigastric pain also occur frequently, reflecting generalized gastrointestinal motility disturbances. Nausea is less prevalent but remains clinically significant in a subset of patients. Overall, these findings confirm that postprandial distress syndrome is the dominant clinical pattern in diabetic functional dyspepsia and are consistent with established literature [11].

Following 4-8 weeks of комплекс therapy, 71.0% of patients demonstrated significant improvement in symptoms. Better outcomes were observed in patients with improved glycemic control, indicating that metabolic regulation plays a key role in symptom reduction.

4. Discussion

The current research indicates that there is a high prevalence of functional dyspepsia (FD) in patients with type 2 diabetes mellitus (T2DM), with the most common symptoms of postprandial fullness, early satiety, and epigastric discomfort. The results are in line with the well-known clinical pattern of postprandial distress syndrome in diabetes groups and indicate underlying changes in gastric motility.The most important conclusion of the study is that there is a strong correlation between the severity of glycemic control and the severity of dyspeptic symptoms. Gastrointestinal complaints were more pronounced in patients that had greater levels of HbA1c, indicating that chronic hyperglycemia is a key factor in the development of functional gastrointestinal disorders. The diabetic autonomic neuropathy mainly mediates this relationship by inhibiting the vagal control of gastric emptying and interfering with the coordination of gastrointestinal motility. Besides neuropathic pathways, the role of metabolic inflammation and oxidative stress is becoming an important issue in gastrointestinal dysfunction in diabetes. Inflammatory

responses to hyperglycemia can cause changes in the role of the enteric nervous system to abnormal visceral sensitivity and dysmotility. Moreover, it has been found that the destruction of the gut-brain axis is one of the major pathophysiological processes that connect metabolic disorders with functional gastrointestinal symptoms [12].

The fact that high rates of bloating, epigastric pain, and nausea were found in this research, also contributes to the multifactoriality of FD in T2DM. These are not only due to delayed gastric emptying but also to visceral hypersensitivity and altered central processing of gastrointestinal signals. This kind of complexity is the reason why the severity of symptoms does not always correlate with the structural findings. Importantly, the results of this study demonstrate that improvement in glycemic control is associated with significant reduction in dyspeptic symptoms. There was a greater clinical improvement in patients that had a superior regulation of their metabolism, which demonstrates the significance of intensive glycemic control as an essential part of the treatment. This confirms earlier findings that normalization of blood glucose level is capable of enhancing gastrointestinal motility and alleviating functional gastrointestinal symptoms [13].

Although these advancements happened, some patients still reported persistent symptoms, which suggests that other factors like psychological stress, changes in gut microbiota, and sensitization of the central nervous system also might be contributing factors. The gut-brain axis is now being recognized as an important regulatory system in functional gastrointestinal diseases and especially in chronic metabolic diseases like diabetes [14].

In general, the results can be compared to the world literature that indicates that T2DM is closely associated with functional gastrointestinal disorders. Nevertheless, this study offers valuable regional clinical information in the Central Asian region where there is limited evidence. This is supported by the relatively large sample size and the real-world clinic environment which increases reliability and applicability of the results.

Future investigation needs to be done to determine predictive biomarkers to diagnose the presence of functional dyspepsia in diabetic individuals early and also to understand new treatment interventions that can be used to address neurogastroenterological pathways [15].

5. Conclusion

This clinical observational trial illustrates that functional dyspepsia is extremely common in patients with type 2 diabetes mellitus and is an element of the disease burden that is significant and, nevertheless, mostly unidentified. The findings indicate clearly that such dyspeptic symptoms like postprandial fullness, early satiety, epigastric pain, and bloating are prevalent in diabetic patients and have a profound impact on their quality of life on a daily basis.The results show that there is a close relationship between the severity of gastrointestinal symptoms and poor glycemic control. The patients who had a higher level of HbA1C were more likely to complain of dyspeptic issues, indicating that chronic hyperglycemia is a major cause of functional gastrointestinal disturbances. This confirms the hypothesis that diabetic autonomic neuropathy and metabolic dysregulation are key processes involved in the pathophysiology of functional dyspepsia. Notably, the research also indicates that the amelioration in the metabolic control is linked to the significant decrease of the severity of symptoms. Clinical improvement that was observed in patients who had improved their glycemic control was significant after complex therapy, which entailed optimization of antidiabetic treatment, prokinetic agents and dietary adjustments. This underscores the significance of a multidisciplinary and personalized approach to treatment of such patients.Although these were positive results, a percentage of patients still had persistent symptoms, which suggests that the issue of functional dyspepsia in

diabetes is a multi-factorial phenomenon that is not only affected by metabolic factors but also by neurogastroenterological and potentially psychological processes. Thus, the management approaches in the future must be based on a wider scope that involves evaluation of gut-brain axis dysfunction and psychosocial aspects. To sum up, functional dyspepsia is a clinically important disorder in type 2 diabetes mellitus that needs to be identified and managed promptly. Glycemic control is an essential part of therapy and is critical in alleviating gastrointestinal symptoms. More extensive research is required to understand the underlying mechanisms and come up with more specific therapeutic approaches.

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