Operative treatment of periampullary retroperitoneal perforation complicating endoscopic sphincterotomy

Leopoldo Sarli, MD,a Cristina Porrini, MD,a Renato Costi, MD, PhD,a Gabriele Regina, MD,a Vincenzo Violi, MD,a Michelina Ferro, MD,b and Luigi Roncoroni, MD,a Parma, Italy

Background. Evidence-based strategies are lacking regarding the appropriate management of periampullary retroperitoneal perforations complicating endoscopic retrograde cholangiopancreatography (ERCP) combined with endoscopic sphincterotomy (ES). We propose a transduodenal operative repair of periampullary retroperitoneal perforation.

Methods. Six patients with duodenal periampullary perforation induced by endoscopic sphincterotomy underwent operation after failure of an attempt of conservative management. After mobilization of the second and the third part of the duodenum, a minimal transversal duodenotomy was carried out, the papilla was exposed, periampullary perforation was readily identified, and was sutured easily as a sphincteroplasty or by 2 or 3 Vicryl 3/0 sutures. Patient outcomes were measured.

Results. Periampullary perforation was repaired as sphincteroplasty in 2 cases, and with Vicryl 3/0 sutures in 4 cases. The mean duration of operation was 176 minutes. There were no intraoperative complications. None of the patients required reoperation after transduodenal repair of the perforation. The patients had a normal postoperative course. The median hospital stay was 10.5 days (range, 9 to 20 days) and the mortality rate was nil. There were no delayed complications during a median follow-up of 60 months.

Conclusions. The transduodenal operative approach to periampullary perforation after ERCP/ES at an early stage in the clinical evolution of the perforation is a safe and effective procedure. We consider this approach a useful option for the treatment of periampullary perforation after ERCP/ES when initial endoscopic and conservative management do not yield good results within 24 hours.

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From the Department of Surgical Sciences, Section of General Surgical Clinics and Surgical Therapy, Parma University, Medical School,a and Department of Surgery, Section of Anesthesiology, Intensive Care and Pain Therapy, Parma Hospital,b Italy.

Endoscopic retrograde cholangio-pancreatography (ERCP) combined with endoscopic sphincterotomy (ES) has become a common procedure worldwide, ushering in the era of minimally invasive management of biliary and pancreatic disorders. Although regarded widely as a safe procedure, ES carries a small but significant number of serious complications.1,2 Common complications include pancreatitis, bleeding, cholangitis, and perforation. Overall, the procedure carries a mortality rate of 0.5% to 1.5%.3,4 ERCP-related perforation occurs in 0.3% to 1% of patients, and the injury carries a mortality rate of 16% to 18%.2,4,6 Perforations were classified as to distinct types: (1) lateral or medial duodenal perforations that are away from the ampulla; (2) periampullary; and (3) guidewire with bile leak or with retroperitoneal air alone.7,8 Guidewire perforations are readily recognized early and the vast majority are repaired with endoscopic therapy and medical management, although duodenal perforations require operative treatment.8 Evidence-based strategies are lacking regarding the management of periampullary perforations: some investigators advocate conservative management based on a clinical course,9 whereas others advo-
citate operative repair in all cases because of the complications associated with delayed operative intervention.10 For cases where the surgeon decides on recourse to operative repair of the periampullary perforation there is no consensus concerning operative modalities.11-18 Based on our successful experience of 6 cases treated at a single center with the same operative procedure, we propose a transduodenal operative repair of periampullary retroperitoneal perforation complicating ES.

PATIENTS AND METHODS

Between 1988 and 2004, 6 patients were referred to our operative unit for operative management of duodenal periampullary perforation induced by ES (Table). Two patients underwent ERCP/ES at another institution and 4 patients underwent an endoscopic procedure at the gastroenterologic unit of our institution. During the same period, 12 other patients had successful conservative treatment for periampullary perforation induced by ES at our institution.

The definition of periampullary perforation relates to the mechanism, and anatomical location, of the injury: the perforation is peri-Vaterian,7 and it is usually caused by the sphincterotome or needle-knife during the cutting of the Vaterian sphincter.

Abbreviated reports of the 6 patients are reported in the Table. Two cannulations of the common bile duct were achieved after several attempts by needle-knife pre-cut papillotomy.19,20 In 2 cases, unsuccessful attempts were made to cannulate the common bile duct by needle-knife fistulotomy.21 In 5 patients, the sphincterotome or the needle-knife was the presumed source of injury, and in one case the mechanism of injury was presumably the extraction of the Dormia basket with the big stone inside it. In 5 cases, the diagnosis was either made or suspected during ERCP. In the remaining patient, the diagnosis was established by abdomen radiography showing pneumoretroperitoneum 48 hours after ERCP.

In 4 cases, periampullary perforation was identified during the endoscopic procedure at our institution. A nasogastric tube for decompression was used in all cases; a biliary endoprosthesis was placed in 2 cases. All patients had medical treatment with intravenous fluid hydration, broad-spectrum parenteral antibiotics, and serial clinical evaluations. Patients were assessed for their response to this management, with control of their clinical symptoms (abdominal pain, fever, tachycardia), physical signs (guarding, subcutaneous crepitus), and laboratory abnormalities (leukocytosis, hyperamylasemia).9 These 4 cases required operative treatment because of the failure of conservative treatment. In the first case of this series (Table), a conventional exploration and drainage was done initially, but the patient then required re-exploration. During the second operation we decided for the first time in our experience to carry out transduodenal repair.

Operative technique. A median incision was made into the peritoneal cavity, with the patient lying flat on his back. Cholecystectomy was carried out as usual in 4 cases, the other 2 cases having already undergone cholecystectomy. We then proceeded with the mobilization of the duodenum. A Fogarty catheter (with a 2.5-ml balloon) was introduced through the cystic duct in 2 cases and through a choledochotomy in the 2 cases with previous cholecystectomy, and down the common bile duct until it could be felt against the duodenal wall. This served as a reference point from which a minimal transversal duodenotomy was carried out with subsequent recovery of the Fogarty balloon. When a biliary stent had been positioned previously, the Fogarty catheter through the cystic duct was not used. After the papilla was exposed, periampullary perforation was readily identified and was easily sutured as a sphincteroplasty (Fig 1) or by 2 or 3 Vicryl 3/0 sutures (Fig 2). Once the procedure was completed, the duodenal wall was closed transversally using a 2-layered re-absorbable suture (3/0). In the 2 cases with choledochotomy, a T-tube was placed in the common bile duct. When the surgeon considered it opportune, intraoperative cholangiography and other operative procedures were carried out, such as sphincteroplasty or hepatojjunostomy. Because there was no established policy, surgeons decided case by case whether to apply procedures potentially necessary to treat diseases of the pancreas or of the biliary tract during the operative treatment for perforation, or to postpone these procedures to a more elective time point. In all cases a drain was applied close to the duodenal suture at the conclusion of the operative procedure.

Cautious postoperative patient management included a nasogastric tube until postoperative day 3, intravenous nutrition until postoperative day 3, restoration of oral intake on postoperative day 4, antibiotic therapy until postoperative day 5 (in 1 case until day 7), 0.2 ml octreotide 3 times daily for 5 days, and antiH2 (PPI in the last 2 cases) and low molecular weight heparin for the entire period of hospitalization.

Outcomes. Patient outcomes were measured as postoperative complications, hospital days until dis-
A 74-year-old male affected by jaundice caused by CBDS after cholecystectomy underwent ES with stone extraction at another institution. After a few hours, abdominal pain, guarding, and retropneumoperitoneum at radiography were observed. The patient was referred to our institution and underwent operation 24 hr after ES. Laparotomy showed fluid in the right perinephric space, but perforation was not identified. A suction drain was placed close to the duodenum. After operation, pain and guarding, fever, and leukocytosis persisted. A new operation was carried out after 4 days. After duodenotomy and choledochotomy, a perforation, associated with an uncorrected sphincterotomy (Fig 1), was repaired as sphincteroplasty with a T-tube placed in the CBD. The postoperative course was uneventful, the T-tube was removed on day 14, and the patient was discharged on day 14.

A 41-year-old male affected by jaundice caused by CBDS underwent ERCP at our institution. Initial attempts at cannulation of the papilla were unsuccessful, and precut biliary needle knife sphincterotomy was carried out by placing the tip of the needle just under the papillary orifice and by cutting in a superior direction. After cannulation, a small contrast extravasation was noted, stones were retrieved, and a biliary endoprosthesis was placed. CT scans showed fluid in the right perinephric space. Clinical deterioration with abdominal pain, fever, guarding, hyperamylasemia, and leukocytosis required operative treatment. After duodenotomy and choledochotomy, a periampullary perforation was identified under the papilla and was repaired by 3 Vicryl 3/0 sutures with a T-tube placed in the CBD. The postoperative course was uneventful, the T-tube was removed on day 9, and the patient was discharged on day 11.

A 73-year-old female affected by jaundice caused by pancreatic carcinoma underwent ERCP at our institution. Transpapillary biliary access failed and cannulation of the papilla was successful after 3 attempts at precut papillotomy. After cannulation, a small contrast extravasation was noted and a biliary endoprosthesis was placed. Because of persistent abdominal pain, after 24 hr, operation was carried out. Laparotomy showed edema and contrast within the hepatoduodenal ligament. After duodenotomy, a periampullary perforation on the left lateral side of the papilla was repaired by 2 Vicryl 3/0 sutures and the endoprosthesis was removed. Hepatojejunostomy was carried out for the treatment of jaundice. The postoperative course was uneventful, the patient was discharged on day 9.

A 23-year-old female affected by asymptomatic CBDS before cholecystectomy was referred to the endoscopist at our institution. Cannulation of the papilla failed after several attempts at precut fistulotomy. Injection of contrast showed perforation. CT scans showed fluid in the right perinephric space. Clinical deterioration with abdominal pain, fever, guarding, hyperamylasemia, and leukocytosis required operative treatment after 24 hr. After duodenotomy, a periampullary perforation was identified on the left lateral side of the papilla and was repaired by 3 Vicryl 3/0 sutures. Complete resection of the sphincter of Oddi with CBDS extraction was carried out. The postoperative course was uneventful and the patient was discharged on day 10.

An 87-year-old female underwent ES for jaundice caused by CBDS at another institution. After easy cannulation, injection of contrast showed a stone (1 cm) over a prolonged stenosis of the intraduodenal segment of the distal CBD. Stone extraction by Dormia was very difficult. Abdominal pain, fever, guarding and leukocytosis also developed. Radiography showed retropneumoperitoneum, and CT scans showed fluid in the perinephric space. The patient was referred to our institution 48 hr after ES and underwent operation the next day. Laparotomy showed fluid in the retroperitoneum and in the abdomen. After duodenotomy and exposure of the papilla, a perforation was repaired as sphincteroplasty and a hepatojejunostomy was carried out. The patient had fever (>38°C) and leucocytosis during the first 5 postoperative days; the subsequent postoperative course was uneventful, and the patient was discharged on day 20.

A 65-year-old male with asymptomatic CBDS, gallbladder stones, and duodenal diverticulum was referred to the endoscopist at our institution. Cannulation of papilla failed after several attempts at precut fistulotomy. Injection of contrast showed perforation. CT scans showed peripancreatic edema. Because of persistent abdominal pain, after 24 hr operative treatment was carried out. Laparotomy showed edema and contrast within the hepatoduodenal ligament. After duodenotomy, a periampullary perforation on the left lateral side of the papilla was repaired by 2 Vicryl 3/0 sutures, after which sphincteroplasty with stone extraction was carried out and the duodenal diverticulum was sutured. The postoperative course was uneventful and the patient was discharged on day 9.

**Table.** Consecutive cases of periampullary retroperitoneal perforation complicating ES or attempts at ES treated by transduodenal repair

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CBD, common bile duct; CBDS, common bile duct stones; CT, computed tomography; ERCP, endoscopic retrograde cholangiopancreatography; ES, endoscopic sphincterotomy.
charge, and death. Records of all patients were collected retrospectively.

RESULTS

Five patients underwent operation the day after ERCP; in the remaining case, time to operation was 3 days (Table). Three patients (cases 1, 2, 4; Table) had duodenal leaks with retroperitoneal fluid collection; 2 patients (cases 3, 6; Table) had only edema and contrast within the hepatoduodenal ligament. The patient who underwent operation after 3 days (case 5; Table) had a large amount of fluid in the retroperitoneum and abdomen. Periampullary perforation was repaired by sphincteroplasty in 2 cases (cases 1, 5; Table) (Fig 1), and with Vicryl 3/0 sutures in 4 cases (Fig 2). A T-tube was placed in the common bile duct in 2 cases (cases 1, 2; Table), a hepatojejunostomy was carried out in 2 cases (cases 3, 5; Table), a complete resection of the sphincter of Oddi22,23 with stone extraction was
carried out in 2 cases (cases 4,6; Table), and a suture of the duodenal diverticulum was carried out in 1 case (case 6; Table).

The mean duration of operation was 176 minutes. There were no intraoperative complications. None of the 6 patients required reoperation after transduodenal repair of the perforation. The patients had a normal postoperative course. The median hospital stay was 10.5 days (range, 9 to 20 days) and the mortality rate was nil. There were no delayed complications during a median follow-up of 60 months (range, 20 to 120 months).

DISCUSSION

Arguments have been made for operative and non-operative management of perforation after ERCP/ES, although consensus is lacking. In our view, one of the reasons for this difference of opinion is that the majority of the studies on the subject refer to differing types of perforation. It is of vital importance to distinguish between the various types of perforation, because the clinical evolution and the prognosis differ widely according to the type of perforation. Stapler et al classified perforations as 4 types: lateral duodenal (type I), peri-Vaterian (type II), bile duct (type III), and retroperitoneal air alone (type IV). In accordance with the latter classification, in this study only, periampullary (ie, type II) perforations were taken into consideration.

Periampullary perforation during ERCP/ES may occur, either during the cutting of the Vaterian sphincter or during pre-cutting. In our experience, 4 of 6 patients were submitted to the pre-cutting technique. This observation is in accordance with several studies, which reported that pre-cutting primarily added to the risk of perforation. Pre-cutting presents a high risk for patients and for practitioners, and thus should be done for good indications (i.e., good documented evidence for some pathology that may require endoscopic treatment) by trained endoscopists only.

Periampullary perforation may be clinically non-apparent initially and later identified incidentally, or diagnosed after the development of clinical symptoms such as fever, abdominal pain, or leukocytosis. Radiography and computed tomography (CT) scans could help in the diagnosis of perforation, although in these cases only operative exploration allows for the identification of the exact type of perforation. On the basis of our experience, however, we concur with Howard et al that periampullary perforation is diagnosed more frequently by experienced endoscopists during the procedure, either by contrast extravasation or the appearance of retroperitoneal air.

A wide range of extremely varied operative procedures has been proposed for the treatment of this type of complication, including simple retroperitoneal drainage, duodenal repair around a T-tube inserted into the perforation, common bile duct exploration and T-tube placement, duodenal diversion by antrectomy and gastrojejunostomy or by gastrojejunostomy with pyloric exclusion, and...
mobilization of the duodenum. In case 1 (Table), difficult to recognize from the outside, even after place in a region adhering to the pancreas, usually after ERCP/ES. The perforation, in fact, takes a periampullary perforation clearly and without fail. The transduodenal operative repair. This technique had never before been described in the literature. In 1993, Chung et al.9 reported that in some cases operation consisted of repair of the perforation as a sphincteroplasty, although no details are provided as to the procedure carried out. In our study, this technique was used in 6 cases and is described in detail. The number of cases reported is low, because the occurrence of type II perforation after ERCP/ES is exceedingly rare. To our knowledge, however, our study is the largest published series from a single center of type II perforation treated with the same procedure.

There are several reasons for the choice of a transduodenal operative repair. The transduodenal approach is the only one that enables us to see a periampullary perforation clearly and without fail after ERCP/ES. The perforation, in fact, takes place in a region adhering to the pancreas, usually through the pancreatic parenchyma, and is often difficult to recognize from the outside, even after mobilization of the duodenum. In case 1 (Table), the initial laparotomy did not allow for the recognition of the perforation, which was recognized at the second exploration only after duodenotomy.

This approach allows for the clear visualization of the relationship between the perforation and the terminal portion of the common bile duct and the Wirsung duct, enabling repair of the perforation with no damage to these 2 important structures. Most patients presenting with this complication had undergone ERCP for common bile duct stones, diagnosed or suspected. In some cases, cannulation of the papilla failed, and in others bile stones had not been retrieved after the discovery of the perforation. The transduodenal approach ensured the resolution not only of the perforation but also of the biliary pathology.

In our experience, the transduodenal approach was very easy to carry out. Our operative team had acquired considerable experience with transduodenal sphincteroplasty for the treatment of bile duct stones31 before the endoscopic era, and that procedure involved the same transduodenal approach to the papilla as that used in the technique described in this study. Our data do not permit us to evaluate whether transduodenal repair of periampullary perforations would be equally easy when the surgeon is inexperienced in transduodenal operative procedures on the papilla. In the era of minimally invasive management of biliary and pancreatic disorders, most surgeons have never carried out transduodenal exploration of the papilla; their lack of skill at carrying out this access to the papilla may thus constitute a limit to the use of the technique we propose.

A further reason for which, in our view, we found this operation easy to carry out is that we chose to operate at an early phase of the clinical evolution of the perforation. At this phase, the duodenal wall is not yet damaged by excessive retroperitoneal inflammation and remains intact sufficiently to allow for easy transduodenal suture of the perforation. Our results do not allow us to calculate what time period would preclude the proposed technique. The 2 patients who underwent operation 4 to 5 days after ERCP had intraoperative findings such as indurated, edematous duodenal wall, or peri duodenal abscess with necrotizing pancreatitis, which would in all probability have precluded our operative approach.

In agreement with Howard et al.8 and with Chung et al.9 we feel that perforations, once diagnosed, should be managed initially endoscopically with bile and duodenal juice diversion through a biliary endoprosthesis or nasobiliary drainage and nasoduodenal tube. The patients should be treated with broad-spectrum parenteral antibiotics and must be assessed clinically for their response to this management. Failure to respond within 24 hours or clinical deterioration requires operative exploration with serial abdominal examinations.

Although the modalities of our study do not allow for definitive conclusions to be drawn as to the overall validity of this algorithm, the results of our experience spur us to continue to use this approach: no patient died; there were no delayed complications; all patients who underwent operation had a normal postoperative course; and none of the 6 patients required re-operation after the transduodenal repair of perforation. Operative intervention could be considered in some cases as being overtreatment. Some investigators advocate a more conservative management.4,7,9,10,25 This approach may be associated with a high failure rate7,16,25 and
an increased risk of complications, however, including the need for salvage operation and subsequent re-operations, and death from sepsis. The possible risk of overtreatment is, in our opinion, acceptable when the prospects of recovery are high and when delay in treatment may result in death. Furthermore, in some cases, operative intervention is necessary to resolve the basic pathology.

In conclusion, the transduodenal operative approach to periampullary (type II) perforation after ERCP/ES when initial endoscopic and conservative management do not yield good results within 24 hours was safe and effective. Our data on the outcomes of these patients can be used for the development of evidence-based management strategies regarding the management of periampullary perforations.

REFERENCES