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Endosonographic imaging of pancreatic pseudocysts before endoscopic transmural drainage

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Background: Endoscopic drainage of pancreatic pseudocysts has become an established alternative to surgery. We performed endosonography before endoscopic drainage to find out whether detailed anatomic information would help in the selection of appropriate candidates and result in a reduction of complications.

Patients and Methods: Between April 1992 and July 1995 endosonography was performed in 32 patients, referred for endoscopic pseudocyst drainage, to determine the minimal distance between the pseudocyst and the gut, to identify interposed vascular structures, and to determine the optimal site for drainage.

Results: Endosonography failed to identify a pseudocyst in 3 patients and in 2 patients the lesion was inconsistent with a pseudocyst. In 7 patients transmural drainage was considered inappropriate: in 4 the distance between the gut and the cyst was too large, in 2 varices were present between the cyst and the gut, and in 1 patient normal pancreatic parenchyma was present between the cyst and the gut. In 20 patients endosonography was followed by ERCP, and in 19 endoscopic drainage was attempted. Transmural drainage was successful in 16 patients. Endosonography changed management in 37.5% of the patients.

Conclusion: Endosonography provides essential information prior to endoscopic drainage of pseudocysts, leading to a change in therapy in one third of patients. (Gastrointest Endosc 1997;46:412-6.)

The development of pancreatic pseudocysts is a well-known complication of acute and chronic pancreatitis. Pancreatic pseudocysts may cause abdominal pain or dyspepsia. More severe complications include infection, hemorrhage, and rupture.¹ Although pseudocysts may resolve spontaneously, especially when they are a sequel of acute pancreatitis, intervention is generally believed to be indi-

cated when the cysts persist for more than 6 weeks, when cyst size exceeds 6 cm in diameter, or when the patient remains symptomatic.² Whether persistence of the pseudocyst after 6 weeks is a strong indication to treat is questionable, and some authors have suggested longer periods of observation in asymptomatic patients.^{1,3} Surgical intervention has been the standard of care with low morbidity and mortality rates but other, less invasive techniques, have been developed in the past decade. External drainage is often performed guided by transabdominal ultrasonography or CT, but such therapy may be complicated by formation of an external pancreatic fistula. Endoscopic internal drainage of pancreatic pseudocysts has been shown to be a feasible technique and would theoretically be an attractive alternative. The route of internal drainage can be either transmural, through the wall of the duodenum or stomach, or transpapillary, in which case the pseudocyst is

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drained via the papilla of Vater and the pancreatic duct.

Recent publications on endoscopic transmural and transpapillary drainage have shown high technical success rates and rather low long-term recurrence rates of 10% to 20%.⁴⁻⁷ These results are satisfactory and comparable to surgical results.⁸ Early complications of transmural drainage consist mainly of bleeding or perforation of the stomach or duodenum. Bleeding occurs when a submucosal vessel or vessel between the wall of the gut and the pseudocyst is accidentally punctured or transected and may require surgical intervention.^{4, 9, 10} Perforation of the stomach or duodenum into the abdominal cavity or retroperitoneum may occur when the distance between the pseudocyst and the gut wall is too large or when a puncture is performed without sufficient endoscopic landmarks. Endosonography provides high-resolution imaging of the gastrointestinal wall and direct surroundings and could theoretically be helpful in selecting those patients in whom endoscopic drainage is appropriate by (1) providing diagnostic information about the cyst and the pancreas itself (Fig. 1), (2) assessing the distance between the gut wall and the pseudocyst, and (3) identifying vessels between the gut lumen and the pseudocyst. This detailed information may prevent complications of the procedure. We undertook a prospective study to evaluate the role of endosonography before endoscopic drainage of a pancreatic pseudocyst. The aim of the study was to determine whether endosonography could identify suitable candidates for endoscopic therapy and the impact of endosonography on the management of these patients.

PATIENTS AND METHODS

Between April 1992 and July 1995, 32 patients were referred for endosonography prior to endoscopic drainage of a pancreatic pseudocyst. There were 17 men and 15 women, with a median age of 48 years (range 29 to 78). The cysts had been detected by transabdominal ultrasonography or CT, which had been performed before the patient was referred for endoscopic drainage. All patients were referred because of size or symptoms of the pseudocyst and were discussed in a medicosurgical conference prior to attempted drainage. The cause of the pancreatitis leading to the 32 pseudocysts was unknown in 15 patients, alcohol related in 7, of biliary origin in 5, due to a trauma in 1, drug related in 1, postpancreatic surgery in 1, due to pancreas divisum in 1, and due to obstruction of the pancreatic duct by an irresectable pancreatic head carcinoma in 1 patient. Two patients were studied twice, 9 and 12 months after the initial successful endoscopic treatment.

Endosonography was performed using a rotating sector scanner (GF-UM20, Olympus Optical Co., Tokyo, Japan).

Figure 1. Endosonographic image of a large pseudocyst in the area of the pancreatic tail, seen from the stomach. Note a markedly dilated pancreatic duct at the bottom, middle, containing a stone with acoustic shadowing.

Patients were examined in the left lateral position after an overnight fast. Topical pharyngeal anesthesia as well as conscious sedation with midazolam (2.5 to 5 mg) was given under continuous monitoring of pulse rate and oxygen saturation. The echoendoscope was introduced blindly into the stomach and then advanced under endoscopic control through the pylorus into the duodenum. Visualization of the pancreatic head and part of the body was first attempted. Thereafter the echoendoscope was pulled back into the stomach to visualize the rest of the body and the tail of the pancreas. The cyst was visualized from the duodenum or stomach or both and the minimal distance between the cyst wall and the lumen of the gut was measured. The endosonographically optimal location for drainage was noted. This was the site in which the pseudocyst and gut wall were closest together in absence of interposed vessels. No attempts were made to mark the optimal location. Finally, the presence of vessels in and around the stomach or duodenum, and in particular between the cyst and the gut, was investigated. Transmural drainage was not attempted when the distance between the cyst and gut exceeded 1 cm or when vascular structures were seen between the gut and the cyst.

ERCP was performed after endosonography on the same day, in most patients. Pancreatography was first attempted and when the pseudocyst communicated with the pancreatic duct, insertion of an endoprosthesis through the papilla of Vater was attempted. If transpapillary drainage could not be performed, the duodenum and stomach were searched for an unequivocal impression from the pseudocyst. If a clear bulging mass with stretched mucosa was identified, a puncture with a diathermic pre-cut needle was made in this bulge to gain access to the cyst. After insertion of the pre-cut needle in

Table 1.
Summary of the results of endosonography performed in 32 patients referred for endoscopic drainage of a pancreatic pseudocyst

Results	n
All patients (n = 32, 100%)	
No cyst seen during ES	5
Not suitable for endoscopic drainage	7
Drainage possible according to ES (n = 20, 63%)	
Complications	3
No endoscopic landmark visible	1
Successful drainage (n = 16, 50%)	

ES, Endosonography.

the cyst, the needle was removed from its catheter, fluid was aspirated for analysis, and contrast medium was injected through the catheter to confirm that the catheter was in a correct position in the cyst. A guidewire was then inserted; over the catheter plus guidewire, a straight Amsterdam-type, polyethylene, 10F endoprosthesis with multiple side holes was inserted into the cyst under fluoroscopic control.

RESULTS

Endosonography was performed without complications in all patients. Table 1 summarizes the results of the endosonography examination and the subsequent therapy for the pseudocyst. In five patients (16%) no clear pseudocyst could be identified endosonographically: in one patient a Billroth II gastrectomy was present prohibiting visualization of the cyst in the pancreatic head; in two patients the cyst had disappeared since the last transabdominal ultrasonography or CT; in one patient the expected cyst had a hyperechoic appearance compatible with a solid tumor; in another patient a large, poorly delineated area with fluid and hyperechoic particles was seen without a clear wall. The last two patients were both treated surgically. The patient with the suspected solid tumor on endosonography turned out to have an ordinary pseudocyst at surgical exploration, filled with clear fluid.

Of the 27 patients in whom a pseudocyst was visualized, 1 patient had two cysts (diameter 9.5 and 3 cm). Seven cysts were located in the pancreatic head, 9 in the pancreatic head and body, 3 in the body of the pancreas, 5 in the body and tail area, and 3 cysts were located in the pancreatic tail. The size of the cysts was too large to measure with endosonography in 2 patients. The other 25 cysts had a median diameter of 7 cm (range 2 to 10 cm) on endosonography. The minimal distance between the cyst and the gut lumen was not recorded in 1 patient. In the remaining 26 patients the median

distance was 5 mm (range 1 to 10 mm). Varices or collaterals were seen in or around the proximal stomach in 6 patients (22%).

Endoscopic transmural drainage was not performed in 7 of the 27 patients (26%) in whom a pseudocyst was visualized with endosonography. In 4 patients the distance between the cyst and the gut lumen was 9 or 10 mm, which was considered excessively large compared to the relatively small size of the cysts (2 to 4 cm). In 2 patients varices were interposed between the gastric wall and the cyst, and in 1 patient with a pseudocyst in the head of the pancreas, a 5 mm rim of normal pancreatic tissue was visible between the cyst and the duodenal bulb. Transpapillary drainage of the cysts was attempted in 4 of these 7 patients and successful in 2.

In 20 patients of the total group of 32 patients (63%), endosonography was followed by ERCP with the intention to drain the pancreatic pseudocyst. In 1 patient no bulge could be found and transmural drainage was not attempted. During pancreatography in this patient no communication between cyst and pancreatic duct could be shown, making transpapillary drainage also impossible. This patient was treated surgically. Endosonography identified the duodenum as the optimal place for drainage in 3 patients. All 3 were successfully drained transduodenally without complications.

In 16 patients endosonography suggested the stomach as the optimal location for transmural drainage. Transgastric drainage was successful in 11 of these 16 patients. In 2 patients transgastric drainage failed because of the inability to find a good stable position of the side-viewing endoscope in the stomach to puncture the pseudocyst, but both patients were successfully drained transduodenally. In both patients the echoendoscope had not been inserted through the pylorus because the impression of the pseudocyst on the antrum prevented a complete investigation. In 3 patients transgastric drainage failed because of complications. In 1 patient, in whom the distance between the gastric wall and cyst was 8 mm, contrast leakage in the peritoneal cavity was seen after puncturing the gastric wall and no further drainage attempts were undertaken. The patient was kept under observation and was discharged 24 hours after the procedure. Slow spontaneous regression of the pseudocyst occurred without intervention. In 2 patients bleeding started during a superficial puncture in the stomach leading to termination of the procedure. No transfusions were necessary and both patients were discharged after 24-hour observation. Surgical marsupialisation was performed in both at a later occasion.

DISCUSSION

Endosonography in the present series of 32 patients referred for endoscopic pancreatic pseudocyst drainage had a major impact on further management. In 12 of the 32 patients (37.5%) endosonography provided complementary information to transabdominal ultrasonography and/or CT, which led us to abandon the intended endoscopic drainage. In 2 of 12 patients a pseudocyst could no longer be found. These had spontaneously resolved between the last investigation and the planned endoscopic treatment. This emphasizes the necessity of imaging the pseudocyst shortly before an attempted endoscopic drainage. In 7 of the 12 patients local factors, such as distance between the gut wall and the cyst and the presence of normal pancreatic tissue or vessels between the cyst and the gut lumen, were considered unfavorable for endoscopic drainage.

Although endosonography provides important information prior to endoscopic drainage of pancreatic pseudocysts, there are a number of drawbacks to the combination of endosonography and ERCP. The patient has to swallow two different endoscopes, the two techniques use a different medium to fill the gut (water vs air) with the risk of water aspiration after the first procedure and, most important, the puncture remains a blind procedure. Ideally, endoscopic marsupialization should be performed under direct endosonographic guidance. This would virtually rule out the possibility of missing the pancreatic pseudocyst with the needle and would probably also eliminate the risk of puncturing a vessel. An attempt to reach this ideal situation was reported by Grimm et al.¹¹ by use of an electronic oblique scanning echoendoscope (FG-32UA, Pentax Precision Instruments, Tokyo, Japan). This technique entails an endosonographically guided puncture of the pseudocyst after which a guidewire is introduced under fluoroscopic control. The echoendoscope is then exchanged for a large-channel endoscope and a 10F endoprosthesis is inserted in the pseudocyst over the guidewire. The small-caliber instrumentation channel of the Pentax echoendoscope does not allow insertion of a large-caliber stent. The endoscope exchange is cumbersome and may result in loss of access to the pseudocyst due to guidewire displacement. In a series of nine patients this method was successful in all patients, two of whom had no endoscopic landmark.¹² An echoendoscope with a large working channel is eagerly awaited to further simplify this procedure.

Another interesting single intubation technique was described by Savides et al.¹³ In patients in whom an impression of a pseudocyst could not be visualized endoscopically, a 6.2F ultrasound catheter

Figure 2. Endosonographic image of collateral vessels between a pseudocyst and the gastric wall, contraindicating endoscopic drainage through the gastric wall because of the risk of severe bleeding.

probe was used through the instrumentation channel of the duodenoscope to identify the optimal site for drainage. Unfortunately, the low penetration depth of the commercially available ultrasound catheter probes prohibits adequate investigation of the entire pancreas and its surroundings.

Acute severe bleeding from the cyst enterostomy site is one of the most important early complications.^{4, 9, 10} Endosonography failed to prevent two episodes of bleeding from the mucosal incision which, although not life-threatening, were severe enough to discontinue further endoscopic intervention. Even real-time endosonography guidance during a cyst enterostomy will probably not completely prevent episodes of bleeding. However, we were able to identify two patients with an increased risk of bleeding because of portal hypertension in the area of the cyst (Fig. 2). In four other patients with portal hypertension no vessels were seen near the impression of the cyst in the gut and endoscopic drainage was successful without bleeding (Fig. 3). The value of Doppler endosonography for this indication is questionable. Although an enthusiastic report recently advocated the use of Doppler endosonography,¹⁴ most vessels can be accurately identified without Doppler. The differentiation between arteries and veins is not possible without Doppler but this differentiation is not important for this indication. The most feared long-term complication of endoscopic drainage is the development of a pancreatic abscess. There was considerable variation in the echogenicity and homogeneity of the contents of the

Figure 3. Endosonographic image of large pancreatic pseudocyst in the tail area compressing the stomach at the greater curvature. The cyst is partially filled with anechoic fluid and partially with hyperechoic material. At the bottom, middle, some varices are seen in the gastric wall, and outside the wall ascites is present. No varices are seen where the cyst makes an impression on the gastric wall.

pseudocysts on endosonography. Although this will not have consequences for the early success of endoscopic drainage, it may influence the long-term results. When endosonography localizes areas of hyperechoic tissue in anechoic fluid, this may well correlate with fragments of necrotic tissue. As these pieces of necrotic tissue will not be evacuated through a 10F endoprosthesis, endoscopic drainage might be contraindicated in these patients because it may lead to the formation of a pancreatic abscess.¹⁵ Further prospective studies of the endosonographic characteristics of the contents of a pseudocyst may help in defining an optimal treatment protocol for individual patients.

In this study we have shown that endosonography with a rotating sector scanning echoendoscope is valuable in selecting patients for endoscopic drainage of pancreatic pseudocysts. Although we were unable to completely prevent complications, we believe that endoscopic drainage of pancreatic pseudocysts can best be performed after selection of patients by endosonography. It is sobering to realize

that after selection of patients with transabdominal ultrasonography and/or CT, only half of the patients could be treated successfully. When patients were selected on the basis of endosonographic appearance the success rate increased to 80%. Greater success will probably only occur once endosonographically guided puncturing and drainage become feasible with the development of an echoendoscope with a large-caliber instrumentation channel.

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