

Surgical management of duodenal perforation after endoscopic retrograde cholangiopancreatography: case series

Manejo quirúrgico de perforaciones duodenales tras colangiopancreatografía retrógrada endoscópica: serie de casos

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Abstract

Background: Complications after endoscopic retrograde cholangiopancreatography (ERCP) are rare, approximately 0.09% to 1.8% are duodenal perforation. This type of injury requires early diagnosis and proper management since the outcomes can be catastrophic, leading to death in 20% of cases. **Objective:** To show our experience in the management of these injuries in order to establish if there is benefit from minimally invasive management versus conventional management. **Method:** Observational, retrospective and descriptive study comparing patients who required surgical management after post-ERCP duodenal perforation in three centers in Bogotá, Colombia, between January 2013 and December 2018. **Results:** 13 patients were taken to surgical management after duodenal perforation post ERCP, 7 laparoscopically (53.8%), with an average hospital stay of 10.7 days and mortality of 0% and 6 by open route (46.1%), with an average hospital stay of 33 days and mortality of 50%, with a minimum follow-up of 6 months. **Conclusions:** Post ERCP duodenal perforation, despite its low incidence, should be suspected due to its high mortality. Laparoscopic surgery is a good tool to address duodenal perforations after ERCP, because it presents a lower rate of complications and mortality.

Keywords: Laparoscopy. Intestinal perforation. Complications. Endoscopic retrograde cholangiopancreatography. Surgery.

Resumen

Antecedentes: Las complicaciones tras la colangiopancreatografía retrógrada endoscópica (CPRE) que necesitan manejo quirúrgico son limitadas y aproximadamente el 0.09-1.8% corresponden a perforación duodenal. Este tipo de lesiones requieren un diagnóstico temprano y un manejo adecuado, ya que los desenlaces pueden ser catastróficos, con una mortalidad reportada de hasta el 20%. **Objetivo:** Presentar nuestra experiencia en el manejo quirúrgico de estas lesiones. **Método:** Estudio observacional, retrospectivo y descriptivo, de pacientes que requirieron manejo quirúrgico por perforación duodenal tras CPRE en tres centros de Bogotá, Colombia, entre enero de 2013 y diciembre de 2018. **Resultados:** Fueron llevados a manejo quirúrgico 13 pacientes, 7 (53.8%) por vía laparoscópica, con una estancia hospitalaria promedio de 10.7 días y una

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mortalidad del 0%, y 6 (46.1%) por vía abierta, con una estancia hospitalaria promedio de 33 días y una mortalidad del 50%, con seguimiento mínimo a 6 meses. **Conclusiones:** La perforación duodenal tras una CPRE, pese a su baja incidencia, se debe sospechar por su alta morbimortalidad. La decisión del abordaje quirúrgico está condicionada por el estado clínico del paciente, y por ende está ligada al pronóstico de este.

Palabras clave: Laparoscopia. Perforación intestinal. Complicaciones. Colangiopancreatografía retrógrada endoscópica. Cirugía.

Introduction

Since 1968, endoscopic retrograde cholangiopancreatography (ERCP) has been used in the treatment of the pathology of the biliary and pancreatic ducts¹. Only 10% of these procedures present complications, among which duodenal perforations (DP) were reported in 0.09-1.8% of cases^{2,3}.

Post-ERCP DPs require early diagnosis and adequate treatment according to the type of injury, as late management leads to worse clinical results with complications such as sepsis, multiple organ failure, and death in 20% of cases. The preferred imaging exam is a computerized tomography (CT) of the abdomen, with a specificity of up to 90%, as it allows to observe the extravasation of the contrast^{4,5}.

The severity and clinical presentation of this pathology determine the need and the surgical approach to perform, but, due to the low frequency, we consider it important to show our experience in open surgery and laparoscopic management of post-ERCP PDs in our institutions.

Method

Statistical analysis

An observational, retrospective, and descriptive study of patients with post-ERCP PD performed by choledolithiasis between January 2013 and December 2018 in Bogota, Colombia, in three institutions: Clínica El Bosque, Policlínico del Olaya and Cardiovascular de Soacha. The inclusion criteria included showing post-ERCP duodenal perforation by choledocolithiasis with intraoperative and postoperative diagnosis. Patients diagnosed with duodenal injury after the procedure were divided in two groups: medical management and surgical management by laparoscopy or open approach.

The relevant data of medical records was collected. The information reviewed included the following

variables: age, gender, diagnostic time, American Society of Anesthesiology (ASA) score, diameter of biliary duct, comorbidity, presence of difficult calculus, type of DP, indication of the ERCP, presence of post-ERCP acute pancreatitis, findings in contrast abdominal CT, surgical approach, hospital stay, and mortality.

Patients were evaluated by a multidisciplinary group of gastroenterologist, surgeons, and internal medicine doctors, according to their comorbidity. All patients had a stratification study for the choledocolithiasis with cholangioresonance or endoscopic ultrasound, or both, prior to the ERCP that would confirm choledocolithiasis.

A suspicion of post-ERCP DP was based on clinical findings, such as signs or peritoneal irritation, paraclinical and imaging. All patients were subject to an abdominopelvic CT scan to evaluate the type of injury. According to the DP type of the Staper, et.al.⁶ classification, and the clinical evolution of the patient, it was determined whether the patient was a candidate for medical or surgical management.

Medical management was based on intestinal rest, placement of nasogastric probe, IV fluids, antibiotic therapy, and strict control of vital signs. The surgical approach was considered in patients who did not respond to medical management after 12 hours, showed a persistent systemic inflammatory response, or had signs of peritoneal irritation⁷.

Open surgery involved primary closure plus pyloric obstruction with gastrojejunal anastomosis, and the laparoscopic approach involved primary closure plus drainage or washing if the injury site was not found. The surgical management by laparoscopic or open surgery varied depending on the hemodynamic stability of the patient, if they were able to withstand pneumoperitoneum, according to the distension of the intestinal loops and the availability of laparoscopic equipment. Monitoring took place for at least 6 months after surgery (Fig. 1).

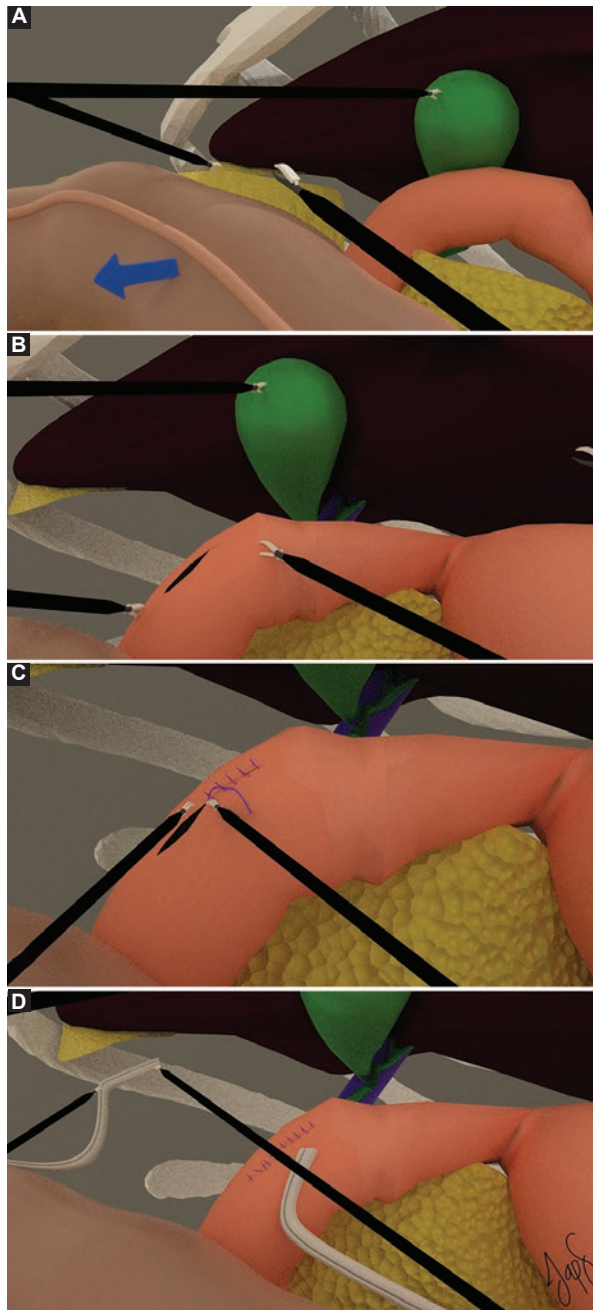


Figure 1. A: release of the hepatic flexure of the colon. B: laparoscopic Kocher maneuver and detection of duodenal perforation. C: primary closure of duodenal perforation with laparoscopic intracorporeal suture. D: draining of the retroperitoneum with placement of anterior and posterior drain on the second portion of the duodenum.

Ethical considerations

Patients signed informed consent, both for the performance of ERCP and surgical procedure (open or laparoscopic). The authors declare that this article does not offer personal information for the identification of patients. The study protocol was approved by

Table 1. Variables demográficas

	Pacientes (n = 28)	Open surgery (n = 6)	Laparoscopic surgery (n = 7)
Women	21 (75%)	5 (83.3%)	5 (71.4%)
Men	7 (25%)	1 (16.7%)	2 (28.6%)
Age	45.4 years	37.6 years	45 years
Comorbidity			
AHT	9 (32.1%)	1 (16.7%)	3 (42.8%)
DM2	8 (28.5%)	2 (33.3%)	2 (28.5%)
COPD	2 (7.1%)	0 (0.0%)	1 (14.3%)
ASA			
I	14 (50.0%)	3 (50.0%)	3 (42.8%)
II	10 (35.7%)	3 (50.0%)	2 (28.5%)
III	4 (14.3%)	0 (0.0%)	2 (28.5%)
Time at diagnosis	1.2 days	2.3 days	1.1 days
Presence of difficult calculus	6 (21.4%)	0 (0.0%)	4 (57.1%)
Biliary duct diameter	5.75 mm	6.8 mm	5 mm

ASA: American Society of Anesthesiology; DM2: type 2 diabetes mellitus; COPD: chronic obstructive pulmonary disease; AHT: arterial hypertension

the ethics committee and implemented in accordance with the provisions of the Declaration of Helsinki and the good clinical practices guidelines.

Results

During the time of the study, 731 ERCPs were performed for a benign biliary pathology in three institutions, in which 28 DPs were diagnosed, with a frequency of 3.8% in our population, whose sociodemographical condition is described in Table 1. The mean age was 41.6 years, and most patients were women (76.9%). DPs were classified according to what was established by Stapfer, et al.⁶ (Table 2).

In patients with suspected perforation during ERCP, the endoscopist inserted a plastic biliary *stent* in 2 (33.3%) in two of the patients with open management and in 5 (71.4%) of the laparoscopic group.

All patients had a contrasted abdominopelvic CT scan with a pneumoretroperitoneum and 5 (38.46%) had pneumoperitoneum. Local pancreatic complications are evidenced, such as the collection of free fluid in 61.5%, acute necrotic collection in 30.7%, and overinfected necrotic collection in 7.6% of the total population, secondary to the associated post-ERCP pancreatitis.

Table 2. Management according to the type of perforation following the classification of Stapfer, et al.⁶

	Description	Open surgery (n = 6)	Laparoscopic surgery (n = 7)
Type I	Injury of the lateral or medial wall	3 (50%)	0 (0.0%)
Type II	Perivaterian injury	1 (16.7%)	1 (14.3%)
Type III	Distal injuries of the biliary duct related to instrumentation near an obstruction	1 (16.7%)	3 (42.8%)
Type IV	Retroperitoneal free air	1 (16.7%)	3 (42.8%)

15 patients responded to conservative medical management and 13 patients requires surgical management with an associated acute pancreatitis. 7 patients were managed with laparoscopy (53.85%) and 6 with open approach (46.15%).

Patients who underwent conventional surgery were diagnosed with DP during surgery, and for this reason a primary closure and a pyloric obstruction with gastrojejunum anastomosis. A patient of this group required a pancreatoduodenectomy after 72 hours due to failure of the initial surgical management with development of necrosis of the second portion of the duodenum, and 15 days later a type C pancreatic fistula appeared, and it was resolved with percutaneous management. Another patient showed severe acute pancreatitis with acute necrotic collection of the total pancreatic tissue after the surgical management, and for this reason, he was taken to an open necrosectomy, and passed away afterward. One patient presented a splenomesenteric thrombosis. In two patients a negative pressure therapy was used.

Among the total of patients who underwent minimally invasive surgery, three had an intraoperative injury diagnosis, a primary closer was performed, and active drainage was left in place. In three patients no macroscopic injury or obvious leak was found, and therefore, washing and placement of active drainage was considered. A patient required conversion to open surgery due to loop distension and open abdomen management.

Surgical outcomes, such as complications and mortality, are shown in Table 3.

Discussion

Complications secondary to ERCP, such as pancreatitis (4.3%), bleeding (1.9%), infections, and

Table 3. Surgical outcomes

	Open surgery (n = 6)	Laparoscopic surgery (n = 7)
Duodenal fistula	2 (33.3%)	0 (0%)
Biliary fistula	3 (50%)	1 (14.2%)
Global hospital stay	33 days	10.7 days
Intensive care stay	14.8 days	4.2 days
Mortality	3 (50%)	0 (0%)

perforations of the digestive tract were described, and among these DP has a maximum incidence of 1.8%^{3,8,9}, as reported by Peñaloza, et al.¹⁰ in a study performed in our local population, where an incidence of 1.3% was found. However, in our study the incidence was 3.8%, and therefore, we believe that it was associated with the presence of gastroenterologists in training. However, type IV PDs were more frequent with a high response rate to medical management and a lower mortality rate.

There are different predisposing factors that increase the probability of a DP, such as anatomical alterations of the biliary duct (stenosis of the biliary duct and dysfunction of the Oddi sphincter) and Billroth II gastrectomy and Roux-in-Y. In addition, factors related to ERCP also influence, such as the length of the sphincterotomy and the sphincterotome management^{5,6,11,12}, and non-modifiable factors, such as being a young woman⁹, as evidenced in our study, where 75% were women and 60.7% were younger than 55.

Stapfer et al.⁶ classify DPs in four types according to their location. Retuerta, et al.¹¹ describe an incidence of 80% of type I and II injuries, but in our study type III and IV injuries were predominant, with a total of 82.1%.

Mortality in patients of conventional surgery in our study was 23.08%, similar to other studies that report 8-23%, due to sepsis and multiple organ failure^{4,5,12}. Koc, et al.¹ find a mortality for the management with laparoscopic surgery in post-ERCP DPs among six people managed with this approach, especially in a total of 28 patients. In our series, the group with minimally invasive surgery had a mortality rate of 0%. However, we have not found in the literature studies with epidemiology weight that compares laparoscopic surgery with the results of open surgery in this pathology.

The suspicion of a DP is based on the physical exam and paraclinical and imaging findings. The patient can

present an incoercible abdominal pain, signs of peritoneal irritation, fever, elevated C-reactive protein and leukocytes. However, these findings are very unspecific and must be supported by diagnostic imaging⁶.

The thorax radiography can show pneumoperitoneum with a sensitivity of 50-90%, but it is unable to show the location of the perforation with certainty in most cases^{6,13}. An abdominal ultrasound can identify intraperitoneal or retroperitoneal free air, and the formation of abscesses. The CT is the most sensitive method for patients with suspected intestinal perforation, with a specificity of 82-90%, as it allow to observe if there is an extravasation of the contrast medium, collections, or neumoretroperitoneum^{5,13,14}. In our study, all patients had a contrasted abdominal CT scan as a diagnostic method, and the most common finding was the pneuroretroperitoneum.

The confirmation of the diagnosis of these injuries can be done intraoperatively, through direct observation, or through extravasation of the contrast fluid evidence in postsurgical imaging¹⁵.

In a systematic review published in 2017, with 259 articles, it was found that patients who underwent surgery late presented an increase in the complexity of the procedure and a higher mortality rate². In our study, the average diagnostic time was 1.2 days. In contrast, patients who passed away had a diagnostic time higher than 3 days. This is consistent with what was reported by Cirocchi, et al.², who highlight the importance of an early diagnosis and management of PDs in order to reduce associated complications and the risk of mortality². Furthermore, all patients treated successfully with conservative medical management were diagnosed within the first 24 hours after the ERCP.

The low prevalence of DP makes it difficult to reach a consensus for its management¹. Four types of management have been proposed: open, laparoscopic, endoscopic, and conservative. However, this depends on factors such as the type of DP, presence of free air or air in the peritoneal cavity, the clinical condition of the patients, the experience of the treating group, and the availability of resources in the hospital¹⁵⁻¹⁷.

Type I DP is usually a large injury, which has an initial surgical management. Some surgeons perform endoscopic repairs, as its diagnosis is generally intraoperative, depending also on patient conditions and the availability of technology. In our environment, not all institutions have this type of resources, and therefore the use of this technique is not very frequent^{2,5}.

Type II DPs can have a medical management associated with an endoscopic biliary *stent*, depending on

the hemodynamic stability and the time after the ERCP. However, the clinical deterioration of the patient is indication for surgical management and not the response to medical management¹². A late diagnosis increases the possibility of infection and the friability of the tissue, which makes surgical repair of the perforation difficult³.

Type III DPs are related to the instrumentation used in the biliary duct, and in them surgery is recommended when there are large collections of retroperitoneal fluid, even though they can be resolved spontaneously or with percutaneous drainage, and do not require surgical management¹⁵. In our study, we had four patients with this type of DP, and three of them were managed with laparoscopy, and one with conventional surgery, with a mortality of 25% and complications of 50%.

Type IV DPs are generally due to the use of compressed air in the upper gastrointestinal tract. In them, no surgical management is used, as long as the patient does not have signs of peritoneal irritation, incoercible abdominal pain, or development of persistent systemic inflammatory response¹⁵. The decision to perform surgery in this type of patients must be based on the individual evolution of each patient. In our study, we had four patients with this type of DP, and three of them were managed with laparoscopy, and one with conventional surgery, with a mortality of 0% and without complications.

In our study, type III and IV DPs were surgically managed, as the initial medical management failed.

On the other hand, the use of a biliary *stent* in DPs as adjuvant management, and a better outcome in these patients has been shown, as the *stent* prevents the biliary leak to the retroperitoneum, achieving a treatment performance rate of up to 100%, as shown by the literature¹⁸.

In our study, 53.8% of cases plastic biliary *stents* were used. The use of *stents* was associated more to the laparoscopic approach, in 71.4% of cases. This finding makes us think that the use of a biliary *stent* can be related to the decrease of mobility in this group of patients: however, we must take into account that patients managed by laparoscopy were in a better physical condition than those managed with open surgery.

Patil, et al.¹⁷ conducted a retrospective study for a period of 12 years, evaluating the morbidity and mortality according to the surgical technique. They compared the primary repair plus drainage by laparoscopy to the pyloric obstruction, and they found a lower mortality rate in the laparoscopic surgery group than in the open surgery group. Furthermore, in our study a higher mortality rate was shown in patients with pyloric obstruction

plus gastrojejunal anastomosis ($n = 3$). In addition, the average hospital stay was longer in patients with open surgery (33 days) than in those with laparoscopic surgery (10.7 days). This can be explained because patients with conventional surgery had a more severe clinical deterioration, determined by hemodynamic instability or septic *shock*, among others, which indicates that not all patients are candidates to laparoscopy and must be adequately selected.

It is worth noting that the literature does not report the association of pancreatitis with post-ERCP DP; however, all our patients showed a multifactorial origin complication. La European Society of Gastrointestinal Endoscopy states that risk factors associated with ERCP to develop pancreatitis are being a young woman, having a biliary duct of normal caliber, cannulations of more than 10 minutes, sphincterotomy or precut, dilation of the sphincter with balloon, and failed removal of calculus, among others¹⁹.

Despite the results, our study is limited, because it is retrospective, by a selection bias, and on the other hand, by the reduced number of patients related to the low incidence of the condition in addition to the availability and experience in laparoscopy of surgeons who participate in the study. The endoscopic approach was not used for the direct closure of DPs, as our institutions did not have this resource (endoclips).

Although the post-ERCP incidence of DP has a low percentage, its early diagnosis and management significantly reduce negative outcomes. Both open surgery and laparoscopy are feasible tools for the management of post-ERCP DP; however, the selection of the procedure will depend on the clinical condition of the patient. An early diagnosis and adequate clinical condition allow for a minimally invasive surgery, while a late diagnosis is associated with a severe clinical condition and the selection of open surgery with possible damage control. Similarly, comorbidity, surgeon experience and availability of resources have influence.

Ethical disclosures

Protection of People and Animals. The authors state that no experiments have been conducted in humans or animals for this research.

Data Confidentiality. The authors state that the protocols of their work center regarding the publication of patient data have been followed.

Right to privacy and informed consent. The authors state that no patient information appears in this article.

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Conflicts of interest

The authors state that they do not have any conflicts of interest.

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