The Endoscopic Pancreatic Function Test

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Introduction

Pancreatic function tests (PFTs) have had a central role in the study of pancreatic disease for more than 70 years. Traditionally, duodenal aspirates were obtained via a peroral gastroduodenal tube after stimulation with secretin. The major limitation of direct pancreatic function testing has been the cumbersome nature and difficulty of pancreatic fluid collection. Over the past several years, a purely endoscopic collection method has been developed that has simplified pancreatic fluid collection, making the test more suitable for widespread use. The upper endoscope is used instead of the gastroduodenal tube (**Figure 1**).

This article describes both the 1-hour (five-sample) and shortened (two-sample) endoscopic PFT (ePFT) and presents a how-to approach to collecting pancreatic fluid for analysis in the laboratory.

Indications

The two most common indications for pancreatic exocrine function testing are (i) the evaluation of possible early exocrine dysfunction in patients with abdominal pain and (ii) the determination of the etiology of steatorrhea. Numerous conditions are associated with pancreatic exocrine insufficiency; the most common cause in adults is chronic pancreatitis (CP). CP is characterized by the gradual and irreversible replacement of normal pancreatic tissue by inflammation and fibrosis. As scarring progresses, there is a concomitant decrease in exocrine function of the duct and acinar cells. Abdominal pain is believed by some investigators to occur in some patients with early or "minimal-change" CP.

Because subtle functional changes occur at an early stage of fibrosis, direct PFTs may be the most sensitive diagnostic tests for early CP. PFTs are usually unnecessary for the diagnosis of advanced CP, because imaging tests often reveal typical structural changes. However, the diagnosis of early CP can be challenging, as these features may not always be apparent. Direct pancreatic function testing is considered the "surrogate" gold standard because obtaining pancreatic tissue from biopsy specimens carries a significant risk of complications.

Diagnosis of pancreatic insufficiency

We generally perform an endoscopic pancreas function test (ePFT) with secretin on patients referred to our Center for Pancreatic Disease with a possible clinical diagnosis of CP in

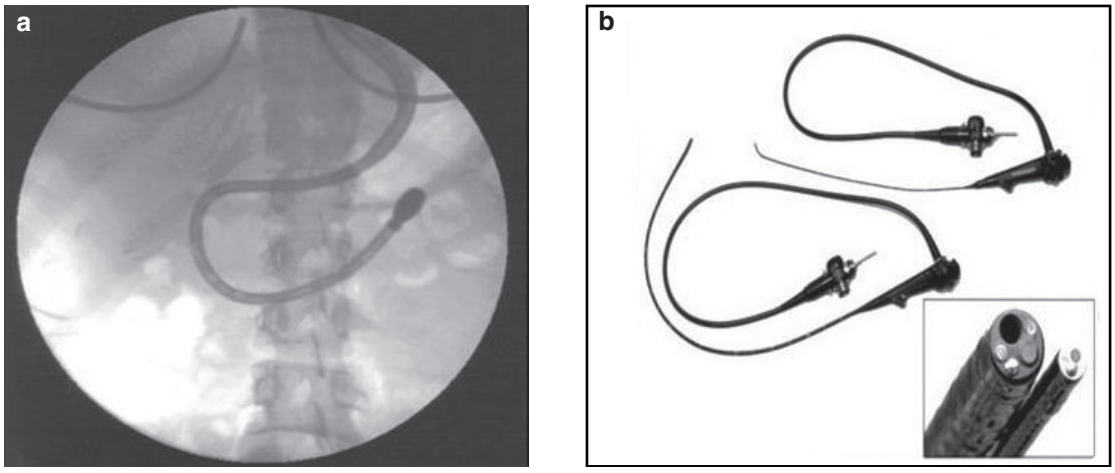

Figure 1. Gastroduodenal (Dreiling) and endoscopic collection methods. (**a**) Fluoroscopic image of a gastroduodenal tube. (**b**) Photograph of an upper endoscope used for pancreatic fluid collection.

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the absence of imaging abnormalities on pancreatic computed tomographic scan. Endoscopic ultrasound (EUS) is often performed in concert with PFTs for a sensitive structural and functional assessment of the gland. In general, the finding of (i) diminished peak bicarbonate concentration with (ii) more than four suggestive EUS changes supports the diagnosis of early CP. Caution is taken not to give a patient a diagnosis of CP in the absence of both abnormal secretory physiology and pancreatic morphologic changes.

The five-sample ePFT

1. The patient is placed in the left lateral decubitus position with the head elevated about 30 degrees. The posterior pharynx is anesthetized with a topical spray. A sedation and analgesia bolus is administered. Further sedation doses may be given if necessary for patient comfort. We have found that using a long-acting benzodiazepine such as diazepam in concert with standard sedation improves patient comfort and tolerance during the procedure—for example, 2–5 mg at the start of the procedure coupled with intermittent boluses of short-acting benzodiazepine administered 2–3 minutes before each collection period. Sedation does not significantly alter pancreatic secretions.

2. Esophagogastroduodenoscopy is performed with a standard (10 mm) or thin (6 mm) upper endoscope. I use a 6-mm scope for the ePFT, because it optimizes patient comfort during the prolonged endoscopy; however, standard adult endoscopes also work well.

3. During luminal examination, an intravenous test dose (0.2 μg) of synthetic human secretin is administered. After the test dose, the patient's oxygen saturation and blood pressure are continuously monitored to detect any potential adverse reaction. Although an allergic reaction to synthetic secretin has never been reported, it is not uncommon to see asymptomatic flushing with secretin administration due to its stimulation of vasoactive intestinal peptide receptors. This is not associated with hemodynamic changes and is not an allergic reaction.

4. Gastric fluid is aspirated as completely as possible through the scope and discarded. I recommend retroflexion to optimally aspirate all fundic gastric juice. Gastric fluid contamination will neutralize duodenal bicarbonate and produce a falsely low bicarbonate value. A pH measurement (>6) of pancreatic fluid can be used as an internal control.

5. Approximately 3–5 ml of fluid should be suctioned from the postbulbar duodenum to rinse residual gastric fluid from the suction channel of the endoscope. (The channel has a volume of about 2 ml.)

6. At time 0, a baseline collection of 3–5 ml of duodenal fluid is collected in a trap (bottle A). Also at time 0, the full intravenous dose of synthetic secretin (0.2 μg/kg, slow push) is administered (**Figure 2**).

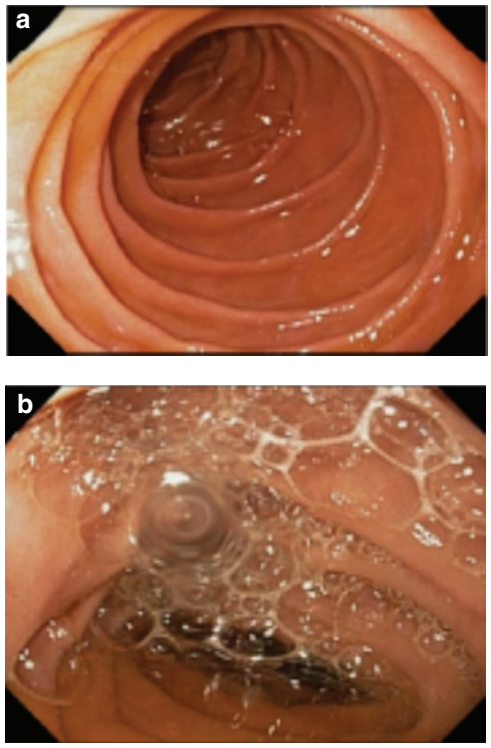

Figure 2. Endoscopic appearance of the duodenum before and after hormonal stimulation with secretin. Large volumes (5–30 ml) of fluid are easily aspirated from the lumen. (**a**) Time 0 minutes; duodenum before secretin injection. (**b**) Time 15 minutes; duodenum after secretin injection.

7. Intermittent 3- to 5-ml fluid aspirates are obtained every 15 minutes for an hour (bottles B at 15 minutes, C at 30 minutes, D at 45 minutes, and E at 60 minutes). The patient is kept in the left lateral decubitus position with the feet lower than the head at about 30 degrees. As pancreatic secretion diminishes, repositioning the patient on the back will cause fluid to pool in the third portion of the duodenum, which facilitates aspiration. Patients generally do not tolerate this for extended periods of time because of choking and coughing. The endoscope remains in place between collection times. If the scope migrates back into the stomach, it should be repositioned into the second or third portion of the duodenum for fluid collection.

8. Fluid should be kept on ice and analyzed within 6 hours. Alternatively, the fluid may be frozen (a subzero freezer is best) for later analysis.

9. A standard hospital-laboratory autoanalyzer may be used for electrolyte concentration analysis.

The two-sample ePFT

We recently reported the validity of a shortened, two-sample collection method in which samples are collected at 30 and 45 minutes after secretin administration. This method retains a high sensitivity for detecting pancreatic exocrine insufficiency and is ideal for screening patients in whom there is a low suspicion of pancreatic disease. The two-sample ePFT also serves as a useful adjunct to advanced endoscopic procedures such as endoscopic retrograde cholangiopancreatography and EUS. Patients with borderline or equivocal two-sample ePFT results should be considered for the 1-hour five-sample collection method.

Diagnosis

The ePFT compares well with the traditional PFT, and the electrolyte composition of the duodenal aspirate is identical to that observed with gastroduodenal collection tube methods after secretin stimulation. The main advantages of endoscopic collection include patient comfort, universal availability, avoidance of radiation exposure, and the ability to collect large sample volumes.

CONFLICT OF INTEREST

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