

## A Comprehensive Literature Review on the Relationships and Management of Gastroparesis

Okelue Edwards Okobi MD, MS<sup>1\*</sup>, Cherechi Godswill Sike MD, MSc<sup>2</sup>,  
Bright Chizitere Nwatomole, MBBS.<sup>3</sup>, Jeffrey Afrah Sackey, MBChB<sup>4</sup>,  
Maame Akosua Ehuramba Beeko MBBS<sup>5</sup>, Esther Tolu Adedibu, MD<sup>6</sup>

<sup>1</sup>Larkin Community Hospital, Palms Spring Campus, Miami, FL, USA.

<sup>2</sup>Windsor University School of Medicine, 1621 Brighton's Estate, Cayon, St Kitts

<sup>3</sup>Calderdale and Huddersfield NHS Foundation Trust, United Kingdom.

<sup>4</sup>Korlebu Teaching Hospital, Guggisberg Avenue, Accra, Ghana

<sup>5</sup>Kyebi Government Hospital, Kyebi, Eastern Region, Ghana

<sup>6</sup>All Saints University School of Medicine Dominica

E-mail: [Drokelue.e.okobi@gmail.com](mailto:Drokelue.e.okobi@gmail.com); [cherechigsike@gmail.com](mailto:cherechigsike@gmail.com);  
[bnwatomole4@gmail.com](mailto:bnwatomole4@gmail.com); [sackeyjeff38@gmail.com](mailto:sackeyjeff38@gmail.com); [mbeeko18@gmail.com](mailto:mbeeko18@gmail.com);  
[esthertoluadedibu@gmail.com](mailto:esthertoluadedibu@gmail.com)

\*Corresponding author details: Okelue Edwards Okobi MD, MS;  
[Drokelue.e.okobi@gmail.com](mailto:Drokelue.e.okobi@gmail.com)

### ABSTRACT

This literature review aims to explore the intricate interplay between diabetes, cardiology, and gastroparesis. Diabetes is a chronic metabolic disorder that significantly affects cardiovascular health, and its association with gastroparesis further complicates patient management. The review critically analyzes recent research articles, clinical studies, and guidelines to elucidate the pathophysiology, epidemiology, diagnostic approaches, and therapeutic interventions for patients with diabetes, cardiology conditions, and concurrent gastroparesis. The findings highlight the impact of gastroparesis on glycemic control, cardiac function, and overall quality of life, emphasizing the need for a multidisciplinary approach to patient care. Additionally, the review explores potential mechanisms linking diabetes, cardiac dysfunction, and gastroparesis, such as autonomic neuropathy, inflammatory pathways, and impaired gut-brain axis communication. Finally, the literature review discusses current treatment strategies, including lifestyle modifications, pharmacological therapies, and novel interventions, while also addressing challenges and gaps in the existing literature. This comprehensive analysis provides clinicians, researchers, and healthcare professionals valuable insights to enhance their understanding of the complex relationship between diabetes, cardiology, and gastroparesis, ultimately promoting optimal patient care and management.

**Keywords:** diabetes; cardiology; gastroparesis; pathophysiology; epidemiology; diagnostic approaches; therapeutic interventions; glycemic control; cardiac function; multidisciplinary approach; autonomic neuropathy; inflammatory pathways; gut-brain axis; treatment strategies; lifestyle modifications; pharmacological therapies; novel interventions.

### INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. With an estimated global prevalence of 9.3% in 2019, diabetes has become a significant public health concern worldwide [1]. Apart from its impact on glucose homeostasis, diabetes exerts profound effects on various organ systems, including the cardiovascular system. Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality among individuals with diabetes, accounting for a significant proportion of diabetes-related complications [2]. The heightened cardiovascular risk in diabetes can be attributed to a complex interplay of traditional cardiovascular risk factors, metabolic abnormalities, and diabetes-specific pathophysiological mechanisms.

In recent years, there has been growing recognition of the impact of diabetes on gastrointestinal motility and associated complications. Gastroparesis, characterized by delayed gastric emptying in the absence of mechanical obstruction, is one such complication that frequently coexists with diabetes. Gastroparesis is estimated to affect approximately 30-50% of individuals with type 1 diabetes and 10-30% of individuals with type 2 diabetes [2]. Gastroparesis not only leads to debilitating symptoms such as early satiety, postprandial fullness, nausea, vomiting, and abdominal pain but also poses significant challenges in diabetes management.

The coexistence of diabetes, cardiology conditions, and gastroparesis present a complex clinical scenario that requires a multidisciplinary approach to patient care.

The intricate relationship between these three entities necessitates a comprehensive understanding of their underlying pathophysiological mechanisms, diagnostic strategies, and therapeutic interventions. By exploring the available literature, this review aims to provide a comprehensive overview of the relationship between diabetes, cardiology, and gastroparesis, highlighting the challenges and advances in managing this complex patient population.

The primary objectives of this literature review are to:

1. Investigate the pathophysiological mechanisms linking diabetes, cardiology conditions, and gastroparesis.
2. Examine gastroparesis's epidemiology and clinical implications in individuals with diabetes and cardiology conditions.
3. Evaluate the diagnostic approaches for identifying gastroparesis in patients with diabetes and cardiology conditions.
4. Explore the impact of gastroparesis on glycemic control and cardiac function in individuals with diabetes and cardiology conditions.
5. Review the current therapeutic interventions, including lifestyle modifications, pharmacological therapies, and novel interventions, for managing gastroparesis in patients with diabetes and cardiology conditions.

## DISCUSSION

### Pathophysiology Interplay between Diabetes, Cardiovascular System, and Gastroparesis

#### • *Autonomic Neuropathy*

Autonomic neuropathy is a common complication of diabetes that affects the autonomic nervous system, leading to dysfunction in various organ systems, including the cardiovascular and gastrointestinal systems. In diabetes, autonomic neuropathy can result in impaired cardiac autonomic regulation and abnormal gastric motility, contributing to the development of both cardiovascular conditions and gastroparesis [3]. The dysregulation of sympathetic and parasympathetic signaling disrupts normal gastric accommodation, gastric emptying, and intestinal motility, leading to gastroparesis symptoms [4]. Additionally, autonomic dysfunction contributes to cardiovascular abnormalities in diabetes, such as abnormal heart rate variability and impaired baroreflex sensitivity, further increasing the risk of cardiovascular events [5].

#### • *Inflammatory Pathways*

Chronic inflammation plays a crucial role in the pathophysiology of both diabetes and cardiovascular diseases. In diabetes, the sustained elevation of pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- $\alpha$ ), promotes insulin resistance,  $\beta$ -cell dysfunction, and endothelial dysfunction [6]. These inflammatory mediators can also contribute to the development of gastroparesis by disrupting the coordination of gastrointestinal motility and impairing smooth muscle contractility [7]. Moreover, chronic low-grade inflammation in diabetes can exacerbate cardiovascular risk by promoting atherosclerosis, endothelial dysfunction, and myocardial remodeling [8].

#### • *Impaired Gut-Brain Axis Communication*

The gut-brain axis, involving bidirectional communication between the gastrointestinal tract and the central nervous system, is crucial in regulating cardiovascular and gastrointestinal functions. In diabetes, alterations in gut hormones, such as glucagon-like peptide-1 (GLP-1) and peptide YY (PYY), impact appetite regulation, insulin secretion, and gastric emptying [9].

Disruptions in these hormonal signals can contribute to gastroparesis development and glycemic dysregulation. Additionally, gut microbiota dysbiosis, commonly observed in diabetes, can lead to increased intestinal permeability, systemic inflammation, and metabolic derangements [10]. These alterations in the gut microbiome have been implicated in cardiovascular diseases and gastrointestinal dysmotility, highlighting their potential role in the pathophysiological interplay.

### Diagnosis of Gastroparesis in Patients with Diabetes and Cardiology Conditions

Diagnosing gastroparesis in patients with diabetes and cardiology conditions requires a comprehensive evaluation that integrates clinical assessment, diagnostic tests, and exclusion of other potential causes for gastrointestinal symptoms. Given these conditions' overlapping symptoms and complexities, a systematic approach is essential for accurate diagnosis. The following components contribute to the diagnostic process:

#### • *Clinical Assessment*

A thorough clinical evaluation is paramount in identifying potential symptoms and risk factors associated with gastroparesis. Patients may present with complaints of early satiety, postprandial fullness, nausea, vomiting, bloating, and abdominal pain. Considering these symptoms' duration, severity, and impact on the patient's quality of life is crucial. Additionally, assessing the presence of comorbidities, such as diabetes and cardiology conditions, helps establish the context for developing gastroparesis [11].

#### • *Medical History*

A detailed medical history should be obtained to identify any underlying conditions, including diabetes and cardiovascular diseases, and their respective duration, severity, and treatment regimens. Medication history, including medications known to delay gastric emptying (e.g., opioids, calcium channel blockers), should also be documented. Moreover, the presence of other gastrointestinal disorders, such as peptic ulcers, inflammatory bowel disease, or gastrointestinal malignancies, should be investigated as they may mimic or coexist with gastroparesis [12].

#### • *Physical Examination*

A physical examination may provide additional clues to support the diagnosis of gastroparesis. Signs of nutritional deficiencies, such as weight loss, muscle wasting, or evidence of malnutrition, should be assessed. Abdominal examination may reveal abdominal distension, tenderness, or abnormal bowel sounds, although these findings are nonspecific and can be present in various gastrointestinal disorders [13].

### Diagnostic Tests

Several diagnostic tests can aid in confirming the diagnosis of gastroparesis and differentiating it from other conditions. These tests can evaluate gastric emptying, assess gastric accommodation, and exclude mechanical obstruction or other structural abnormalities. Commonly employed diagnostic modalities include:

#### • *Gastric Emptying Scintigraphy*

Gastric emptying scintigraphy is considered the gold standard for diagnosing gastroparesis. It involves ingesting a radiolabeled solid or liquid meal, followed by serial imaging to assess the gastric emptying rate. Delayed gastric emptying, typically defined as retention of more than 10-20% of the meal at 4 hours, supports the diagnosis of gastroparesis [12-13].

- **Breath Testing**

Carbon-13 (C-13) or radioactive hydrogen (H-2) breath tests can be utilized to assess gastric emptying noninvasively. These tests involve the ingestion of a substrate (e.g., C-13-labeled octanoic acid or H-2-labeled water), which is metabolized by bacteria in the stomach. The subsequent measurement of exhaled gases indirectly estimates gastric emptying [12].

- **Upper Gastrointestinal Endoscopy**

Upper gastrointestinal endoscopy may be performed to exclude mechanical obstruction or other structural abnormalities that can mimic gastroparesis. It also allows for evaluating mucosal inflammation, ulcers, or signs of other associated gastrointestinal disorders [13].

- **Exclusion of Other Causes**

It is crucial to exclude other potential causes of delay; this involves ruling out mechanical obstruction, mechanical obstruction, functional dyspepsia, peptic ulcers, gastric malignancies, and medication-induced effects that can mimic.

### **Management of Gastroparesis in Patients with Diabetes and Cardiology Conditions**

The management of gastroparesis in patients with diabetes and cardiology conditions focuses on symptom control, improving gastric motility, and addressing underlying contributing factors. The treatment approach is often multifaceted and involves lifestyle modifications, dietary adjustments, medication therapy, and, in some cases, procedural interventions. The following strategies are commonly employed in the management of gastroparesis:

#### **1. Dietary Modifications:**

Dietary modifications play a crucial role in managing gastroparesis symptoms. Patients are advised to consume smaller, more frequent meals that are low in fat and fiber to facilitate gastric emptying. A liquid or pureed diet may be recommended in severe cases. Additionally, patients are advised to avoid foods that exacerbate symptoms, such as fatty and spicy foods, caffeine, and alcohol. Collaborating with a registered dietitian is essential to tailor the diet to the individual patient's needs [12-13].

#### **2. Medications:**

Several medications are utilized to manage gastroparesis symptoms and improve gastric motility. Prokinetic agents, such as metoclopramide and domperidone, enhance gastrointestinal motility and facilitate gastric emptying. However, using these medications requires careful consideration due to their potential side effects, including neurological adverse effects. Other medications, such as erythromycin and ghrelin agonists (e.g., relamorelin), may be considered in some instances [12-14]. Antiemetics, such as ondansetron and promethazine, may be prescribed to alleviate nausea and vomiting symptoms.

#### **3. Glycemic Control:**

Optimizing glycemic control is crucial in patients with diabetes and gastroparesis. Fluctuating blood glucose levels can exacerbate gastroparesis symptoms and delay gastric emptying. Individualized management plans that incorporate dietary modifications, appropriate use of antidiabetic medications (e.g., insulin, oral agents), and regular blood glucose monitoring are necessary to achieve stable glycemic control [15].

#### **4. Treatment of Underlying Conditions:**

If gastroparesis is associated with underlying conditions such as diabetes or cardiology conditions, optimizing the management of these conditions is essential.

Aggressive management of diabetes, including glycemic control, may help alleviate gastroparesis symptoms and improve gastric motility. In patients with cardiac disorders, careful adjustment of medications to minimize their impact on gastric motility should be considered [13].

#### **5. Procedural Interventions:**

In refractory cases of gastroparesis, procedural interventions may be warranted. These include gastric electrical stimulation, which involves implanting a device to modulate gastric electrical activity and improve symptoms, and pyloric interventions such as botulinum toxin injection or endoscopic pyloromyotomy. These interventions are generally considered in patients who have failed conservative management and have significant impairment of gastric emptying [12-13].

Close monitoring of symptoms, periodic reassessment, and collaboration with a multidisciplinary team consisting of gastroenterologists, endocrinologists, dietitians, and specialized nurses are crucial to optimize the management of gastroparesis in patients with diabetes and cardiology conditions.

### **Prognosis of Gastroparesis in Patients with Diabetes and Cardiology Conditions:**

The prognosis of gastroparesis in patients with diabetes and cardiology conditions can vary depending on the underlying etiology, disease severity, and individual patient characteristics. Gastroparesis is a chronic condition that can significantly impact patients' quality of life and may lead to complications if not effectively managed. Understanding the prognosis is essential for healthcare providers to provide appropriate support and interventions. The following factors influence the prognosis of gastroparesis:

#### **1. Underlying Etiology:**

The underlying etiology of gastroparesis, particularly its association with diabetes and cardiology conditions, can affect the prognosis. Patients with diabetic gastroparesis may experience a more chronic and progressive disease course, as diabetes-related autonomic neuropathy contributes to gastric dysmotility. Concurrent cardiology conditions, such as heart failure or ischemic heart disease, may further complicate the prognosis by impairing gastric function [12, 15].

#### **2. Disease Severity:**

The severity of gastroparesis symptoms and the degree of impairment in gastric motility can influence the prognosis. Patients with milder symptoms and less severe impairment in gastric emptying may have a better prognosis and respond well to conservative management strategies, such as dietary modifications and medication therapy. However, patients with more severe symptoms and significant delays in gastric emptying may experience a more protracted course of the disease and may require more intensive interventions [12-13].

#### **3. Response to Treatment:**

The response to treatment is another critical determinant of prognosis in gastroparesis. Patients who respond favorably to conservative management measures, such as dietary modifications and prokinetic medications, may experience better symptom control and improved gastric motility. On the other hand, patients who fail to respond adequately to these interventions or require more invasive procedures, such as gastric electrical stimulation or pyloric interventions, may have a more challenging prognosis [12-13].

#### 4. Complications:

Gastroparesis can lead to various complications, which can impact the overall prognosis. These complications include malnutrition, dehydration, electrolyte imbalances, and the development of gastrointestinal symptoms such as gastroesophageal reflux disease (GERD) and small intestinal bacterial overgrowth (SIBO). If left untreated or poorly managed, these complications can significantly worsen the prognosis and contribute further [12-15].

#### 5. Comorbidities:

The presence of comorbidities, such as diabetes and cardiology conditions, can influence the prognosis of gastroparesis. Patients with poorly controlled diabetes and associated complications may experience a more challenging disease course and a higher risk of complications. Similarly, the presence of cardiology conditions, particularly those affecting cardiac function, can complicate the management of gastroparesis and impact overall prognosis [12-15]. In general, gastroparesis is a chronic condition that requires long-term management. While it can significantly impact patients' quality of life, early diagnosis, comprehensive treatment strategies, and close monitoring can help improve symptoms, prevent complications, and enhance prognosis. Collaborative care involving gastroenterologists, endocrinologists, cardiologists, and other healthcare professionals is essential for optimizing patient outcomes.

#### CONCLUSION

Gastroparesis in patients with diabetes and cardiology conditions presents unique diagnosis, management, and prognosis challenges. The interplay between these conditions and the pathophysiology of gastroparesis underscores the need for a comprehensive approach to patient care. Accurate diagnosis, tailored treatment strategies, and proactive management of comorbidities are essential for optimizing patient outcomes. Despite the complexities associated with gastroparesis in this patient population, advancements in diagnostic techniques, therapeutic options, and multidisciplinary collaboration have improved our ability to manage the condition effectively. Clinical assessment, medical history, physical examination, and specific diagnostic tests facilitate the diagnosis of gastroparesis and help differentiate it from other gastrointestinal disorders. The management of gastroparesis includes lifestyle modifications, dietary adjustments, medication therapy, glycemic control, and treatment of underlying conditions. These interventions aim to alleviate symptoms, improve gastric motility, and enhance patients' overall quality of life. However, the individualized nature of treatment requires close monitoring and regular reassessment to ensure optimal outcomes.

#### OUR RECOMMENDATIONS

1. Based on the recommendations from the American Diabetes Association (ADA), healthcare providers should prioritize the early diagnosis and management of gastroparesis in patients with diabetes. Regular screening for symptoms and risk factors should be implemented, and timely referral to gastroenterologists or specialized centers should be encouraged for further evaluation and management.

2. Collaborative care involving gastroenterologists, endocrinologists, cardiologists, dietitians, and specialized nurses is essential for the comprehensive management of gastroparesis in patients with diabetes and cardiology conditions. Regular communication and shared decision-making among healthcare professionals will help optimize treatment strategies and improve patient outcomes.

3. In addition to established guidelines, healthcare providers should consider the individual patient's preferences, lifestyle, and comorbidities when developing a treatment plan for gastroparesis. Patient education and support should be emphasized to promote self-management and adherence to recommended lifestyle modifications and medication regimens.

4. Continued research and innovation in diagnostic modalities, therapeutic interventions, and targeted therapies are needed further to improve the management of gastroparesis in this patient population. This includes exploring novel prokinetic agents, advancements in procedural interventions, and personalized medicine approaches based on underlying pathophysiological mechanisms.

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