depletion or ischemic necrosis and sepsis. At this time, there are no laboratory tests that are especially useful for identifying the presence of simple or strangulated obstruction, although increases in serum D-lactate, creatine kinase bb isoenzymes, or intestinal fatty acid binding protein levels may be suggestive of the latter.

In all cases, when considering diagnostic imaging, the key is not to delay surgical consultation and operative intervention when the patient's signs or symptoms strongly suggest that high-grade or complete obstruction or bowel compromise is present. Plain films of the abdomen, which must include upright or cross-table lateral views, can be completed quickly and may confirm the clinical suspicion 60% of the time. Interpretation immediately after operation is difficult. A "staircasing" pattern of dilated air and fluid-filled small-bowel loops >2.5 cm in diameter with little or no air seen in the colon are classical findings in patients with small-bowel obstruction, although findings may be equivocal in some patients with documented disease. Little bowel gas appears in patients with proximal bowel obstruction or in patients whose intestinal lumens are filled with fluid. Upright plain films of the abdomen of patients with large-bowel obstruction typically show colon dilatation. Small-bowel air-fluid levels will not be obvious if the ileocecal valve is competent. Although it can be difficult to distinguish from ileus, small-bowel obstruction is more likely when air-fluid levels are seen without significant colonic distension. Free air suggests that perforation has occurred in patients who have not recently undergone surgical procedures. Radiopaque foreign bodies or enteroliths may be visualized. A gas-filled, "coffee bean"–shaped dilated shadow may be seen in patients with volvulus.

More sophisticated imaging can be beneficial when the diagnosis is unclear. Magnetic resonance imaging has been used to diagnose small-bowel obstruction, but it is more expensive and, typically, provides less spatial resolution. Ultrasonographic evaluations are especially difficult to interpret but may be sensitive and appropriate studies to evaluate patients who are pregnant or for whom x-ray exposure is otherwise contraindicated or inappropriate.

Computed tomography (CT) is the most commonly used imaging modality. Its sensitivity for detecting bowel obstruction is approximately 95% (78–100%) in patients with high-grade obstruction, with a specificity of 96% and an accuracy of ≥95%. Its accuracy in diagnosing closed-loop obstruction is much lower (60%). Examples of some CT images are reproduced in Fig. 355-2. It may also provide useful information regarding location or identify particular circumstances where surgical intervention is needed urgently. Patients who have evidence of contrast appearing within the cecum within 4–24 h of oral administration can be expected to improve with high sensitivity and specificity (~95% each). For example, contrast studies may demonstrate a "bird's beak," a "c-loop," or "whorl" deformity on CT imaging at the site where twisting obstructs the lumen when a colonic volvulus is present.

CT imaging with enteral and IV contrast can also identify ischemia. Altered bowel wall enhancement is the most specific early finding, but its sensitivity is low. Mesenteric venous gas, pneumoperitoneum, and pneumatosis intestinalis are late findings indicating the presence of bowel necrosis. CT scanning after a water-soluble contrast enema may help distinguish ileus or pseudo-obstruction from distal large-bowel obstruction in patients who present with evidence of small-bowel and colonic distention. CT enteroclysis can accurately identify neoplasia as a cause of bowel obstruction. Contrast enemas or colonoscopies are almost always needed to identify causes of acute colonic obstruction.

Barium studies are generally contraindicated in patients with firm evidence of complete or high-grade bowel obstruction, especially when they present acutely. Barium should never be given orally to a patient with possible obstruction until that diagnosis has been excluded. In every other case, such investigations should only be performed in exceptional circumstances and with great caution because patients with significant obstruction may develop barium concretions as an additional source of blockage and some who would have otherwise recovered will require operative intervention. Barium opacification also renders cross-sectional imaging studies or angiography uninterpretable.

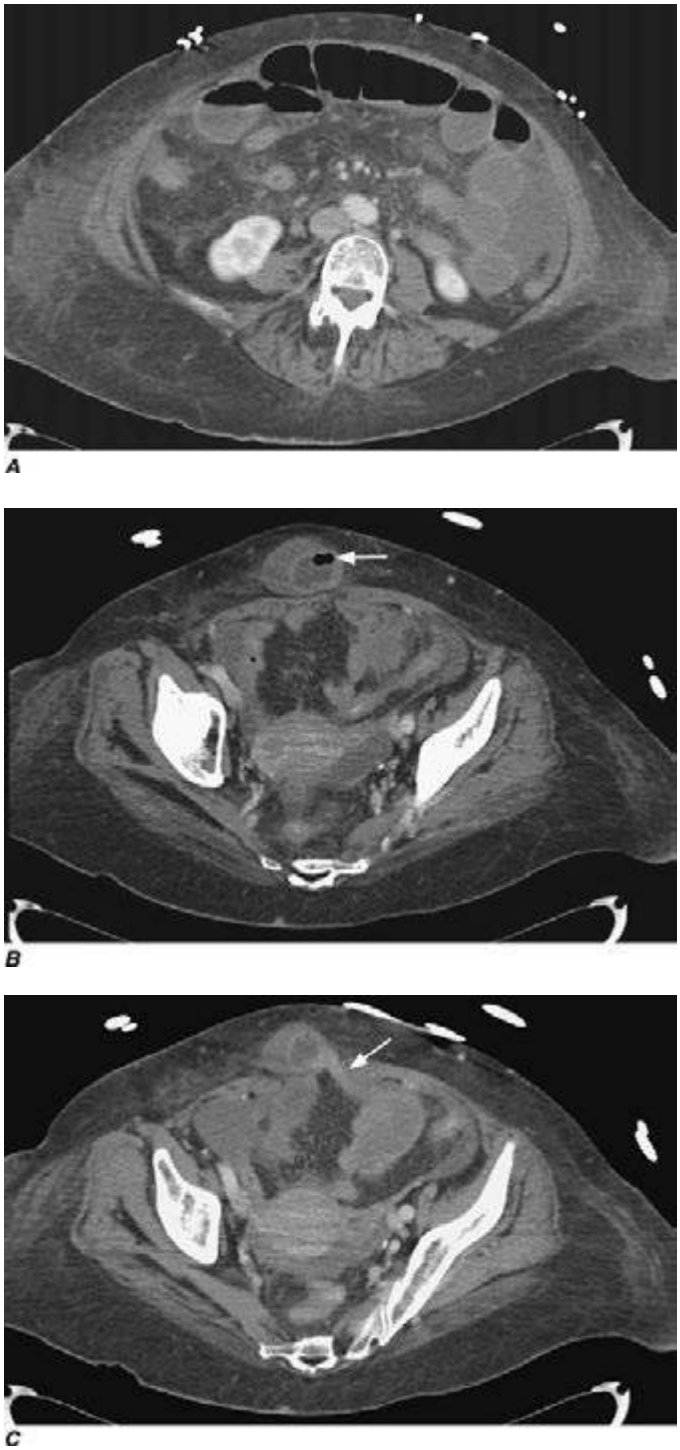

FIGURE 355-2 Computed tomography with oral and intravenous contrast demonstrating (***A***) evidence of small-bowel dilatation with air-fluid levels consistent with a small-bowel obstruction; (***B***) a partial small-bowel obstruction from an incarcerated ventral hernia (*arrow*); and (***C***) decompressed bowel seen distal to the hernia (*arrow*). *(From W Silen: Acute intestinal obstruction, in DL Longo et al [eds]: Harrison's Principles of Internal Medicine, 18th ed. New York, McGraw-Hill, 2012.)*

TREATMENT ACUTE INTESTINAL OBSTRUCTION

An improved understanding of the pathophysiology of bowel obstruction and the importance of fluid resuscitation, electrolyte repletion, intestinal decompression, and the selected use of antibiotics have likely contributed to a reduction in the mortality from acute bowel obstruction. Every patient should be stabilized as quickly