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CASE REPORT | ESOPHAGUS

Identifying the Hiccup-Induced Esophagogastric Waveform: A Case Series Report Using High-Resolution Manometry

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ABSTRACT

Hiccups result from involuntary contractions of the diaphragm, driven by a complex neuromuscular reflex. Three patients with persistent hiccups underwent esophageal high-resolution manometry during hiccup episodes, revealing a consistent finding: sustained contraction of the esophagogastric junction with intermittent pressure peaks. This pattern, termed the "Hiccup-Induced Esophagogastric Waveform," shows significant esophageal pressure changes linked to hiccup reflex. It may reflect a compensatory mechanism to expel excess esophageal residue or gas. These findings suggest hiccups could exacerbate symptoms of esophageal disorders, such as dysphagia and chest pain, and highlight the need for targeted therapeutic strategies. Further research is needed to explore these mechanisms.

KEYWORDS: hiccupus; singultus; esophageal manometry; esophagus; dysphagia; chest pain

INTRODUCTION

Hiccup, or singultus, is a clinical manifestation secondary to a diaphragmatic myoclonic contraction mediated by a complex neuromuscular reflex that likely serves the primitive biological function of expelling excess air from the stomach of mammals during breastfeeding.[1,2] This reflex involves an afferent sensory loop composed of the vagus nerve and sympathetic ganglion chains, a central integration area including the hypothalamic reticular formation, the medulla oblongata near the nucleus ambiguus, and the lateral reticular nucleus, as well as an efferent motor loop formed by the phrenic nerve. The afferent sensory loop includes the complex of the phrenic nerve diaphragm and accessory nerve-intercostal muscles, leading to unilateral left diaphragmatic contractions, coordinated with intercostal muscle contractions.[1–4] This mechanism results in a rapid intake of air into the respiratory tract, quickly interrupted by the glottic closure through stimulation of the recurrent laryngeal nerve, which produces the characteristic hiccup sound.[2,3] The neurotransmitters involved in this neuromuscular sequence are dopamine and gamma-aminobutyric acid.[4]

The etiology of hiccups can be secondary to any pathology or stimulants affecting any component of the neuromuscular integration of this reflex arc, ranging from central nervous system disorders to less severe causes such as aerophagia, gastroesophageal reflux disease, or consumption of certain foods.[4,5]

Although the diagnosis of hiccups is clinical, imaging studies are directed toward addressing the etiology of this disorder.[6] There is limited information regarding the manometric findings related to hiccups, and among these, lower esophageal sphincter (LES) incompetence, inhibition of esophageal peristalsis, and brief diaphragmatic contractions have been described.[4,7] In this report, we present the manometric findings (high-resolution manometry) of 3 patients who were referred for the study of esophageal symptoms and hiccups.

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Patient 1: A 64-year-old man with a body mass index (BMI) of 24.2 kg/m^2 rereferred for heartburn, regurgitation, and belching for over 5 years, with intermittent chronic hiccups. These hiccups triggered dysphagia, chest pain, and epigastric pain during

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swallowing. The esophagogastric junction (EGJ) morphology was type II, and the LES resting pressure was 41.1 mm Hg. Esophageal motility assessment showed 100% ineffective swallows, with 50% being weak and 50% failed. Relaxation of the EGJ was adequate with a median integrated relaxation pressure (IRP) of 11.8 in the supine position. Multiple rapid swallow (MRS) showed absent peristaltic reserve, while rapid drink challenge (RDC) demonstrated adequate EGJ relaxation. During a hiccup crisis, a unique pattern was recorded, characterized by sustained EGJ contraction with pressurization to 30 mm Hg, and 3 pressure peaks with a contractile integrated (CI) of 2,953 mm Hg cm s was observed (Figure 1).

Patient 2: A 67-year-old man with a BMI of 27.7 kg/m^2 and a history of Alzheimer dementia reported regurgitation, dysphagia, chest pain, cough, and intermittent chronic hiccups. EGJ was type II, and LES resting pressure was 17.8 mm Hg. Esophageal motility assessment showed 100% failed swallows. Relaxation of the EGJ was adequate with a median IRP of 14 in the supine position. MRS showed absent peristaltic reserve, while RDC demonstrated adequate EGJ relaxation. During a hiccup crisis, the same pattern described previously was recorded: sustained EGJ contraction with pressurization below 30 mm Hg and 6 pressure peaks with a CI of 6,342.4 mm Hg cm·s were observed during symptoms of obstructive dysphagia and chest pain, with 1 episode resulting in vomiting (Figure 2).

Patient 3: A 74-year-old man with a BMI of 20.83 kg/m^2 and belching disorder reported chronic cough of long duration and intermittent chronic hiccups. EGJ was type IIIa, and LES resting pressure was 38.1 mm Hg. Esophageal motility assessment showed 90% ineffective swallows, with 50% being weak and 50% failed. Relaxation of the EGJ was adequate with a median IRP of 14 in the supine position. MRS showed absent peristaltic reserve, while RDC demonstrated adequate EGJ relaxation. During a hiccup crisis, again, a sustained EGJ contraction with pressurization below 30 mm Hg and 3 pressure peaks with a CI of 1,264.7 mm Hg cm·s were observed, as well as an episode of panesophageal pressurization above 30 mm Hg and increased intragastric pressure to 34 mm Hg (Figures 3 and 4).

DISCUSSION

Hiccup is a common symptom in patients affected by disorders of peristalsis with hypomotility patterns.[6,8] These disorders tend to decrease esophageal clearance, making hiccup a physiological response to expel excess esophageal residue.[1,2,9,10]

Despite these patients having disorders of esophageal hypomotility patterns, in all cases, we found a unique and consistent pattern: a spastic phenomenon with sustained EGJ contraction and features of EGJ outflow disorders with panesophageal pressurization above 30 mm Hg occurred following a hiccup crisis or "Hiccup-Induced Esophagogastric Waveform".[8] The Hiccup-Induced Esophagogastric Waveform is hypothesized to be a unique manometric pattern resulting from the diaphragmatic myoclonic contractions characteristic of hiccups. This pattern manifests as a sustained contraction of the EGJ with periodic pressure peaks, potentially serving a compensatory role in expelling excess esophageal residue or gas, which may alleviate symptoms associated with gastroesophageal reflux and other esophageal motility disorders. However, it is possible that the contraction observed in the EGJ manometry images is related to a postswallow contraction of the LES. While this pattern may reflect a typical postswallow LES contraction, the intensity of the contraction observed could still play a role in exacerbating esophageal motility disorders and contribute to the symptomatology in affected patients.

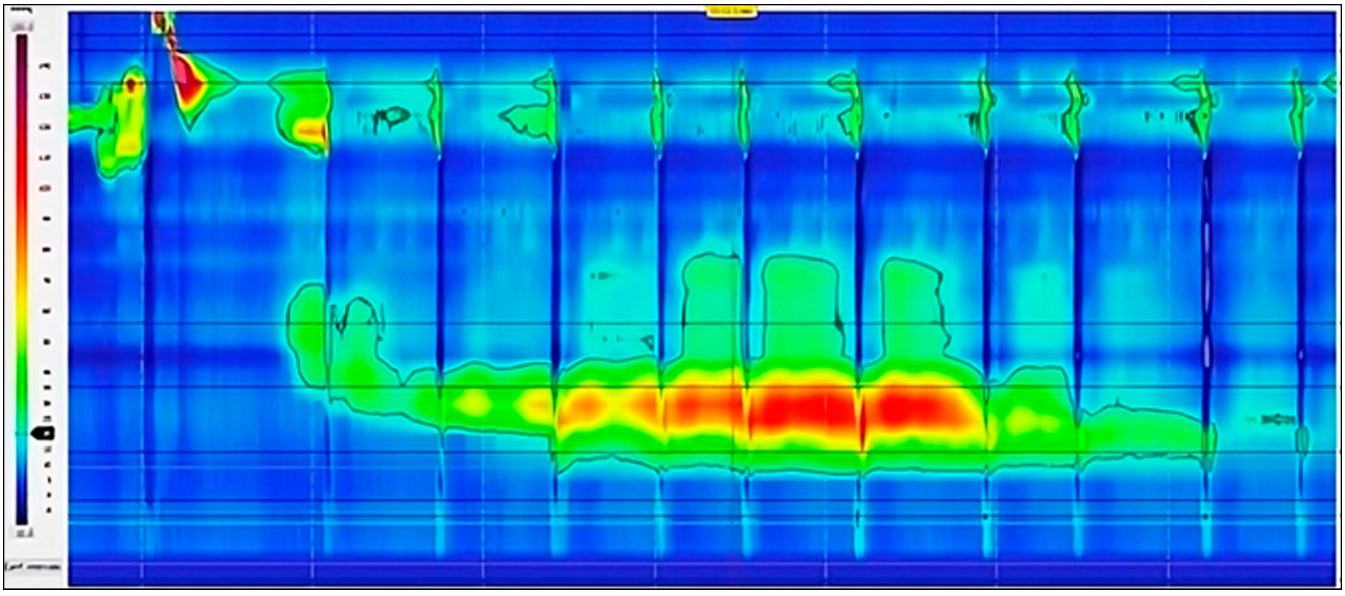

Figure 1. Sustained esophagogastric junction contraction with pressurization to 30 mm Hg and 3 pressure peaks with a contractile integrated of 2,953 mm Hg cm·s during hiccup crisis.

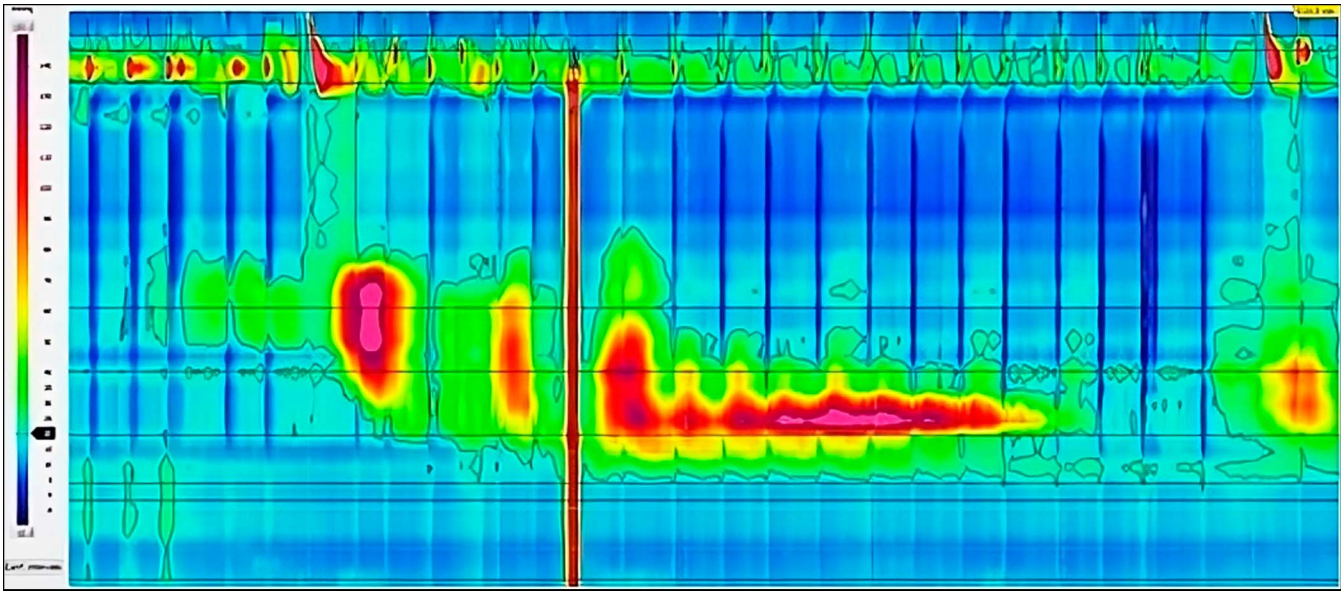

Figure 2. Sustained esophagogastric junction contraction with pressurization below 30 mm Hg and 6 pressure peaks with a contractile integrated of 6,342.4 mm Hg cm·s during hiccup crisis with symptoms of obstructive dysphagia and chest pain.

Although the use of high-resolution manometry in patients with hiccups may be questionable, manometry was pursued because hiccups are a clinically evident symptom, and it is important to consider differential diagnoses, such as supragastric belching. By performing manometry, we aimed to identify any underlying esophageal motility disorder contributing to the hiccups. While the findings presented in this case series are intriguing and highlight a rarely reported manometric pattern, the clinical impact of these results remains uncertain due to the small sample size. It is important to acknowledge that, although the identification of vigorous LES contractions may enhance our understanding of the pathophysiology of symptoms in these patients, it is still unclear how this information could directly translate into immediate changes in clinical management. In this context, additional studies with larger cohorts will be necessary to evaluate whether the presence of vigorous LES contractions in patients with esophageal hypomotility and persistent hiccups could influence therapeutic strategies or clinical guidelines.

DISCLOSURES

Author contributions: JM Remes conceived and designed the research. JM Remes, FA Félix and RA Jimenez performed the

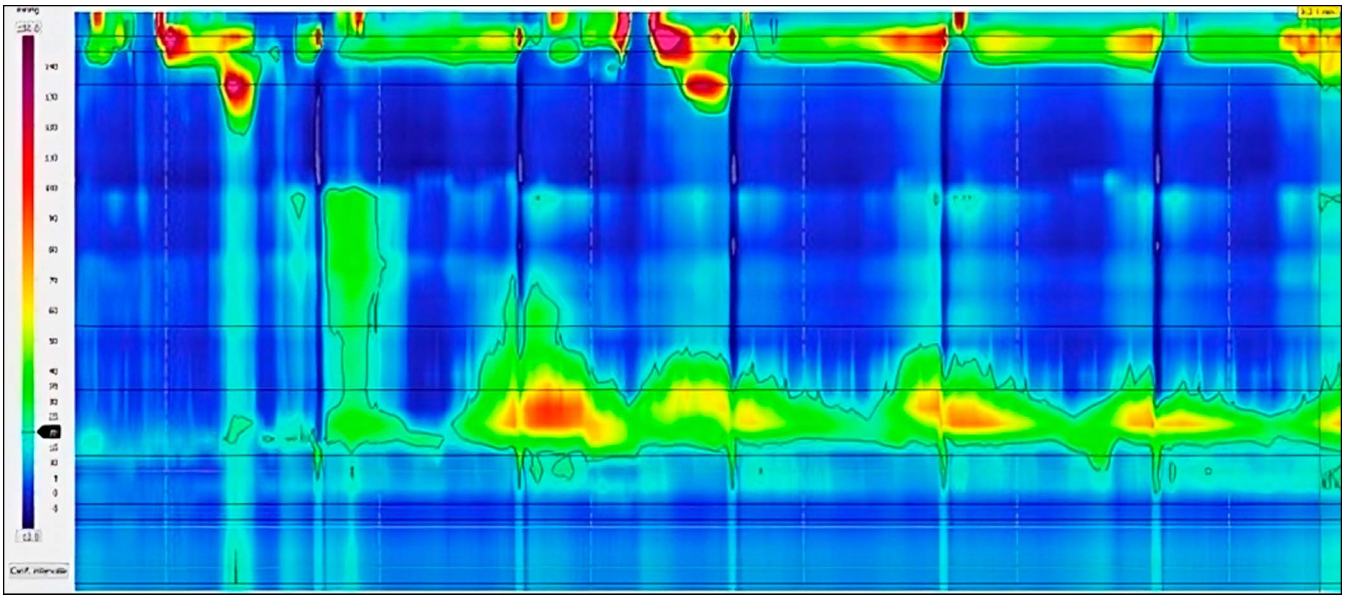

Figure 3. Sustained esophagogastric junction contraction with pressurization below 30 mm Hg and 3 pressure peaks with a contractile integrated of 1,264.7 mm Hg cm·s during hiccup crisis.

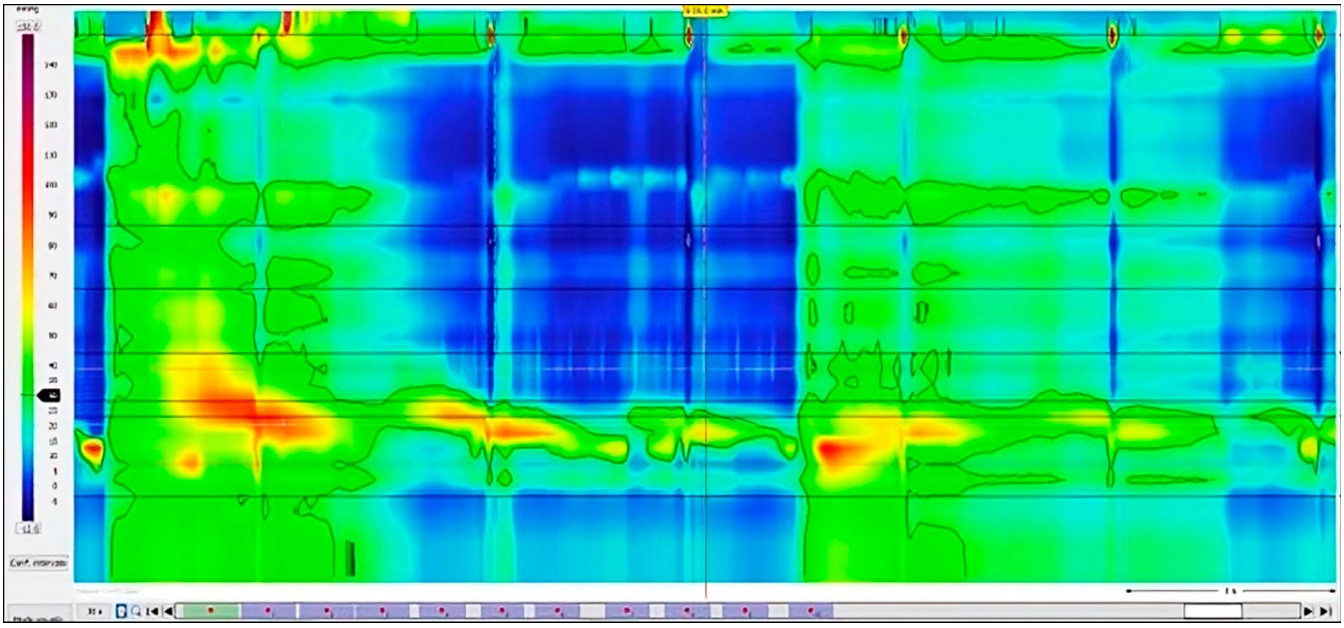

Figure 4. Episode of panesophageal pressurization above 30 mm Hg and increased intragastric pressure to 34 mm Hg during hiccup crisis.

HRM. FA Félix drafted the manuscript and JM Remes revised and approved the final version of the manuscript. JM Remes is the article guarantor.

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