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schedule of 1.5 grams the first day followed by 1 gram daily for six days. The patient's only complaint of side effects during either course of niclosamide therapy was occasional abdominal cramping (relieved by bowel movement). Following the second course of therapy the patient continued to gain weight without recurrence of abdominal cramping. Tests of stool specimens after one week, one month and three months were negative for *H. diminuta* eggs.

### Discussion

Rodents are the definitive hosts of *H. diminuta*. Eggs are excreted in the rodent feces and subsequently ingested by arthropods (millipedes, beetles, earwigs, rat flea larvae and others) in whom larval stage development occurs. Rodents then ingest infected arthropods to complete the worm's life cycle. Most reported human infections have been in children who are infected by eating parasitized arthropods, which are usually ingested as grain and cereal contaminants. Protection of food storage from both insects and rodents in the United States has prevented widespread human infection, although human infection has been reported in several states, particularly in the Southeast.<sup>1</sup>

Although most human infections are asymptomatic, the case presented illustrates its clinical presentation and course which may include weight loss, anorexia, nausea, vomiting, abdominal pain and diarrhea. Diagnosis is made by finding the characteristic eggs or proglottids in the patient's feces. This report underscores the value of stool examination for ova and parasites in immigrant children from endemic areas who have gastrointestinal complaints.

Until recently quinacrine provided the most effective treatment; however, the availability of niclosamide, a more effective agent for most tapeworm infections, has enabled definitive cure in more resistant cases such as this.

### Summary

This case report of a child clinically infected with the rat tapeworm, *Hymenolepis diminuta*, describes (1) a disease rarely diagnosed in the western United States and (2) the use of niclosamide to cure the infection.

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## Acute Gastric Volvulus— Endoscopic Derotation

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GASTRIC VOLVULUS is a rare, acquired condition in which the stomach rotates upon itself. Bockus,<sup>1</sup> in his second edition (1974), noted that there had only been 277 cases reported in the literature at that time, this number including cases of both acute and chronic volvulus. Acute gastric volvulus presents as an abdominal emergency with a high mortality rate, and usually requires immediate surgical therapy. This report describes the case of a 52-year-old woman who presented with acute gastric volvulus. After gastric decompression by nasogastric tube, the volvulus was derotated with a fiberoptic endoscope. Clinical and radiologic features in acute gastric volvulus are characteristic. Use of modern therapeutic techniques should improve treatment of this condition.

### Report of a Case

A 52-year-old woman, who had been in excellent health without previous gastrointestinal symptoms, was admitted to hospital because of severe abdominal pain. The night before admission she had a small amount of Mexican food with a cocktail but did not overeat. Shortly thereafter she noted the onset of severe abdominal pain followed by repeated bouts of retching without being able to vomit. Her pain became progressively more severe and she noted abdominal distention. She was seen in the emergency room at 2 AM, eight hours after the onset of symptoms, in excruciating pain and was admitted at that time.

Her past history was unremarkable. She smoked and drank alcohol in moderation and took no medications. Family history and review of systems were unremarkable.

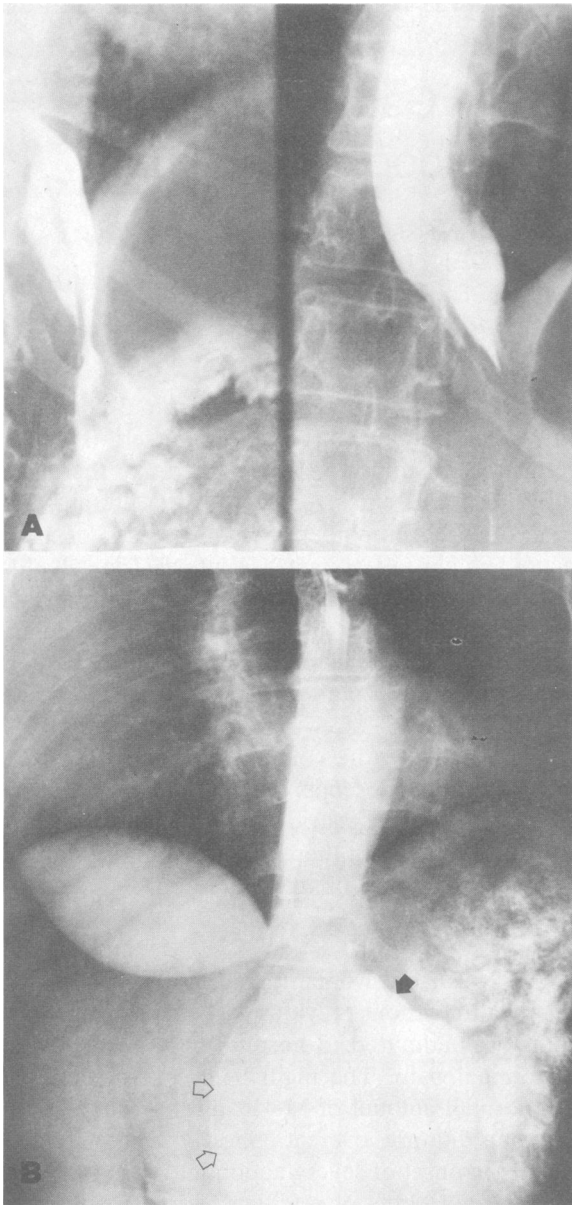
When first examined the patient was in excruciating pain, unrelieved by an intramuscular

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**Figure 1.**—**A**, Spot films of the barium filled esophagus show a beak-like termination of the esophagus at the esophagogastric junction. Gas in the massively dilated gastric fundus is noted superiorly and diluted barium is noted in the dilated stomach inferiorly. **B**, Upper gastrointestinal series in the right posterior oblique projection shows the beak-like termination of the esophagus. The massively dilated stomach is outlined by diluted flocculated barium. The greater curvature is delineated by open arrows and the antrum by a closed arrow. Note the complete obstruction at the pylorus was evidenced by no passage of barium distal to this point.

injection of 75 mg of demerol. Blood pressure was 150/90 mm of mercury and pulse was 110. Moderate dehydration was present, otherwise the ear, nose and throat examination showed no ab-

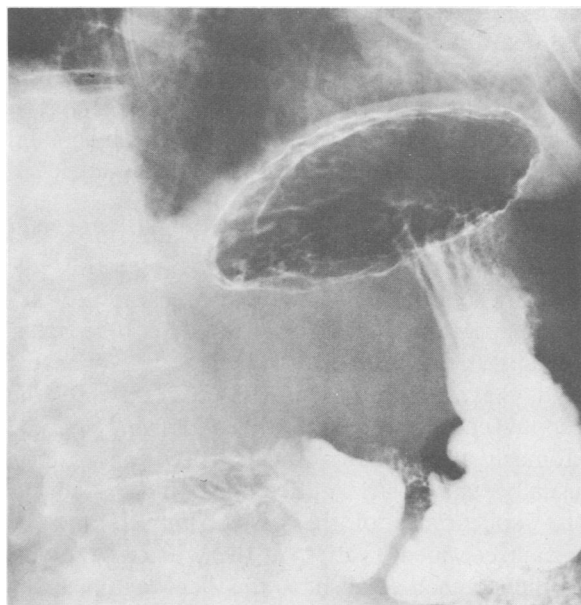
normalities. There was no adenopathy. The heart and lungs were normal. Examination of the abdomen was difficult because of the exquisite tenderness. There appeared to be a hard, tender, tympanitic mass in the left upper quadrant. Bowel sounds could not be heard.

Results of complete blood count, urinalysis, electrolytes and Sequential Multiple Analysis (SMA-12) panel were unremarkable. On x-ray studies of the abdomen a huge left upper quadrant mass was seen with a large air-fluid level consistent with massive gastric dilatation. Upper gastrointestinal examination showed a dilated esophagus with high grade obstruction at the cardioesophageal junction. The distal esophagus had a tapered beak-like configuration with twisted thickened mucosal folds (Figure 1A and 1B). A small amount of barium entered a massively dilated stomach which was completely obstructed at the pylorus. The dependent position of the greater curvature was characteristic of mesentero-axial gastric volvulus.

Under fluoroscopic observation, a nasogastric tube with an opaque marker (Salem Sump®) was carefully passed into the stomach. More than 2,000 ml of gastric contents were aspirated. Immediately following decompression the patient became quite comfortable and the abdomen became soft and nontender. Fluoroscopic examination indicated that there was still considerable residual material remaining in the stomach and that the volvulus had not been derotated.

Shortly following this procedure the patient was premedicated and upper gastrointestinal endoscopy, utilizing the Olympus® GIF forward-viewing panendoscope, was carried out. Barium and debris were present in the dilated esophagus. The distal half of the esophageal mucosa appeared dusky in color and edematous with thickened longitudinal ridges going down the esophagus. At 35 cm from the lower incisor teeth the lumen was pinched off by a twisting effect of the longitudinal folds going into the esophagogastric junction. With careful manipulation and gentle pressure the instrument was passed through this narrowed, twisted area and into the gastric cavity. This cavity was full of retained secretions and some barium, much of which was aspirated through the endoscope. The instrument was manipulated in all directions and a huge gastric pouch could be discerned. Mucosa was edematous and dusky in appearance, with punctate hemorrhagic areas seen throughout. All of the stomach seen appeared to be fundic tissue

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**Figure 2.**—Upper gastrointestinal series done two days after derotation of the gastric volvulus shows normal stomach and duodenal position.

with large folds being present. No normal gastric anatomy could be discerned and the stomach appeared to end in a blind pouch where the other end of the twist was felt to be present. The instrument was then manipulated into a "J-shape" and repeated attempts at rotating the instrument in a counterclockwise direction proved to be of no avail. Counterclockwise rotation of the instrument had been previously planned after review of the x-ray films led us to believe that the volvulus had been an anterior type of clockwise type of rotation. The instrument was then rotated in a clockwise direction and with a sudden maneuver the volvulus was observed to derotate, suggesting that this had been a posterior or counterclockwise type of rotation. Immediately, normal stomach anatomy could be appreciated and the entire stomach was then carefully examined. The fundus, antrum and pylorus were all normal and the instrument was easily passed through the pylorus into the duodenum, which was normal. The cardioesophageal junction and esophagus were noted to be normal as the instrument was withdrawn. No hiatal hernia was seen.

The patient was observed in the hospital for 48 hours and was then discharged completely asymptomatic. Upper gastrointestinal roentgenograms before discharge showed a normally positioned esophagus, stomach and duodenum (Figure 2). The patient was told that acute gas-

tric volvulus could recur. Elective operative fixation of the stomach was advised, but the patient did not wish to undergo any further therapy at that time.

The patient has remained well and when last interviewed four months following discharge she described no subsequent gastrointestinal symptoms.

### Discussion

Gastric volvulus was first described at autopsy by Berti in 1866. The first successful surgical treatment was reported by Berg in 1897. Since that time less than 300 cases of gastric volvulus, including both acute and chronic presentations, have been reported. The classification of this rare condition was proposed by Von Haberer in 1912 and was modified by Singleton<sup>2</sup> (see Table 1).

Ligamentous relaxation is a major factor permitting volvulus to occur. The degree of rotation is variable, but in total volvulus it varies from 180 degrees to 360 degrees.<sup>8</sup> Partial volvulus usually involves rotation of less than 180 degrees. Cole<sup>9</sup> suggests that "volvulus" should be reserved for complete or total obstruction and that "torsion" should be reserved for those that are less than complete or are chronic.

Acute total gastric volvulus presents as an acute condition of the abdomen. There is sudden onset of epigastric pain which rapidly becomes very severe. Vomiting may be present initially, but is soon replaced by persistent retching without emesis due to the cardioesophageal obstruction. Distension of the upper abdomen soon develops with the appearance of a mass usually in the left upper quadrant, which may be tympanic (closed-loop obstruction). The lower abdomen is often flat and nontender. Because of its excellent blood supply, the stomach is able to tolerate the pronounced degree of torsion and congestion of gastric tissues which develops.<sup>10</sup> The blood vessels are rarely obstructed sufficiently to cause early necrosis or gangrene.<sup>9,11</sup> Vascular compromise with necrosis and shock may occur with death ensuing, however, if the patient remains untreated. With treatment, the mortality for this condition has been reported to be from 30 to 50 percent. These figures come from the older literature and certainly early surgical therapy under modern conditions is probably associated with a much lower mortality. Consequences of acute volvulus include perforation,<sup>12,13</sup> hemorrhage,<sup>14</sup> acute gangrene<sup>8,11</sup> and splenic rupture.<sup>15</sup> Borchardt<sup>16</sup> in

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TABLE 1.—*Classification of Gastric Volvulus*

Type (rotational axis)	<p><i>Organo-axial.</i> Rotation of the stomach on its longitudinal axis or cardiopyloric line, either right to left or in the opposite direction.</p> <p><i>Mesentero-axial.</i> Rotation of the stomach about its transverse axis or the line connecting the middle of the lesser curvature with the middle of the greater curvature.</p> <p><i>Mixed.</i> Combination of the two types. Mesentero-axial rotation can predispose the stomach to further twisting in an organo-axial direction.</p>
Extent	<p><i>Total.</i> Complete rotation of the stomach, usually associated with gastric dilatation and obstruction.</p> <p><i>Partial.</i> Rotation is limited to a segment of the stomach, usually the pylorus. Acute obstructive symptoms are less common.</p>
Direction	<p><i>Anterior.</i> The transverse colon comes to lie in front of the stomach. Rotation is in a clockwise direction and is the most common type.</p> <p><i>Posterior.</i> The transverse colon must pass behind the stomach, in counterclockwise direction, elongating or tearing the meso-colon.</p>
Severity	<p><i>Acute form.</i> Presents as an upper abdominal catastrophe resulting from obstruction or strangulation.</p> <p><i>Chronic form.</i> Presents with recurrent or persistent and invariably confusing symptoms, or may be asymptomatic.</p>
Cause	<p><i>Idiopathic.</i> In a third of cases, no associated disease or abnormality is noted. Relaxation of the ligamentous support of the stomach is essential for development of volvulus, that is, weakness of the gastrohepatic, gastrocolic or gastrosplenic ligaments.<sup>3,4</sup> Acute dilatation of the stomach, hourglass stomach, trauma, intractable vomiting, increased intra-abdominal pressure such as is seen in pregnancy, and exaggerated peristaltic activity are some of the precipitating factors that have been described.<sup>3</sup></p> <p><i>Secondary.</i> Most cases can be related to demonstrable intra-abdominal disease which can be intragastric or extragastric in origin.<sup>5</sup> The most common causes are hiatal hernia, eventration of the diaphragm, benign or malignant tumors of the stomach, paragastric adhesions, and chronic gastric ulcers. Rarer causes include chronic duodenal ulcer, splenomegaly, distended colon and phrenic nerve injury. Cases have also been reported in patients with congenital absence of the left lobe of the liver<sup>6</sup> or with resected left lobe of the liver,<sup>7</sup> as well as after pneumonectomy or lower lobectomy.</p>

1904 described a diagnostic triad for acute gastric volvulus, which has been widely quoted: (1) inability to vomit with retching; (2) upper abdominal distension; (3) inability to pass a tube into the stomach.

The diagnosis may be difficult but is suggested in a patient with an acute condition of the abdo-

men if the above features are present, although Borchardt's third criterion is not invariably present. Radiographic findings of acute gastric volvulus are diagnostic.<sup>17</sup> Plain films of the abdomen may show a left upper quadrant mass with air-fluid levels. A left upper quadrant double fluid level, when seen, is suggestive of the diagnosis. Immediate upper gastrointestinal examination will confirm or exclude the diagnosis of gastric volvulus. The esophagus may be dilated with a beak-like appearance at the obstructed cardioesophageal junction. Twisting of edematous esophageal folds may also be present. If barium traverses the esophageal obstruction, the massively dilated stomach will be visualized in a twisted position usually with gastric outlet obstruction. A beak-like appearance of the gastric antrum may be visualized. Identification of the greater curvature of the stomach adjacent to the diaphragm is characteristic of organo-axial volvulus. The gastric antrum in a pronounced superior and anterior position identifies the mesentero-axial type. Angiography<sup>18</sup> may be helpful in the diagnosis of chronic gastric volvulus but would appear unnecessary in acute volvulus.

Patients with acute gastric volvulus require immediate treatment; death usually results if patients are not treated. Surgical mortality has been high and probably relates to delays in diagnosis and treatment. Although spontaneous resolution of acute partial volvulus has been reported,<sup>19</sup> these cases were not associated with total volvulus and complete obstruction. Nasogastric decompression alone has resulted in derotation of a volvulus and has been recommended as sole treatment. Recurrent acute volvulus following decompression alone has occurred, however, and definitive surgical therapy is usually recommended.<sup>4</sup> It has been stated that a tube often cannot be passed into the stomach, and because cases of perforation of the esophagus and of the stomach have been attributed to "blind" gastric intubation,<sup>3,9</sup> this procedure has been felt to be dangerous. Tubes have been passed into the stomach, however, with dramatic improvement in symptoms following aspiration of gastric contents.<sup>3,20</sup> Relief is only temporary, however, and the stomach rapidly distends again when aspiration is discontinued. With the advent of radiopaque marked tubing and image-intensification fluoroscopy, it would seem that gastric intubation should be immediately attempted in cases of acute gastric volvulus.

The historical surgical teaching for the manage-

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ment of acute gastric volvulus has been immediate laparotomy.<sup>16</sup> The usual surgical maneuvers have included decompression of the stomach with a trocar and untwisting of the volvulus. In idiopathic cases, suturing the entire gastrocolic and gastrosplenic ligaments to the peritoneum of the anterior abdominal wall with nonabsorbable sutures is a safe method of gastropexy to prevent recurrent volvulus.<sup>2</sup> The gastrocolic and gastrosplenic ligaments are sutured along a wide arc from the lower pole of the spleen to the pylorus. The stomach is fixed in its normal position so as not to be angulated by changes in the patient's position. The fixation is without gaps to prevent the possibility of intestinal obstruction. Shortening of the gastrohepatic ligament and gastrotomy are unnecessary. In secondary cases, surgical correction is directed to the primary cause, if the patient's condition permits. This may include gastric resection or procedures to repair a hiatal hernia or eventration of the diaphragm. The recommended operation in patients with eventration of the diaphragm is colonic displacement of the stomach.<sup>22</sup> The greater curvature of the stomach is completely freed from the colon so that the transverse colon and greater omentum can roll up under the left diaphragm without twisting the stomach. A gastropexy is also done.

Endoscopy has not been previously reported in any patient with total acute gastric volvulus. The gastroscope was utilized once,<sup>23</sup> apparently to derotate a partial volvulus. It has been stated that fiberoptic endoscopy should play little role in this condition since the twist precludes passage of the instrument.<sup>24</sup> This case is instructive in that it appears to be the first reported instance in which an acute total volvulus of the posterior mesenteroaxial type was derotated endoscopically. Definitive surgical fixation of the stomach was advised, but further treatment was not desired by the patient. Recurrent acute volvulus certainly remains a possibility in this case.

In light of the present case, a more contemporary approach to the management of this rare condition is suggested. Clinical suspicion of acute gastric volvulus should be confirmed by emergency upper gastrointestinal x-ray studies, followed by attempted passage of a radiopaque nasogastric tube under fluoroscopic control. If successful, gastric decompression should then make the patient comfortable and remove the urgency of the situation. Intravenous fluid replacement and sedation can be initiated, and if possible the

colon should be evacuated with enemas. The patient can then be prepared for fiberoptic endoscopy. This should be done as soon as feasible, with the understanding that endoscopy under conditions of vascular compromise of the gastric tissues must be contemplated with care. The risks of mucosal injury or perforation are probably greater than under usual endoscopic conditions and great caution should be used. Certainly not all cases of volvulus may be amenable to endoscopic derotation. If the stomach can be entered, then endoscopic derotation should be cautiously attempted. If derotation is successful, the situation is then no longer critical and further confirmation with contrast radiography is possible. Definitive surgical procedures to prevent recurrence of volvulus can then be done under controlled elective conditions and after the previously engorged gastric tissues have returned to normal.

Failure to intubate and decompress the stomach in acute total volvulus constitutes a grave surgical emergency. Because of the consequences of vascular compromise to the stomach, surgical operation should be carried out immediately if decompression has not been successful.

### Summary

A 52-year-old woman presenting with severe abdominal pain was found by radiographic studies to have an acute total gastric volvulus. Decompression of a massively dilated stomach was possible after a radiopaque nasogastric tube had been passed into the stomach under fluoroscopic guidance. Fiberoptic endoscopy was done and derotation of the volvulus was successfully accomplished with the endoscope, thereby obviating the need for immediate surgical intervention. Subsequent upper gastrointestinal x-ray studies showed no abnormalities. The patient refused definitive surgical fixation and has remained well without further gastrointestinal symptoms. The clinical features and radiographic findings in this rare condition are described and a contemporary therapeutic approach is suggested.

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## Acute Pulmonary Cavitation in Sarcoidosis

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SARCOIDOSIS IS A relatively common multisystemic disorder whose cardinal findings are most frequently pulmonary and consist of bilateral hilar adenopathy or diffuse pulmonary fibrosis, or both. The purpose of this report is to present a rare manifestation of sarcoidosis: pulmonary cavitation.

### Report of a Case

A 31-year-old black woman presented to the hospital with cough, sharp pain on the left side of the chest and dyspnea. A chronic cough had been present for a year, producing small to mod-

erate amounts of whitish to yellowish sputum. She had lost eight pounds in the four months before admission. The patient said that there had been no fever, chills, night sweats, skin rash, arthralgias, or cardiac or renal problems. One year before admission she had been admitted to another hospital for delivery of her second child. At that time, an abnormality was noted on a chest x-ray film which was felt to be consistent with pulmonary tuberculosis. Sputum mycobacterial cultures were negative. The patient was given isonicotinic acid hydrazide, ethambutol and streptomycin. After two months she was lost to follow-up. She was followed at another clinic for hypertension and took alpramethyldopa and hydrochlorothiazide until five months before the present admission.

On physical examination at admission the patient appeared chronically ill and was in mild respiratory distress. Temperature was 102.8°F (39.3°C) orally; pulse, 160 per minute; respirations, 44 per minute and labored; blood pressure, 160/100 mm of mercury. Breath sounds in the left side of the chest were decreased and moderate tenderness in the abdominal right lower quadrant was noted. Results of the examination were otherwise unremarkable.

The leukocyte count was 11,000, with a mild left shift of the differential count. Analysis of urine showed no abnormalities. The serum glutamic pyruvic transaminase value was 50 (normal, 5 to 40 units) and the serum glutamic oxaloacetic transaminase value was 70 (normal, 5 to 40 units). The rest of the liver function studies, electrolytes and renal function studies showed no abnormalities. Gram stain of the sputum showed moderate numbers of polymorphonuclear leukocytes and Gram-positive cocci. A few Gram-negative rods were also noted. Sputum cultures showed normal aerobic flora. Fungal and mycobacterial cultures were negative. A transtracheal aspirate study showed the presence of anaerobic streptococcus, diphtheroids and bacteroides melaninogenicus. Tuberculin, histoplasmin and coccidioidin skin tests were negative. However, there was a 5 mm induration for mumps skin test. The serum immunoelectrophoresis showed slight elevation of IgA.

An x-ray film of the chest (Figure 1) showed a left pneumothorax. A chest tube was placed. During the ensuing two-month hospital stay, the patient had a stormy course, marked by fever and continued pulmonary cavitation (Figure 2).

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