

# Gas under the right diaphragm



**Figure 1.** Radiography of the chest with the patient standing showed gas under the right diaphragm (arrows).



**Figure 2.** The Chilaiditi sign on computed tomography, with volvulus of the cecum between the diaphragm and liver and a closed-loop obstruction (arrows).

A 66-YEAR-OLD MAN presented to the hospital with 3 days of nausea, vomiting, and abdominal pain. He had come to the emergency department several times during this period, but the cause of his symptoms had not been determined.

He had no significant medical history and no previous hospital admissions. He had never undergone colonoscopy and had never taken anticoagulant agents, steroids, laxatives, or nonsteroidal anti-inflammatory drugs.

His abdomen was mildly tender without guarding or rigidity. The standing chest radiograph showed gas under the right diaphragm (**Figure 1**), and computed tomography (CT) revealed the Chilaiditi sign, with volvulus of the cecum between the diaphragm and liver and a closed-loop obstruction (**Figure 2**).

The patient was successfully treated with urgent right hemicolectomy.

## THE CHILADITI SIGN AND SYNDROME

The Chilaiditi sign is an infrequent anomaly found incidentally on chest or abdominal radiography as a colonic interposition between the liver and right hemidiaphragm.<sup>1</sup> It is often asymptomatic but is sometimes accompanied by nausea, vomiting, abdominal pain, and constipation, ie, Chilaiditi syndrome.

Generally, after conservative treatment with fasting and pain control, symptoms may subside and follow-up should be sufficient. However, nasogastric decompression and laxatives are occasionally needed and are often effective in patients with Chilaiditi syndrome. Urgent abdominal surgery is indicated for pa-

tients with symptoms of volvulus of the colon, stomach, or small intestine.<sup>2</sup>

## DISTINGUISHING CHARACTERISTICS

The Chilaiditi sign is often confused with pneumoperitoneum, which usually requires urgent abdominal surgery. But the presence of haustration or valvulae conniventes (folds in the small bowel mucosa) in the hepatodiaphragmatic space helps distinguish between intraluminal gas and free air. If the patient presents with abdominal pain without signs of peritonitis, and if imaging indicates the Chilaiditi sign, then supplementary imaging (eg, decubitus radiography, chest CT, abdominal CT) is recommended to make the definitive diagnosis and to avoid unnecessary surgery.

Gas under the diaphragm on standing chest radiography without signs of peritonitis may also be seen after laparotomy and after scuba diving as well as in cases of biliary enteric fistula, incompetent sphincter of Oddi,

gallstone ileus, and pneumatosis cystoides intestinalis. The incidence rate of the Chilaiditi sign detected by radiography is between 0.025% and 0.28%.<sup>3</sup>

## PREDISPOSING FACTORS

The cause of the Chilaiditi sign remains unknown. Predisposing factors can be categorized as diaphragmatic (diaphragmatic thinning, phrenic nerve injury, expanded thoracic cavity), intestinal (megacolon, increased intra-abdominal pressure), and hepatic (hepatic atrophy, cirrhosis, ascites).

In healthy people, Chilaiditi syndrome is usually attributed to a congenital abnormal lengthening of the colon or to undue looseness of ligaments of the colon and liver.

Recognizing the Chilaiditi sign is particularly important in patients scheduled to undergo a percutaneous transhepatic procedure or colonoscopic examination, as these procedures increase the risk of perforation.

## REFERENCES

1. **Chilaiditi D.** Zur Frage der Hepatoptose und Ptose im allgemeinen im Anschluss an drei Fälle von temporärer, partieller Leberverlagerung. *Fortschritte auf dem Gebiete der Röntgenstrahlen* 1910; 16:173–208.
2. **Williams A, Cox R, Palaniappan B, Woodward A.** Chilaiditi's syndrome associated with colonic volvulus and intestinal malrotation—a rare case. *Int J Surg Case Rep* 2014; 5:335–338.
3. **Orangio GR, Fazio VW, Winkelman E, McGonagle BA.** The Chilaiditi syndrome and associated volvulus of the transverse colon. An indication for surgical therapy. *Dis Colon Rectum* 1986; 29:653–656.

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Predisposing factors are categorized as diaphragmatic, intestinal, and hepatic

## Gas under the right diaphragm

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In the article “Gas under the right diaphragm” (Matsuura H, Hata H. *Cleve Clin J Med* 2018; 85[2]:98–100), **Figure 2** appeared upside down. It should have appeared as follows:



**Figure 2.** The Chilaiditi sign on computed tomography, with volvulus of the cecum between the diaphragm and liver and a closed-loop obstruction (arrows).

The correction has been made to the online version at [www.ccm.org](http://www.ccm.org).

## Physical examination in dyspnea

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On page 949 of the article “Diagnostic value of the physical examination in patients with dyspnea” (Shellenberger RA, Balakrishnan B, Avula S, Ebel A, Shaik S. *Cleve Clin J Med* 2017; 84[12]:943–950), the terms “abdominojugular reflex” and “hepatojugular reflex” should have been “abdominojugular reflux” and “hepatojugular reflux.” This error also occurred in **Table 5** on that page. The correction has been made to the online version at [www.ccm.org](http://www.ccm.org).