Enteric fistulae result from gastrointestinal perforations in which communication is established between the site of perforation and another hollow viscus, potential space, or skin surface. Certain types of enteric fistulae are difficult to demonstrate by conventional radiographic methods, and CT is unique in its ability to demonstrate the extent and nature of extraluminal changes. The purpose of this study is to illustrate the CT findings of enteric fistulae occurring in a variety of abdominal and pelvic organs.

**Index words**: Fistula, gastrointestinal, Gastrointestinal tract, CT

Enteric fistulae can develop as a result of a broad spectrum of inflammatory or neoplastic processes anywhere along the length of the gastrointestinal (GI) tract. As the signs and symptoms are varied and nonspecific, CT may be the initial imaging study performed on patients with fistulae. CT itself may not visualize a fistula, though certain CT findings may suggest the use of a barium study for diagnosis. In addition, in patients with known enteric fistulae, CT may disclose other ancillary extraluminal abnormalities or complications, such as abscess formation, peritonitis, or lymphadenopathy, which barium study alone, might not reveal. This report illustrates the CT findings of various types of enteric fistulae and correlates them with those of conventional contrast studies.

**Technical Considerations**

Routine CT examinations of the abdomen often result in inadequate evaluation of enteric fistulae, unless special effort is made to enhance their detection. In a certain type of fistula, modifications of CT scanning protocol can improve the overall diagnostic rate. In patients with biliary-enteric fistula, pre-enhanced CT scanning may help determine the etiology. To assess the thickness of bowel wall and distinguish abscess from bowel loops, optimal bowel opacification and proper distention is essential, and to achieve this, several techniques may be employed (1). In suspected cases of pelvic fistulae, rectal contrast materials are routinely administered unless contraindicated by the presence of severe rectal pain and/or perineal disease. To eliminate the possibility of abnormal air in the pelvic organs, bladder catheterization and gynecologic examination should be avoided for 24 hours before CT examination. In the search for an abscess and in the evaluation of thickened bowel wall or mass, contrast materials are important, but if an enterovesical fistula is suspected, intravenous contrast enhancement should be avoided.

Eight-to-ten-millimeter collimation at 10-millimeter intervals covering the entire abdomen and pelvis is preferred initially; this can be followed by contiguous scanning of the region of interest, using thinner sections. For demonstration of the fistula tract, delayed examination is often helpful.

**Fistulous Communication between the GI Tract**

A variety of fistulae, including gastrocolic, gastroenteric, enterenteric, enterocolic, or colocolic, may occur as a complication of benign or malignant disease of the GI tract; presentation varies depending on the cause and type of fistula. Pathognomonic symptoms of
gastrocolic or duodenocolic fistula are feculent vomiting or the passage of undigested food in the stool. In most cases, however, nonspecific symptoms, such as abdominal pain, malabsorption, diarrhea, and weight loss are the common features (2). For diagnosis of a fistula, traditional barium study of the GI tract is considered to be the method of choice; since, however, the exact nature and extent of the extraluminal disease process cannot be evaluated, the usefulness of this approach is limited. CT, on the other hand, can provide important intraluminal and extraluminal pathologic findings as well as clues which can help differentiate the underlying cause of a fistula. Malignant tumors that cause fistula are bulky and infiltrating (Fig. 1), and are often associated with metastatic foci in other intra-abdominal organs. Multiple fistula formation with mesenteric change is often characteristic of Crohn’s disease (Fig. 2) (1, 2).

The presence of these types of fistula can be diagnosed on CT by outlining the contrast-filled fistulous tract, but the diagnosis commonly depends on secondary signs, such as flow diversion of orally administered contrast medium (Fig. 3), severe adhesion, thickening of adjacent bowel wall, or an extralumi-

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Fig. 1. Gastro-colic fistula in a patient with transverse colon carcinoma.
A. Contrast-enhanced CT shows a large inhomogeneous mass of colon carcinoma in splenic flexure, directly invading the stomach. A fistulous tract filled with contrast material is suspected (arrows).
B. A barium enema shows an annular type of luminal narrowing involving transverse colon and splenic flexure of colon with contrast-filled stomach due to presence of gastro-colic fistula (arrows).

Fig. 2. Ileo-ileo-sigmoid fistula in a patient with Crohn’s disease.
A. Contrast-enhanced CT shows irregular thickening of sigmoid colon and ileal loops with matted appearance due to severe adhesion. The sigmoid mesocolon is also diffusely infiltrated. Multiple fistulous tracts are suspected (arrows).
B. A barium enema demonstrates multiple fistulous communications (arrows) between ileal loops and sigmoid colon.
Fig. 3. Gastro-colic fistula in a patient with history of subtotal gastrectomy.
A. Contrast-enhanced CT shows nice depiction of a short fistulous tract between stomach and transverse colon (arrow).
B. CT scan at the level of mid portion of kidneys shows relatively a large amount of oral contrast material in descending colon (D) as compared with that of ascending colon (A).

Fig. 4. Pancreatic pseudocyst with fistulous communication to transverse colon.
A. Contrast-enhanced CT shows a cystic mass (arrows) filled with contrast material and air in the transverse mesocolon due to fistulous communication between mass and transverse colon. The pancreas appears to be normal in size and contour.
B. A barium enema confirms the fistulous communication of cystic mass (arrowheads) with the transverse colon.

Fistulous Communication between the Bowel and Abdominal Abscess
Gastrointestinal fistulas and intra-abdominal abscesses commonly co-occur; some are probably causative in nature, and others are sequelae. The most frequent causes of intra-abdominal abscess with fistulous communication to the GI tract are recent GI tract surgery with anastomotic leakage, and complications of pancreatitis, diverticulitis, inflammatory bowel disease, trauma, or malignancy. CT may be used not only for the diagnosis of an abscess with a fistulous communication to the GI tract but also to provide guidance for drainage. Although rarely seen, the presence in a CT image of orally-administered contrast medium within an abscess pocket is definite evidence of fistulous communication to the GI tract (Fig. 4) (3). Other CT findings suggesting this type of fistulous communication include obviously high air-fluid levels within an abscess, or bowel wall thickening at the site of a fistula. In clinically suspected cases, however, the absence of
A fistulous communication of the bowel with intraperitoneal abscess resulting from perforated appendicitis. 

**A.** Contrast-enhanced CT shows an abscess with irregular and thick wall (arrows), closely attaching to adjacent bowel. There is no evidence of air or contrast collection within abscess cavity.

**B.** Cavitogram through the needle inserted percutaneously 3 days after CT examination shows an abscess cavity (A) with fistulous communication to ileal loop (I).

**Fig. 5.**

A 82-year-old woman with cholecysto-duodenal fistula caused by squamous cell carcinoma of gallbladder carcinoma. Contrast-enhanced CT shows irregular thickening of gallbladder wall (arrows) with air and contrast material in the lumen.

**Fig. 6.**

A 56-year-old man with cholecysto-duodenal fistula due to perforated acute cholecystitis. Contrast-enhanced CT shows distended gallbladder with air-fluid level (open arrows) in the lumen and discontinuity of the wall in association with pericholecystic air and fluid collection (solid arrows). The interface between gallbladder and duodenum is completely lost with thickened duodenal wall.

**Fig. 7.**

Recto-vesical fistula in a patient with Crohn’s disease. Contrast-enhanced CT shows a small amount of air (arrows) in the bladder as well as irregular thickening of the posterior bladder wall (arrowheads) and rectosigmoid colon with complete loss of interface between these two organs.
Fig. 9. Recto-vesico-uterine fistula in a patient with cervix cancer.
A. Contrast-enhanced CT shows contrast collection in uterine cavity (U) with a fistulous tract (arrows) between bladder (B) and uterine cavity. The tumor diffusely infiltrates the uterus and bladder with complete loss of interface.
B. Contrast-enhanced CT scan 2 cm cephalad to (A) shows air collection (arrow) in the uterine cavity due to rectouterine fistula. The interface between uterus and rectum is also lost with focal thickening of the rectal wall.

Fig. 10. Rectovesical fistula in a patient with perforated rectal cancer.
A. Contrast-enhanced CT shows direct communication (arrow) between bladder and necrotic tumor (arrowheads) in rectovesical pouch. The posterior wall of the bladder is irregularly thickened as well.
B. Lateral view of the pelvic cavity during intravenous pyelogram shows contrast filling of rectum (R) and necrotic tumor through fistulous communication from the bladder (B). The posterior wall of the bladder is irregularly indented and invaded by tumor (arrowheads).

Air and fluid does not exclude the possibility of an internal fistula (Fig. 5).

**Fistulous Communication to the Biliary Tract**

In 90% of cases, spontaneous communication between the biliary and GI tracts occurs as a complication of the presence of stones in the biliary tract; 10%, however, are caused by peptic ulcer, tumor, or trauma. The duodenum is the most common site of biliary-enteric fistulae, and most others are found in the stomach or colon. Ascending cholangitis, GI bleeding, diarrhea, or malabsorption may complicate biliary-enteric fistulae, though a fistulous tract can act as a physiological conduit or permanent alternate route for the excretion of bile. For these reasons, recognition of this type of fistula is essential for proper management.

Characteristic CT findings of biliary-enteric fistulae are the presence of air or orally-administered contrast medium in the biliary tree (Figs. 6 and 7); CT can demonstrate air in this location with exquisite sensitivity. In addition to spontaneous biliary fistulae, however, previous surgery, patulous sphincter of Oddi, and ascending cholangitis with gas-forming organisms should be considered in differential diagnosis. Other
ancillary findings include bowel wall thickening at the site of the fistula termination and surrounding inflammatory change (Fig. 7). Occasionally, CT is also helpful in evaluating the primary cause of a biliary-enteric fistula.

**Fistulous Communication to the Genitourinary Tract**

Fistulous communication between the GI and genitourinary tract can develop as a result of complications arising from diverticulitis, colorectal malignancy, Crohn’s disease, gynecologic malignancy, previous pelvic surgery or irradiation, or trauma. Because of the close proximity of its anatomic location, the majority of fistulae occur in the pelvic cavity and include the enterovesical, rectourethral, enterouterine, and enterovaginal types. In such cases, patients usually present with urinary symptoms which suggest diagnosis; they are related to diversion of urinary or fecal flow, such as fecaluria, pneumaturia, or passing feces or urine via the vagina.

For evaluating this type of fistula, CT has proven to be more sensitive and accurate than conventional contrast studies (5); unless a pathologic pathway is directly demonstrated (5), the key finding is the depiction of air or orally-administered contrast medium in the genitourinary tract (Figs. 8 and 9). Other ancillary CT findings include an extraluminal mass adjacent to the bowel, focal wall thickening of the involved organs, and complete loss of the intervening fat plane between the GI and genitourinary tract (Fig. 10).

**References**