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Case Report

Emphysematous Gastritis in a Patient with Concomitant COVID-19 Infection and Celiac Trunk Stenosis: A Case Report

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ABSTRACT

This case report reviews a 75-year-old male with several comorbidities who presented with acute encephalopathy and sepsis in the setting of COVID-19 pneumonia, who was noted to have significant gaseous distention of the stomach, emphysematous gastritis (EG), and severe stenosis of the celiac trunk on initial CT imaging. He was treated with empiric IV antibiotics, including ceftriaxone and metronidazole, which were changed to intravenous piperacillin-tazobactam after 24 hours. After being evaluated by surgery and gastroenterology, it was determined that risks outweighed the benefits of EGD and surgical intervention as the patient had a labile hemodynamic status. After extensive goals of care discussions with the patient's family, he was transitioned to comfort measures only on day 4 of admission and ultimately passed the same day due to cardiopulmonary arrest. EG is often diagnosed late in its course and is associated with extremely high mortality, even with surgical intervention. Evidence from recent case series suggests increasing success with conservative management in selected patients; there are no formal guidelines.

1. Introduction

Emphysematous gastritis is a rare and often lethal entity, characterized by the infiltration of gas-forming microbes within the gastric mucosa. A recent comprehensive systematic review by Elnaggar et al. described a total of 121 EG cases documented in the literature, including case reports and case series [1]. Several pathogenic microorganisms have been implicated, including E coli, Staphylococcus aureus, Pseudomonas, and Streptococcus species [2]. Postulated risk factors include diabetes mellitus, use of non-steroidal anti-inflammatory drugs, and prolonged immunosuppression [3], none of which were present in our patient. Of note, there have been a growing number of case reports demonstrating emphysematous gastritis in the setting of an underlying COVID-19 infection [4, 5, 6]. Given the low incidence of EG, there are no established management guidelines for diagnosis and treatment. However, Watson et al. demonstrated in their review that surgical intervention in EG has markedly declined over time, with a corresponding improvement in overall mortality, underscoring a shift toward more conservative management [7].

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2. Case Presentation

A 75-year-old male with a past medical history of advanced dementia, chronic kidney disease, hypertension, and chronic obstructive pulmonary disease was admitted from a nursing facility in the evening after being found unresponsive and hypotensive. He was admitted to the medicine service for acute metabolic encephalopathy and respiratory failure secondary to aspiration with COVID-19 pneumonia. His outpatient medications included donepezil, trazodone, memantine, olanzapine, and sertraline. He did not take NSAIDs, antiplatelets, anticoagulants, steroids, PPIs, or antibiotics prior to this admission.

On initial presentation, vital signs were notable for tachycardia at 109 beats/minute, blood pressure of 90/60 mm Hg, and spO2 of 95% on 3L supplemental oxygen via nasal cannula. Diffuse abdominal tenderness, distension, and rigidity were noted on the physical exam. An abdominal X-ray taken on the day of admission showed significant gaseous distension of the stomach. Blood cultures were obtained, and empiric broad-spectrum antibiotics, intravenous ceftriaxone and metronidazole, were administered at the time of admission for presumed sepsis with hypotension. He was appropriately fluid resuscitated as per sepsis protocol.

Pertinent laboratory results on admission included an elevated white blood cell count of $13.3 \times 10^9/\mu$L, BUN of 31 mg/dL, creatinine of 1.4 mg/dL, bicarbonate of 20 mmol/L, an anion gap of 20 mmol/L, and lactate of 3.3 mmol/L. The respiratory viral panel PCR test returned a positive result for COVID-19. Outpatient vaccination records were unavailable to us.

Computed tomography (CT) imaging with IV contrast of the abdomen/pelvis was performed in the ED on day 0 of admission, which revealed gas within the gastric wall **(Figure 1)** predominantly in the cardia and antrum with marked distention as well as

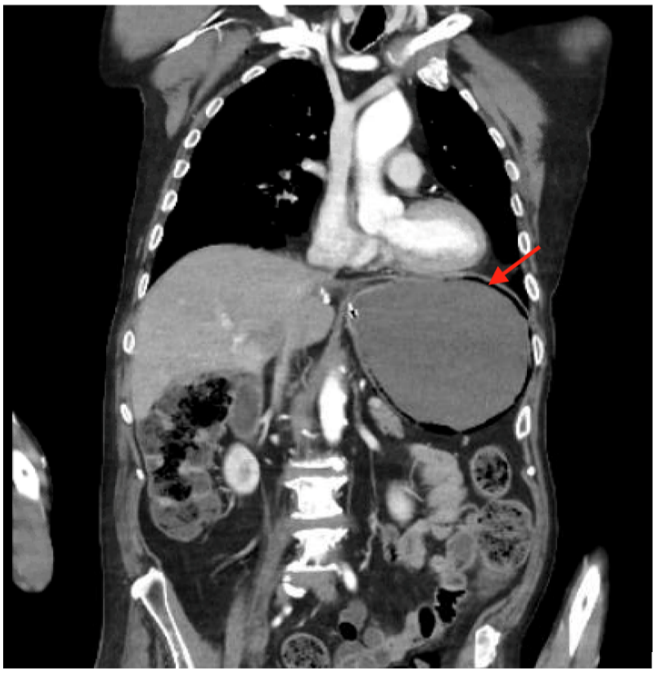

Figure 1: Contrast-enhanced CT with intravenous contrast. Coronal section demonstrating diffuse gastric mural gas, most prominent in the cardia and antrum (arrow).

hepatic portal venous gas **(Figure 2)**, without pneumoperitoneum. Additionally, there was a reported near-complete occlusion of the celiac trunk involving approximately a 0.8 cm segment with distal reconstitution **(Figure 3)**. The superior and inferior mesenteric arteries were grossly patent. The esophagus was fluid-filled and dilated secondary to gastric distention. A nasogastric tube was placed for decompression within an hour of CT imaging, which yielded 400 mL of coffee-ground aspirate. Due to concerns of GI bleeding, a high-dose intravenous proton pump inhibitor was initiated, and gastroenterology was consulted. Labs showed hemoglobin of 11.0g/dL, which was lower than his baseline of 12.0g/dL. Coagulation profile was within normal limits. Patient was upgraded to ICU level of care given findings of EG and suspicion of active GI bleeding.

Subsequently, on day 2 of admission, antibiotics were broadened to intravenous piperacillin-tazobactam to ensure appropriate coverage against gram-positive, gram-negative, and anaerobic organisms, including possible resistant strains. Empiric antifungal therapy was deferred, given the predominantly bacterial or polymicrobial etiology of EG, absence of early fungal risk factors, and pending assessment of clinical trajectory. Hemoglobin trend remained stable thereafter with no subsequent coffee ground aspirate, melenic stool, or blood per rectum. The patient continued to deteriorate with labile blood pressures and worsening mental status clinically. Lactic acid increased to 10.3 mmol/L despite continued fluid resuscitation, and the anion gap, which was previously normal, increased to 20. Oxygen requirements remained stable on a 2-3L nasal cannula; hence, steroid/ anti-viral therapy was considered but not administered. Surgical management with a laparotomy and/or gastric resection was deferred owing to poor prognosis and the absence of pneumoperitoneum. Given the patient's multimorbidity, critical illness, and labile blood pressures, investigation with EGD was also deferred as the patient was not deemed a suitable candidate. Blood culture remained sterile throughout the hospital stay; fungal markers were not obtained.

Goals of care discussions with next of kin entailed informing them of the poor prognosis of EG and risks & benefits of pursuing invasive treatment, i.e., surgical intervention, given his hemodynamic instability. He was ultimately transitioned to comfort measures on day 3 of admission and was moved to the floor level of care. He died on day 4 of hospital stay due to cardiopulmonary arrest.

2.1. Follow-up and Outcomes

Our patient was hospitalized for a total of 4 days. His clinical course was complicated by worsening distributive shock in the setting of emphysematous gastritis and COVID pneumonia. However, he was treated with broad-spectrum IV antibiotics, NG decompression, IV fluid resuscitation, and as-needed oxygen supplementation via nasal cannula. He continued to clinically deteriorate from day 2 to 3 of his hospital stay. EGD and surgical intervention were deferred due to worsening hemodynamic instability and risks of intervention exceeding the benefits. He was transitioned to comfort measures after goals of care discussions with next of kin. He died on day 4 of hospitalization due to cardiopulmonary arrest in the setting of distributive shock.

3. Discussion

First identified in 1889 [7], emphysematous gastritis is a rare and life-threatening condition caused by gas-forming bacteria within the wall of the stomach, with mortality rates as high as 61%. Early recognition and conservative care can succeed in stable patients; surgery is usually reserved for patients with perforation, necrosis, or rapid clinical deterioration. Multiple risk factors have been associated with EG, including gastroenteritis, alcohol use disorder, diabetes mellitus, End Stage Renal Disease (ESRD), prolonged non-steroidal anti-inflammatory drug (NSAID) use, malignancy, caustic ingestion, and immunodeficiency [8, 9, 10]. There have also been cases linked to severe atherosclerosis predisposing to gastrointestinal necrosis [11]. Patients may be at risk of developing

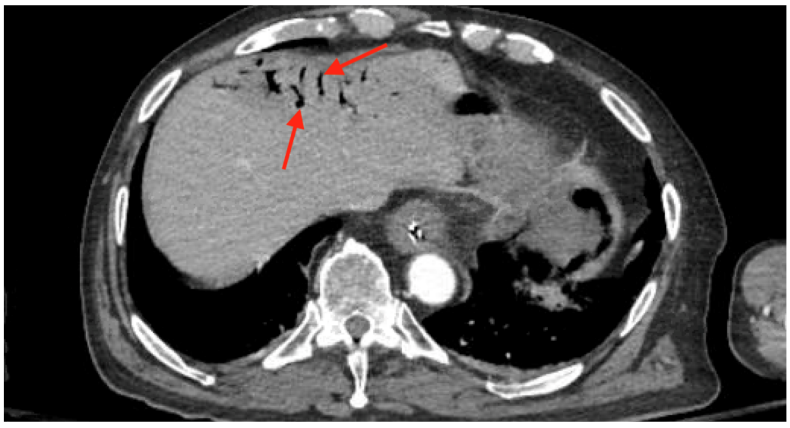

Figure 2: Contrast-enhanced CT with intravenous contrast. Axial section demonstrating hepatic portal venous gas, predominantly within the left hepatic portal venous system (arrows).

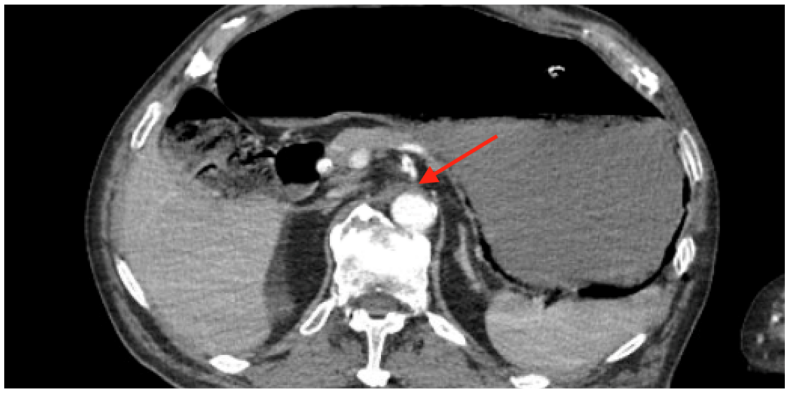

Figure 3: Contrast-enhanced CT with intravenous contrast. Axial section demonstrating near-complete occlusion of the celiac artery at its ostium with distal reconstitution (arrow).

EG through any ischemic lesions, including gastric ulcers, which can act as a nidus for bacterial growth. [12].

The clinical presentation of EG is variable. However, most cases reported have generalized abdominal symptoms, including nausea, abdominal pain with or without localization, and vomiting. Patients may also present with fulminant features of septic shock [13]. These findings may not always be present, particularly in the immunocompromised patient. The source of infection and culprit organism may not always be identifiable. Pathogens are typically isolated following culture of intra-abdominal fluid aspirate at exploratory laparotomy [14], which was deferred in our patient. Patients with pre-existing dementia or altered mentation may be unable to communicate worsening abdominal symptoms, necessitating a high index of suspicion for timely diagnosis.

Definitive diagnosis of EG is through imaging, with a CT scan of the abdomen being the modality of choice. Findings on CT scans, which may suggest the development of EG, include thickening of the gastric mucosal folds, gas in the portal vein, air in the gastric wall, especially in the gastric fundus and greater curvature, which may also be present as cystic pockets and intramural penetration of the contrast medium [15]. Our patient's imaging study demonstrated distension of the stomach with mural gas, predominantly within the cardia and the antrum, and the presence of hepatic portal venous gas on CT imaging. Severe atherosclerosis may lead to impaired mucosal barrier integrity due to reduced blood flow, creating favourable conditions for bacterial growth and translocation [16]. The celiac trunk serves as the primary arterial supply for the stomach, and our patient had severe flow-limiting stenosis of the same. There is a rare risk of gastric ischemia occurring in the setting of celiac stenosis with poor collateral circulation or multi-vessel disease. This, in turn, can lead to mucosal breakdown and serve as a nidus for infection by gas-producing organisms.

While our patient had risk factors for the development of EG, he also had a COVID-19 infection, which may be associated with EG. Literature on the association between COVID-19 infection and EG is scarce and is limited to case reports [4, 17, 6]. COVID-19 may contribute to EG through gastrointestinal angiotensin-converting enzyme 2 (ACE2) receptor–mediated gastrointestinal inflammation, vascular endothelial injury leading to hypercoagulability, and impaired host defenses [5, 18]. Active COVID-19 infection can also be considered an immunocompromised state, which is a risk factor for the development of EG [17].

Prompt identification of the condition and differentiation of EG from gastric emphysema and other etiologies of acute abdomen, including pneumoperitoneum, is crucial in treatment. While often used interchangeably, gastric emphysema is a benign, non-infectious condition occurring due to air influx into the gastric wall after instrumentation, mucosal trauma, or increased intraluminal pressure. Patients are typically hemodynamically stable and have

Table 1: Table comparing EG vs. GE in contrast to our case report

Feature	EMPHYSEMATOUS GASTRITIS	GASTRIC EMPHYSEMA (GE)	OUR CASE REPORT
Definition	Severe, life-threatening infectious entity occurring due to infiltration of gas-producing organisms (E.coli, Clostridium spp) into the gastric mucosa	Benign, non-infectious entity resulting from an influx of air into the gastric wall. Often incidental or secondary to instrumentation.	NA
Risk factors	Diabetes mellitus, NSAID use, ESRD, immunosuppression, gastroenteritis, gastric surgery, gastric perforation, instrumentation	Vomiting/retching, instrumentation/endoscopic procedures, positive-pressure ventilation	Concomitant COVID-19 infection, stenosis of the celiac trunk
Signs/symptoms	Severe abdominal pain, nausea, and vomiting. Peritonitis on physical exam.	Usually incidental, asymptomatic, mild GI symptoms	Altered mental status, grimacing on physical exam.
Lab markers	Leukocytosis, lactic acidosis, elevated inflammatory markers (ESR, CRP), metabolic acidosis, or markers of end-organ damage, if septic	Normal or mild leukocytosis	Leukocytosis, lactic acidosis
Imaging findings	Irregular or patchy intramural gas; gastric wall thickening or edema; portal venous gas	Linear or circumferential intramural gas, typically without thickening or edema; Portal venous gas	
Management	Aggressive fluid resuscitation, broad-spectrum antibiotics, surgical intervention, and conservative care	Observation, bowel rest (NG tube decompression, if indicated), PPI, fluid resuscitation	Broad-spectrum antibiotics, conservative
Outcomes/mortalit rate	Poor; high mortality (approximately 50-60%)	Good; typically self-limited; low mortality	The patient was transitioned to comfort measures only and eventually succumbed to cardiopulmonary arrest.

EG, Emphysematous Gastritis; GE, Gastric Emphysema; E. coli, *Escherichia coli*; NSAID, Nonsteroidal Anti-Inflammatory Drug; ESRD, End-Stage Renal Disease; GI, Gastrointestinal; ESR, Erythrocyte Sedimentation Rate; CRP, C-Reactive Protein; PPI, Proton Pump Inhibitor; NG, Nasogastric

a good prognosis after the inciting factor is addressed. EG, in contrast, is a fulminant condition requiring aggressive treatment, and can prove fatal if missed [19] **(Table 1)**.

Treatment should be initiated promptly, especially in patients presenting with shock. Conservative management has been well described with fluid resuscitation and broad-spectrum antibiotics with anaerobic, gram-negative coverage and rarely anti-fungal coverage [20, 21, 2]. Mortality is high in patients with EG, including patients who undergo definitive surgical treatment such as gastrectomy [15]. Our patient's mental status improved minimally after initial fluid resuscitation, with improvement in lactic acidosis; however, he continued to deteriorate clinically. Following extensive goals of care discussions with family, the decision was made to transition him to comfort measures only.

4. Conclusions

Emphysematous gastritis remains a rare, rapidly progressive, and highly lethal condition requiring early recognition and prompt intervention. And reiterate that causality cannot be inferred. This case highlights the potential co-occurrence of EG with COVID-19 infection and severe celiac artery stenosis, underscoring the importance of considering ischemic and infectious mechanisms while generating differential diagnoses in critically ill patients. Increased awareness of this condition is crucial for guiding timely diagnosis, optimizing management strategies, and improving outcomes.

Conflicts of Interest

There is no actual or potential conflict of interest in the conduct of this study.

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None

Informed Consent

Verba l informed consent for publication of this case report and the accompanying images was obtained from the patient's son, who is the legal next of kin.

Large-Language Model

None

Authors' Contribution

HK, AR, and MD conceived and designed the study. HK, AR, and KAA performed the investigation. Resources were provided by MD. HK curated the data. The original draft of the manuscript was prepared by HK, and AR, KAA, and MD contributed to the review and editing. Supervision was provided by MD, and project administration was conducted by HK.

Data Availability

All data supporting the findings of this case report are contained within the article; no additional datasets were generated or analyzed.

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