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Evaluation of the Biliary Intestinal Limb of a Roux-en-Y Choledochojejunostomy Using Computed Tomographic Cholangiography

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Abstract

Computed tomographic (CT) findings involving the biliary intestinal limb of a Roux-en-Y choledochojejunostomy may be ambiguous because oral agents frequently do not reflux into that limb. We describe 2 cases where antegrade biliary intestinal limb opacification by intravenous CT cholangiography in the left lateral decubitus position obviated the need for biopsy of an apparent enlarging mass in the biliary intestinal limb. We conclude that CT cholangiography may help clarify the status of a Roux-en-Y choledochojejunostomy.

Keywords

CT cholangiography; Roux-en-Y choledochojejunostomy; Whipple procedure; small bowel

Evaluation of the biliary intestinal limb of a Roux-en-Y reconstruction may be difficult.^{1,2} This limb is usually inaccessible by endoscopy and may not opacify with oral contrast material during fluoroscopic examination. When examined during a computed tomographic (CT) scan, only 5% to 53% of examinations show reflux of oral contrast material into the biliary intestinal limb.^{3–5} Furthermore, postsurgical changes involving the biliary intestinal limb may create ambiguous appearances at CT.^{3,4} The distinction of a normal biliary intestinal limb from adjacent structures in the surgical bed is of particular concern when evaluating for possible tumor recurrence⁶ and in patients with otherwise unexplained abdominal pain. We describe our experience in 2 patients where intravenous biliary-excreted cholangiographic contrast material was administered as a problem-solving method to opacify the biliary intestinal limb of a Roux-en-Y choledochojejunostomy.

MATERIALS AND METHODS

Patients

This was a retrospective single-institution study approved by our Committee on Human Research and compliant with requirements of the Health Insurance Portability and Accountability Act. Patient consent was not required. We identified all patients at our institution who had undergone intravenous CT cholangiography to evaluate the biliary intestinal limb of a Roux-en-Y reconstruction (n = 2 patients). Both patients had a prior Whipple

procedure for pancreatic adenocarcinoma and had a CT-guided biopsy requested for an apparent enlarging mass abutting the biliary intestinal limb. Serial conventional abdominopelvic CT scans had been done previously in each patient, raising the concern for enlarging masses in the pancreatic resection bed. The serum creatinine for both patients was normal. A diagram of a Roux-en-Y choledochojejunostomy is shown in Figure 1.

Imaging Technique

The initial conventional abdominopelvic CT scans were performed on a 16-detector-row CT (Lightspeed; GE Healthcare, Milwaukee, Wis) during a single breathhold after the administration of 150 mL of intravenous iohexol (Omnipaque 350; GE Healthcare) and 800 mL diatrizoate meglumine (Hypaque; GE Healthcare). The technique included 5-mm slice thickness; 5-mm reconstruction interval; tube potential, 120 kVp; gantry rotation time, 0.8/s; and tabletop speed, 27 mm/s.

For the CT cholangiograms, we followed our institution's routine protocol that we have used for the evaluation of biliary tract in more than 300 patients. In brief, 20 mL of iodipamide meglumine 52% (Cholografin; Bracco Diagnostics, Princeton, NJ) diluted in 80 mL isotonic sodium chloride solution was infused over 30 minutes after premedication with 25 mg of intravenous diphenhydramine (Benadryl; Pfizer Inc., New York, NY).⁷ No oral water nor contrast nor other intravenous contrast material was given for the CT cholangiogram examinations. Because iodipamide meglumine is approved by the US Food and Drug Administration and CT cholangiography is a routine clinical examination, patient consent was not required. The abdomen was imaged by 16-detector-row CT (Lightspeed; GE Healthcare) during a single breathhold 15 minutes after completion of the infusion. Slice thickness, reconstruction interval, gantry rotation time, tube potential, and tabletop speed were 2.5 mm, 2.5 mm, 0.8/s, 120 kVp, and 13.5 mm/s, respectively. One patient was initially imaged in the supine position. Both patients were imaged in the left-lateral decubitus position to improve flow of the biliary contrast material into the short segment of proximal bowel anastomosed to the pancreatic remnant. The patients were observed for contrast reactions from the start of intravenous cholangiographic contrast injection until the end of the CT examination (~55 minutes), and no reactions occurred. Two authors (B.M.Y. and F.V.C.) reviewed all CT images by consensus on a picture archive communication system workstation (Agfa, Mortsels, Belgium) and evaluated all medical records.

RESULTS

The clinical data are summarized in Table 1. For both patients, serial CT scans suggested that there was an enlarging mass in the area of resection in or adjacent to the biliary intestinal limb (Figs. 2, 3), prompting a referral for CT-guided biopsy. On the day of the scheduled biopsy, CT cholangiography was then performed with the intent to improve tumor visualization during the biopsy. In both cases, the biliary intestinal limb opacified well with biliary-excreted contrast material and clarified that no recurrent tumor was present, thereby obviating the need for biopsy. Notably, left lateral decubitus positioning was required to fully opacify the bowel near the pancreatic anastomosis in 1 patient because inadequate intestinal opacification was seen with supine positioning (Fig. 2). The other patient was imaged only in the left lateral decubitus position and did not require further imaging.

DISCUSSION

Evaluation of the biliary intestinal limb can be challenging. Pseudotumors in the pancreaticojejunal anastomosis region are common and may be difficult to distinguish from true tumor recurrence.^{3,4,6} In our 2 cases, CT cholangiography clearly contributed to patient management of the biliary intestinal limb of a Roux-en-Y choledochojejunostomy by clarifying

the anatomy. In particular, we found value in use of the left lateral decubitus position to promote passive flow of biliary-excreted contrast material into the more proximal segment of jejunum at the pancreatic anastomosis in our patients who both had prior Whipple procedure.

There is a paucity of literature describing bowel opacification with CT cholangiography. Only 1 prior report described the use of CT cholangiography to evaluate the bowel,⁸ but the results were confounded by the concurrent use of oral contrast material, and patients with suboptimal biliary intestinal limb opacification were not imaged in the left lateral decubitus position.⁸ Another report described the use of CT cholangiography to evaluate patients where a Roux-en-Y choledochojejunostomy prevented direct biliary evaluation by endoscopic retrograde cholangiography,⁹ but the value of CT cholangiography to examine the bowel was not assessed in this latter study.

Although the use of intravenous biliary-excreted contrast material to evaluate the jejunum by CT scans has not been extensively studied, it is a relatively noninvasive study, simple to perform, and has many potential advantages. First, the contrast material enters the biliary intestinal limb largely in an antegrade fashion, which allows for opacification of this targeted and often inaccessible segment of bowel. Second, the contrast material is inexpensive. Third, the study does not require sedation. Fourth, the biliary intestinal limb remains under physiological, rather than external mechanical pressure; therefore, artifactual dilatation of the bowel by a bolus effect is unlikely. Fifth, intravenous contrast agents may be better tolerated than oral agents in nauseated patients.

Although use of biliary-excreted contrast material may be useful for opacification of the biliary intestinal limb, it also has several clear limitations. An important consideration is that the excretion of intravenous cholangiographic contrast material is variable and under the influence of poorly understood factors.^{7,9} The best documented predictor of poor excretion is a serum total bilirubin greater than 2.0 mg/dL.⁷ However, in patients whose primary concern is disease of the bowel, biliary function is usually normal. Another consideration for the use of iodinated intravenous biliary contrast material is the perceived high risk of contrast reactions.^{10,11} However, in several recent studies of CT cholangiography, reactions were minor and seen in only 1% to 3% of patients,^{12–16} a rate similar to that of conventional intravenous contrast-enhanced CT. No major reactions were reported.^{12–16} Nevertheless, to minimize the risk of adverse reactions, we premedicated our patients with diphenhydramine, diluted the contrast material, and gave it by slow infusion.^{7,16} These precautions seem logical, but systematic studies confirming their efficacy are unavailable. A third concern is that borderline renal function may be a contraindication because 10% or more of the intravenous cholangiographic contrast material may be excreted through the kidneys (package insert). However, for patients without hepatorenal disease, several radiology groups routinely administer both biliary-excreted and conventional intravenous contrast agents in the same day for CT examination.^{8,16,17} Other biliary-excreted contrast agents with low complication rates are also available, including oral iodinated agents and intravenous magnetic resonance imaging agents (eg, mangafodipir trisodium, gadobenate dimeglumine), but their usefulness for evaluating the bowel has not yet been described.

Certainly, other imaging options are available for the evaluation of the biliary intestinal limb, including MR imaging and ultrasound, and each have their own advantages, including the absence of exposure to ionizing radiation. Magnetic resonance imaging can assess for the folds of bowel if sufficient fluid is present in the bowel lumen, and similarly, ultrasound can evaluate the Whipple resection bed if an acoustic window is available. The choice of whether additional imaging workup is needed, and which modality to use, depends on the level of suspicion for tumor and local expertise. In our 2 cases, the suspicion for pancreatic adenocarcinoma recurrence was sufficiently high to prompt a CT-guided biopsy. The CT cholangiograms were

performed only to help guide the biopsies. Unexpectedly and fortuitously, both cases demonstrated only normal bowel.

Our study has limitations. Although the contrast material completely opacified the proximal biliary intestinal limb when the patients were in the left-lateral decubitus position, complete opacification might not occur if intestinal peristalsis is active or the configuration of the bowel is unfavorable. However, because the distance between the hepatojejunostomy and the important pancreatic anastomosis is generally short, only a small amount of contrast material needs to reflux into that segment for good opacification. In addition, our experience is very limited at this point. Certainly, further study is needed to define the role of CT cholangiography in segments of otherwise inaccessible bowel, and our positive initial experience suggests that such study is warranted.

In summary, CT cholangiography can clarify the anatomy and function of the biliary intestinal limb of a Roux-en-Y choledochojejunostomy at CT when prior conventional imaging studies give ambiguous results. In particular, left lateral decubitus positioning may improve opacification of the peripancreatic segment of the biliary intestinal limb of a Whipple reconstruction.

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FIGURE 1.

Diagram of Roux-en-Y choledochojejunostomy for a Whipple procedure. The common bile duct (bd) and pancreatic remnant (P) are anastomosed to the proximal biliary intestinal limb (B), which is in turn anastomosed to the stomach to empty into the Roux limb (R). At CT cholangiography, intravenous cholangiographic contrast material is excreted into the bile ducts, allowing for opacification of the biliary intestinal limb.

FIGURE 2.

A 35-year-old man with prior Whipple procedure 2 years ago for ampullary adenocarcinoma. A, Conventional intravenous contrast-enhanced CT shows what seemed to be an enlarging mass at the site of pancreaticoduodenal resection (arrow). Two weeks later, abdominal CT with intravenous cholangiographic contrast material and patient in the supine position shows opacification of a normal caliber biliary tract (arrowhead; B) and partial opacification of the biliary intestinal limb (arrowhead; C). The apparent “mass” (arrow) is not opacified with contrast material. D, Patient in the left lateral decubitus position imaged 5 minutes later reveals the apparent “mass” to be normal-caliber bowel (arrow) that completely fills with intravenous cholangiographic contrast material. Biopsy was therefore obviated.

FIGURE 3.

A 78-year-old woman with Whipple procedure for pancreatic adenocarcinoma 13 months ago now has persistent right upper quadrant dull ache. A, Conventional abdominal CT shows an apparent mass (arrow) in the region of the biliary intestinal limb of the Roux-en-Y. This apparent mass had increased in prominence compared with CT scans 4 and 7 weeks prior (not shown). B, Subsequent abdominal CT cholangiogram with the patient in the left-lateral decubitus position shows the previously noted “mass” (arrow) to be normal-appearing bowel that fills with intravenous cholangiographic contrast material. Biopsy was therefore obviated.

TABLE 1

Patient Demographics, CT Findings, and Outcome

Demographics	Patient 1	Patient 2
Age	35	78
Sex	M	F
Clinical history	Whipple 2 yrs ago for ampullary adenocarcinoma	Whipple 13 mo ago for pancreatic adenocarcinoma. Dull right upper abdominal pain
Prior CT results	Probable local tumor recurrence	Probable local tumor recurrence
Time between conventional CT and CT cholangiogram (d)	14	10
Results of CT cholangiogram	No local tumor at Whipple site: biliary limb fills completely with contrast material	No local tumor at Whipple site: biliary limb fills completely with contrast material
Outcome	No local recurrence. Paraaortic lymph node recurrence 8 mo later	Disease and symptom free 3 mo later