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Management of Complications of Digestive Endoscopic Procedures: A Review

Ruiz-Tovar J*

Department of Health Sciences, Comillas Pontifical University, Spain

***Corresponding authors:** Jaime Ruiz Tovar, Department of Health Sciences, San Juan de Dios School of Nursing and Physical Therapy, Comillas Pontifical University, Madrid, Spain, Email: jruiztovar@gmail.com

Review Article

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Abstract

Endoscopic procedures are currently a fundamental tool in the diagnosis and treatment of numerous digestive pathologies. They form part of the minimally invasive management of many pathologies, avoiding numerous surgeries. However, as they are invasive procedures, they are not exempt from suffering complications, which must be identified early on in order to be able to carry out the most appropriate treatment.

The most frequent complications include bleeding and perforations after upper gastrointestinal endoscopies, colonoscopies and endoscopic retrograde cholangiopancreatography (ERCP), but also pancreatitis, hepatic and splenic injuries, among others. In many cases, these complications can be managed endoscopically or with minimally invasive percutaneous therapeutic options, but in other cases emergency surgery is mandatory

Keywords: Complications; Endoscopic Procedures; ERCP; Upper Gastrointestinal Endoscopy; Colonoscopy

Abbreviations: ERCP: Endoscopic Retrograde Cholangiopancreatography; UGE: Upper Gastrointestinal Endoscopy; CBD: Common Bile Duct.

Introduction

Endoscopic procedures are currently a fundamental tool in the diagnosis and treatment of numerous digestive pathologies. They form part of the minimally invasive management of many pathologies, avoiding numerous surgeries. They can be performed under sedation and their effectivity is very high in experienced hands. However, as they are invasive procedures, they are not exempt from suffering complications, which must be identified early on in order to be able to carry out the most appropriate treatment. In this manuscript we will review the complications of the most frequently performed endoscopic digestive procedures [1].

Upper Gastrointestinal Endoscopy (Uge)

Complications of UGE include those arising from diagnostic and therapeutic manoeuvres, as well as from sedation during the procedure. The overall complication rate is estimated to be around 0.13%, with a mortality rate of 0.004%, which doubles when therapeutic manoeuvres are performed [1].

Bleeding

Bleeding is very rare after purely diagnostic procedures, but increases with therapeutic manoeuvres such as oesophageal dilatation, percutaneous gastrostomy or endoscopic mucosal resection. Clinically, it may manifest as haematemesis or melena after the procedure. Management should be identical to that of any upper gastrointestinal haemorrhage. Haemodynamic stability should be ensured

first. Fluid resuscitation should be initiated and the patient should be placed on an absolute diet. In case of severe anaemia, blood products should be transfused [1,2].

Once haemodynamic stability is assured, and if there is a history of recent gastrointestinal endoscopy, the endoscopy should be repeated for diagnostic and therapeutic purposes. After aspiration of the haematic contents of the gastric cavity and identification of the bleeding site, a therapeutic approach to control the bleeding should be taken, which may consist of electrocoagulation or argon, clip placement or sclerosis of the bleeding vessel, associated or not with adrenaline injection. More advanced methods may include endoscopic pursestring suturing [3].

Associated with endoscopic procedures, treatment with Proton Pump Inhibitors (PPIs) is recommended. PPIs are mainly indicated for ulcerative gastrointestinal bleeding, but it has been shown that in bleeding of other aetiology, the neutralisation of gastric acid favours the formation of clots on bleeding lesions. Prokinetics (erythromycin and metoclopramide) can be used before repeat endoscopy. They promote gastric emptying and thus facilitate visualisation of the bleeding site in a cavity filled with blood.

In case of failure of endoscopic treatment, angiography with selective embolisation of the bleeding vessel may be chosen. Surgery remains as a last chance, when all previous measures have failed. The approach will vary depending on the location of the bleeding site, but may range from suturing of the bleeding bed, ligation of the tributary blood vessel to the bleeding region, to segmental resection of the gastrointestinal tract [4].

Perforation

UGE is the main cause of oesophageal perforation. It is especially frequent in oesophageal dilatation manoeuvres or in patients with oesophageal diverticula. The risk of perforation varies from 0.03% at diagnostic UGE to 6% after pneumatic dilatation in achalasia [1,3,5].

Oesophageal perforation is a surgical emergency, as extravasation of oesophageal and gastric contents into the mediastinum can lead to sepsis, multi-organ failure and ultimately death. Initial management should include bowel rest and broad-spectrum antibiotic therapy, as well as transfer to an ICU for haemodynamic monitoring [5].

The surgical treatment of choice is primary repair, but this is only possible if diagnosed within 24 hours. After this time and when there is a large amount of devitalised tissue around the perforation, the best alternatives may be to place a mediastinal drain and, in extreme cases, with haemodynamic instability or technical impossibility to repair the perforation, to associate it with oesophageal exclusion with lateral cervical oesophagostomy and gastrostomy or feeding jejunostomy. An alternative could be to use a pedicled flap, mainly made of intercostal muscle, to plug the perforation in favourable cases where primary repair of the perforation is not possible. Perforations in the cervical oesophagus have a better prognosis and often close spontaneously, requiring cervical drainage only. Perforations in the abdominal oesophagus are repaired by dissection of the oesophageal hiatus, suturing of the perforation and fundoplication as a patch to reinforce the suture.

When there is no extensive mediastinal contamination, a therapeutic alternative in thoracic oesophageal perforations may be the placement of a stent graft. Sometimes stenting can be combined with simple surgical drainage of the mediastinum [6].

As mentioned above, drainage as the sole treatment is feasible for cervical oesophageal perforations, but not for thoracic or abdominal perforations, where it is necessary to seal the leak to prevent the spread of fluid to adjacent spaces.

In very selected cases, with haemodynamically stable patients, with small perforations, diagnosed during endoscopy, without signs of systemic inflammation and with minimal extravasation of intraluminal contents (absence of liquid collections on CT), conservative treatment could be considered, exclusively with bowel rest and antibiotherapy. These patients require very close clinical and analytical monitoring, and at the slightest sign of poor outcome, more aggressive management should be considered.

Despite early diagnosis and treatment, oesophageal perforation is associated with a high mortality rate of up to 20% in iatrogenic perforations after endoscopy. Depending on the site of perforation, the worst prognosis is shown by thoracic perforations, with a mortality of up to 35%, followed by intra-abdominal perforations (30% mortality) and cervical perforations (up to 6% mortality). It is estimated that when the diagnosis of perforation is made after the first 24 hours, the associated mortality rate doubles [3,5].

Infection

The risk of infection following UGE is very low, although cases of hepatitis B or C transmission have been reported, as well as bacterial infections, all of which are related to instrument disinfection problems [4].

Colonoscopy

The risk of complications following colonoscopy is low, with an incidence of up to 0.28%. More than 85% of complications occur during polypectomies. The perforation

rate is estimated at 0.05% and the bleeding rate at 0.26%, with a mortality rate of 0.007%. Although these are very safe procedures, the high number of scans performed means that these complications are relatively frequent in a hospital emergency [7]. The risk of colonoscopy depends on several factors, being higher in older patients and those with cardiopulmonary comorbidities.

Complications Related to Sedation

Cardiopulmonary complications are the most frequent. To reduce them, a pre-anaesthetic assessment to evaluate the risk is advised, as well as adequate monitoring during and after the procedure [7].

Complications Related to Preparation

The intestinal preparation may cause adverse effects such as water and electrolyte disturbances, nausea or vomiting, abdominal distension or bronchopulmonary aspiration [7].

Bleeding

Bleeding is usually associated with polypectomies and is rare after diagnostic colonoscopies. After polypectomy, the incidence of bleeding is estimated to be as high as 2% and increases with resection of larger polyps, in thrombopenic patients or in patients with coagulopathies.

Other therapeutic manoeuvres more frequently associated with bleeding are stricture dilatations and endoscopic mucosal resection.

Post-polypectomy bleeding can be immediate or delayed. In cases of immediate onset, they are usually diagnosed during the procedure and treated by endoscopic methods (clips, electrocautery, adrenaline injection) [7,8].

Delayed bleeding usually occurs several days after colonoscopy. They are thought to be due to the detachment of an scar plugging a blood vessel. They usually manifest as rectorrhagia, haematochezia or melena. A new colonoscopy is usually able to control the haemorrhage. If the bleeding point cannot be identified or the bleeding cannot be controlled, arteriography and selective embolization of the bleeding vessel is indicated, although after these procedures the patient must be kept under close surveillance due to the risk of segmental ischaemia of the colon whose territory has been embolized. In this case, the patient would then be destined to undergo segmental resection of the ischaemic segment of the colon. In case of failure of radiological embolization, the last option would be blind colonic resection of the colon territory where the polypectomy was performed. The main problem is that the exact location of the bleeding site for segmental resection is often not known, resulting in extensive and unnecessary colonic resections and even total colectomies [9].

Perforation

Perforations occur due to:
- Excessive insufflation pressure (usually in the cecum).
- Direct trauma of the colonoscope on the colon wall (usually in the rectum-sigmoid)
- Electrocautery during polypectomy

The risk of perforation varies from 0.01% in diagnostic colonoscopies to 18% during dilatation of strictures in patients with Crohn's disease. Because of the mechanism of injury, perforations during diagnostic procedures are typically long, while those during polypectomies are punctate. Mortality from iatrogenic perforations can be as high as 0.65% according to different series. Risk factors for mortality are advanced age, presence of comorbidities, colonic obstruction and resection of polyps larger than 1cm. Sedation or general anaesthesia has been shown to increase the risk of perforation and mortality due to increased endoscopic aggressiveness and delayed or inadvertent diagnosis of perforation during the procedure. Inexperience is also obviously a risk factor for complications. Mechanisms to reduce the risk of perforation have been described, such as submucosal fluid infiltration to elevate the lesion to be resected, not dilating areas with inflammatory signs, and minimising air insufflation during stent placement [10].

Symptoms resulting from perforation depend on the size of the perforation as well as the degree of faecal contamination of the peritoneum. The typical symptom is abdominal pain, although fever, nausea or vomiting, chest pain, scapular or neck pain may occur. This occurs in peritoneal perforations. However, perforations in the right colon, hepatic and splenic flexures or distal rectum may be retroperitoneal and have asymptomatic or minimal symptoms.

Although perforation can be confirmed in many cases by plain chest and abdominal radiographs, showing pneumoperitoneum, pneumothorax, pneumomediastinum or subcutaneous emphysema, the test of choice is abdominal CT with water-soluble contrast. This test is particularly diagnostic in retroperitoneal perforations [9,10].

Management of Colonic Perforations

Apart from the initial supportive measures (fluid therapy, bowel rest and broad-spectrum antibiotic therapy), the patient must be evaluated by a surgeon. Surgical treatment

is usually required in most cases, although there are cases of small perforations, with the colon prepared, with minimal extravasation of colonic contents and often located in the retroperitoneum, which can be managed conservatively, with clear clínical improvement within 24 hours.

Occasionally, if the perforation is perceived during the procedure, endoscopic clip placement may be attempted to close the perforation, but if the diagnosis is delayed, further colonoscopy is contraindicated.

In patients who show no improvement after 24 hours of conservative treatment or with diagnosed colonic lesions that will require surgical resection, surgical treatment is mandatory.

Currently, the surgical approach to perforation can be performed laparoscopically, with primary suturing of the perforation, lavage of the cavity and placement of drainage. In case of concomitant lesions that are candidates for surgical resection, such resection will be performed during emergency surgery. If there is no major faecal contamination (which does not usually occur because the colon is mechanically prepared for endoscopy) and the patient's haemodynamic conditions permit, a primary anastomosis may be performed[7-10].

Endoscopic Retrograde Cholangiopancreatography (ERCP)

ERCP is a therapeutic and diagnostic endoscopic procedure, where a side-view endoscope is used, introduced into the duodenum and allows cannulation of the bile and pancreatic ducts. It is a technically complex procedure, which requires a long learning curve and is associated with several serious complications. The overall complication rate is estimated to be as high as 12% with a mortality rate of 1.4% [11-13].

As with all endoscopic procedures, the complication rate is higher when therapeutic manoeuvres are performed than when the test is simply diagnostic. Nowadays, the diagnostic usefulness of ERCP has been drastically reduced with the development of magnetic resonance cholangiography and the procedure has been left almost exclusively for therapeutic purposes.

Most ERCP complications arise from sphincterotomy (section of the sphincter of Oddi), which is the most commonly performed procedure in therapeutic ERCP. Simple sphincterotomy already implies a complication rate of 10% and a mortality rate of 0.5%. Sphincterotomy is associated with a 3% risk of haemorrhage, a 1% risk of perforation and a 5% risk of pancreatitis [13-16].

Pancreatitis

Post-ERCP pancreatitis is one of the most feared complications of ERCP and is associated with a high mortality rate. It occurs during sphincterotomy and manipulation of the common bile duct (CBD). Sometimes, during the cannulation of the CBD, repeated cannulation of the duct of Wirsung occurs and, as a result of these traumas, inflammation and stenosis of the pancreatic duct occurs, with the consequent difficulty of drainage of pancreatic secretion into the gastrointestinal tract and autodigestion of the gland. For this reason, and in an attempt to avoid the risk of pancreatitis, many endoscopists choose to place a prosthesis in the duct after repeated manipulation of the pancreatic duct in an attempt to avoid obliteration of the duct [12,17].

The incidence of post-ERCP pancreatitis can be as high as 15% and up to 1% of cases will develop severe pancreatitis. Factors associated with its occurrence are inexperience of the endoscopist, sphincter of Oddi dysfunction, difficult cannulations and therapeutic ERCP (rather than purely diagnostic, possibly due to sphincterotomy or multiple cannulations of the papilla prior to sphincterotomy). Post-ERCP pancreatitis is also more frequent in women, young patients and patients with normal bilirrubin values and, therefore, without CBD dilatation [17].

Post-ERCP pancreatitis manifests clinically like pancreatitis of other aetiology. The main symptom is usually abdominal pain in the epigastrium and right hypochondrium, radiating to the back. Fever, nausea and vomiting, sweating and, in severe cases, haemodynamic instability may also occur as a result of the systemic inflammatory response syndrome that develops.

Diagnosis is confirmed by laboratory elevation of amylase and lipase (elevation of amylase levels more than 3 times their normal level and maintained for at least 24 hours), accompanied by typical symptoms. An isolated elevation of amylase and lipase is normal in up to 75% of cases after ERCP and does not imply the development of acute pancreatitis. Abdominal CT is the imaging test of choice to assess pancreatic gland involvement and is also of prognostic value. There are different severity scales (APACHE II, Ransom, SOFA) that determine the prognosis of pancreatitis [13-17].

Management is similar to that of pancreatitis due to another aetiology, with initial supportive measures. Most cases are mild pancreatitis that resolve with fluid therapy, bowel rest and analgesia within a few days. However, more severe cases may require ICU admission and enteral and parenteral nutrition. The use of antibiotic therapy is controversial. In case of progression to pancreatic necrosis

and infection of the pancreas, drainage of the pancreas is required, as in acute pancreatitis of other aetiology [14-17].

Bleeding

Bleeding after ERCP is a consequence of the sphincterotomy. After ensuring haemodynamic stability and initiating the support measures explained above for bleeding after upper endoscopy, the endoscopy should be repeated to identify the bleeding site. Once located, attempts are made to control the haemorrhage by electrocoagulation or with argon, placement of clips over the bleeding bed or sclerosis of the vessel, all associated with the injection of adrenaline [11-14].

In case of failure of endoscopic treatment, selective embolization of the bleeding vessel by angiography may be attempted. Surgery must be preserved as the last treatment option. This will require a wide Kocher manoeuvre, duodenotomy to identify the papilla and suture the bleeding site, with or without ligation of the gastroduodenal artery and tributary pancreaticoduodenal vessels. If this is not controlled, ampulectomy and in extreme cases even pancreaticoduodenectomy may be necessary [16].

Infection

Cases of infection after ERCP are usually due to manipulation of an obstructed bile or pancreatic duct, leading to cases of acute cholangitis. Cholangitis can also occur due to migration of micro-organisms from the gastrointestinal tract into the CBD. In these cases, sphincterotomy or, if necessary, stenting allows drainage and control of the primary focus, which, in addition to broad-spectrum antibiotic therapy, is the standard management of CBD infection. If drainage of the focus cannot be achieved endoscopically, percutaneous drainage of the CBD via the transparietohepatic route should be considered, leaving surgical drainage with biliodigestive bypass (choledocho-duodenostomy, hepatic-jejunostomy) as the last option [15,16].

Duodenal Perforation

Perforations after ERCP can be retroperitoneal duodenal perforations due to periampullary lesions, intraperitoneal perforations of the free wall, or of the bile duct and pancreatic duct. Duodenal retroperitoneal perforations are the most common (about 70% of perforation cases) and usually result from a sphincterotomy extending beyond the intramural portion of the bile duct. Perforations of the bile or pancreatic ducts are often associated with dilatation, stenting or injury during guidewire manipulation [18]. The incidence of retroperitoneal duodenal perforation ranges from 0.5-2% of procedures performed and may be associated with a mortality of up to 0.1%.

Clinical manifestations vary depending on whether the perforation is intraperitoneal or retroperitoneal. Intraperitoneal perforations are usually diagnosed earlier. The patient starts with abdominal pain and distension with signs of peritonism. It is true that free bowel perforations are usually diagnosed during the procedure, whereas retroperitoneal perforations are in 90% of the cases, diagnosed at a later stage by CT scan when retroperitoneal air is observed. The patient with retroperitoneal perforation will show less abdominal pain, sometimes lumbar pain, but usually begins with fever hours after the procedure and the blood tests show marked leukocytosis. CT findings are diagnostic. There are cases of retroperitoneal perforations that manifest as pneumothorax, pneumomediastinum, subcutaneous emphysema or even portal pneumatosis [19].

Although both pneumoperitoneum in free perforation and retropneumoperitoneum in retroperitoneal perforation can be seen on plain abdominal X-ray, abdominal CT is the test of choice for the diagnosis of perforation. The amount of free air observed does not reflect the size of the perforation, but rather the endoscopic manipulation once the lesion has occurred. The mere presence of retropneumoperitoneum in the absence of symptoms is not indicative of perforation. These radiological findings have been reported in up to 30% of ERCPs, as after colonoscopy. It is not known whether this finding is a consequence of plugged microperforations or is simply air extravasation under pressure from an intact bowel [11,12,18,19].

Duodenal pneumatosis is a localized accumulation of air in the duodenal wall and has been described after endoscopic sphincterotomy. If identified during the procedure, it should be terminated immediately because of the risk of frank duodenal perforation.

Initial management of duodenal perforation should include bowel rest, nasogastric tube and broad-spectrum antibiotic therapy. Free perforation to the peritoneum usually requires surgical treatment, while retroperitoneal perforations can be managed conservatively. Surgical management usually consists of suturing the perforation, lavage and drainage. When the perforation involves the bile duct, surgical management is complicated, sometimes requiring biliary bypass, which, depending on the location of the perforation, can range from choledochojejunostomy to pancreaticoduodenectomy.

Sometimes, when perforation is diagnosed during the performance of the procedure, endoscopic treatments such as clip placement, pursestring suture of the perforation, stent placement or application of biological glues may be

attempted [18,19]. Duodenal perforation is a very serious complication that can have mortality rates of up to 13%.

Bleeding after Splenic Trauma

Intraperitoneal bleeding from these lesions has been reported. Splenic injury is more frequent after colonoscopy, but has also been described after upper gastrointestinal endoscopy and ERCP. Previous abdominal surgeries with adhesion formation have been described as factors involved in the genesis of these traumas. The severity of splenic trauma varies from subcapsular haematoma to avulsion of the splenic vessels. The genesis of splenic injury may be torsion of the gastric greater curvature. Except in cases of contained subcapsular haematomas, splenic injuries usually require urgent surgery and often splenectomy [20].

Impaction of the Stone Extraction Baskets and Breakage of the Metal Guides

The most frequent impaction of the Dormia basket occurs in the intraduodenal portion of the ampulla, although there are reported cases of impaction in the intrapancreatic portion of the CBD and in any other segment of the bile duct, including even the gallbladder. The risk of entrapment increases with large stones and when small sphincterotomies are performed. Once entrapment has occurred, the first manoeuvre to be performed is mechanical lithotripsy of the stones. If the guidewire fails or breaks, insertion of a new Dormia basket can be tried. Other non-surgical methods include increasing the size of the sphincterotomy or using an extracorporeal choledochoscope with a lithotripsy wave. If still unresolved, surgery with duodenotomy and sphincterotomy should be considered to remove the trapped material [20,21].

Complications Associated with Biliopancreatic Stents

The main long-term complication of plastic stents is occlusion. However, in the immediate post-placement period, pancreatitis may occur; biliary stenting is a risk factor for developing post-ERCP pancreatitis. Other complications may include migration into the retroperitoneum or intrahepatic bile duct, and stent rupture. In these cases it is usually possible to reposition or remove the stent without problems. The stent itself can generate excessive pressure on the duodenal wall, leading to necrosis and perforation.

Stents can also migrate through the gastrointestinal tract, distal to the duodenum. Cases of obstruction, perforation and intestinal and colon fistula formation secondary to migration of stents placed for the treatment of choledocholithiasis have been reported.

Although complications described with metallic stenting are minor, stents can also occlude, become impacted, migrate or cause intestinal and biliary perforations.In most cases of intestinal obstruction and perforation by stents, treatment is surgical, usually consisting of intestinal resection of the affected segment and primary anastomosis [20,21].

Guide-Related Injuries

Injuries related to guidewire manipulation are very rare. Cases have been described of perforation of the hepatic and pancreatic parenchyma with the guidewire, causing haematomas and subcapsular biliomas. Management of these cases is usually conservative, with observation and antibiotherapy to avoid superinfection and abscess formation, given that the guidewire comes from the gastrointestinal tract and is contaminated [20,21].

Biliary Ileus

Although rare, cases of biliary ileus have been reported in the absence of cholecystoduodenal fistula and therefore secondary to sphincterotomy. Ileus usually occurs late, due to smaller stones than classic biliary ileus, but which accumulate, predominantly at the level of the ileocaecal valve, and cause an obstructive condition. Treatment is usually surgical with enterotomy and removal of the stones, as well as cholecystectomy to prevent further stone migration [20,21].

Conclusion

An increasing number of digestive endoscopies are performed, not only for diagnostic purposes, but more and more interventional procedures are being carried out as part of the therapeutic options for pathologies of the gastrointestinal tract. As a result, endoscopic procedures are becoming increasingly complex and this carries a higher risk of complications. Currently, many complications arising from these endoscopic procedures can also be resolved endoscopically, such as sclerosis in cases of post-interventional bleeding, and clip placement or endoscopic suturing in the case of perforations. However, these approaches are technically complex and are not available to less experienced endoscopists. Moreover, sometimes these endoscopic approaches are not technically possible or fail. Therefore, it is important that both endoscopists and surgeons are aware of the complications that may arise from these endoscopic procedures in order to be able to manage these pathologies appropriately according to the circumstances of each patient.

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