Gastric *Sarcina* organisms in a patient with cystic fibrosis

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**Abstract** *Sarcina* are large Gram positive anaerobic bacteria which grow in recognizable tetrads and octets. Less than 10 cases of human infection with *Sarcina* have been reported, many of these in the setting of delayed gastric transit. Here, we present the first reported case of gastric *Sarcina* in a patient with cystic fibrosis, a known cause of gastroparesis. Following a 2 week history of intermittent epigastric pain, endoscopic and histologic examination revealed numerous *Sarcina* organisms in association with linear gastric ulcerations. Yeast forms morphologically compatible with *Candida* were also identified. The occurrence of *Sarcina* in cystic fibrosis further confirms the association of this organism with delayed gastric emptying and suggests a possible predisposition in patients with genetic disorders of chloride ion transport, as one previous report occurred in a patient with congenital chloride diarrhea. Recognition of this unique organism in endoscopic biopsies should prompt several diagnostic considerations.

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A 37-year-old female with an established diagnosis of cystic fibrosis, genotype homozygous delta F508, presented with a 2 week history of intermittent epigastric pain lasting for approximately 30 minutes to several hours. The pain was associated with mild nausea without vomiting and exacerbated by coughing. She also reported diminished appetite and one episode of more severe abdominal pain associated with loose stool, but no exacerbation of symptoms with food consumption.

Abdominal exam showed a large, distended abdomen. Bowel sounds were normal. She had a palpable and soft 3 cm mass at the umbilicus. She was tender to deep palpation in the epigastrium and right upper quadrant without guarding, rigidity, or rebound. Laboratory testing was significant for mild anemia with hemoglobin of 11.5 g/dL and transaminitis with ALT of 135 U/L and AST of 100 U/L. Alkaline phosphatase was elevated at 263 U/L. Total bilirubin and lipase levels were within reference range.

CT imaging demonstrated diffuse, low-attenuation throughout the liver suggestive of fatty infiltration. There was diffuse fatty replacement of the pancreas. The visualized portions of the non-opacified small and large bowel

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were unremarkable. There was a small fat-containing umbilical hernia.

The clinical differential diagnosis for this new-onset subacute pain included gastroparesis, peptic ulcer disease, gastroesophageal reflux disease, and less likely, biliary colic and constipation. She began empiric treatment with omeprazole with partial symptomatic improvement. Serologic testing for *Helicobacter pylori* IgG was negative. A nuclear medicine gastric emptying study was performed and showed delayed emptying at 240 minutes post ingestion of a standard meal with radioactively labeled water. After 3 days, the patient’s pain persisted, and esophagogastroduodenoscopy was performed. The esophagus appeared normal. The Z-line was regular. There was severe erythema in the posterior wall of the gastric antrum characterized by linear erosions (Fig. 1). Biopsy of the gastric antrum showed superficial mucosal hemorrhage with moderate chronic gastritis characterized by lymphoid and plasmacytic infiltrates of the lamina propria (Fig. 2). Acute intraepithelial inflammation was not seen. The superficial mucous contained large, basophilic coccoid bacterial forms arranged in tetrads and octets, characteristic for *Sarcina* species (Figs. 3 and 4). Yeast forms morphologically compatible with *Candida* species were also identified. Following biopsy, she continued therapy with omeprazole with resolution of symptoms. Follow-up upper endoscopy was not performed. Prior to this presentation, her disease had been complicated by sequelae of cystic fibrosis including pulmonary bronchiectasis, endobronchial colonization by *Pseudomonas*, chronic pansinusitis, and pancreatic insufficiency with intestinal malabsorption, but she had no specific issues referable to her tubular gastrointestinal tract.

**Fig. 1** Endoscopic view of the gastric antrum with linear and hemorrhagic erosions present on the gastric folds.

**Fig. 2** Clusters of *Sarcina* organisms present in debris and mucous above the hemorrhagic gastric mucosa (200 × magnification, hematoxylin and eosin stain).

**Fig. 3** High power view of surface mucous containing tetrads and octets of *Sarcina* admixed with budding yeast forms, morphologically compatible with *Candida* (600 × magnification, hematoxylin and eosin stain).

**Fig. 4** Higher power view demonstrating clear tetrad morphology of the *Sarcina* organisms (1000 × magnification, hematoxylin and eosin stain).
**Gastric Sarcina organisms in a patient with cystic fibrosis**

*Sarcina* organisms constitute a unique group of Gram positive bacteria which grow in distinctive and recognizable packets. *Sarcina maxima* and *Sarcina ventriculi*, the best characterized species, are anaerobic, sugar-fermenting bacteria with the ability to survive and grow at highly acidic conditions, pH less than 1. The first human report of *S. ventriculi* was made in 1842 by John Goodsir who observed a previously undescribed bacterial form in the stomach contents of a patient with gastrointestinal symptoms. *Sarcina* is not normally found in the human stomach but instead in environmental soils. It is presumed that human infection occurs through consumption of food with contaminated soil. In mammals with slowing of the enteric flow of food, either by stenosis or dysmotility, the highly acidic environment of the stomach combined with the presence of non-transiting carbohydrates is thought to provide an optimal environment for growth of these organisms [1]. Though *Sarcina* has been more thoroughly studied in non-human mammals, there have been at least 8 reports of the organism in humans within the last 12 years [2]. Herein, we report the 9th case identified in a tissue biopsy, and the first in a patient with cystic fibrosis.

*Sarcina* organisms are easily identified in histologic sections by their large size and characteristic packeted morphology with formation of tetrads and cube-like octets of 8 individual organisms. *S. ventriculi* and *S. maxima* have diameters of 2 microns and 2.5 microns, respectively [3]. Other bacterial organisms that form tetrads include *Micrococcus* but these organisms are characteristically smaller with a diameter of 0.5 microns [4]. Given the unique morphology, a genus specific diagnosis of *Sarcina* can be reliably rendered by routine histology alone. Subsequent molecular confirmation in nearly all cases morphologically diagnosed as *Sarcina* on routine sections in a case series of 5 patients supports this practice [4].

The pathogenicity of this organism in humans has not been well-established and indeed it may instead represent a marker of a disease state rather than a causative agent, as has been suggested by previous authors [2,4,5]. At least one case has been associated with emphysematous gastritis [6], but it is not clear that *Sarcina* was the cause. The majority of the other reported cases occurred in patients with non-specific gastrointestinal symptoms including nausea, vomiting, and epigastric discomfort. Similar to the report by Laass and colleagues, coexisting organisms morphologically consistent with *Candida* were also identified our patient, which may suggest an interesting relationship. *Candida* organisms are not frequently seen in endoscopic biopsies of gastritis, but when present, are frequently presumed to be oral contaminants. However, there are reports of *Candida* being identified in association with gastric ulcers, including some coexisting with *Campylobacter*-like organisms [7,8].

The presence of *Sarcina* in this patient with cystic fibrosis lends further support to the association of this organism with delayed gastric emptying. Gastrointestinal tract dysmotility is not infrequent in cystic fibrosis patients, though the exact cause is not certain [9]. It may not be unreasonable to suggest that abnormal chloride secretion related to the cystic fibrosis transmembrane conductance regulator (CFTR) may result in altered electrophysiology of the enteric nervous system leading to gastroparesis.

Perhaps of greater interest is a recent report of *S. ventriculi* identified in the blood of a patient with a history of congenital chloride diarrhea [10]. That patient had no potential invasive sources, such as catheterization or other intravenous access, and the gastrointestinal tract was the presumed site of bloodstream entry. Congenital chloride diarrhea is a rare, autosomal recessive form of chronic diarrhea characterized by severe watery diarrhea with high levels of chloride. It is caused by mutations of the SLC26A3 gene on chromosome 7, which is a transmembrane chloride/bicarbonate exchanger found in the apical aspect of lower enteric tract epithelial cells [11]. Genetic studies have demonstrated close linkage of SLC26A3 to the CFTR gene responsible for cystic fibrosis, also located on chromosome 7, and both genes are involved in chloride metabolism. Delayed gastric emptying has not been reported in congenital chloride diarrhea but may represent the common link between this disease and *Sarcina* infection. While the finding may be entirely coincidental, the identification of this rare organism in patients with a disorder of chloride transport represents a possible association.

In summary, we report another case of human infection with *Sarcina* organisms with clinical and endoscopic features similar to what has been previously reported. Of note, we identified similarities in this case to two of the previous reports, which raise consideration for unusual pathophysiology. First, we identified *Sarcina* coexisting with *Candida* in the gastric contents which has only been described once before. Second, we described *Sarcina* infection in a patient with cystic fibrosis, similar to a recent report of *Sarcina* bacteremia in a patient with another disorder of chloride transport, congenital chloride diarrhea. The identification of *Sarcina* should prompt a careful search for causes of delayed gastric emptying, including gastroparesis, stenosis, or a mass lesion, as well as cystic fibrosis or other diseases of chloride transport. Moreover, the identification of *Candida* in a gastric biopsy should prompt more careful examination of the tissue for coexistent organisms. While pathogenicity of this organism is not entirely certain, its recognition in an endoscopic biopsy raises important diagnostic considerations.

**References**


