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## Endoscopic retrograde cholangiopancreatography (ERCP): outcomes of 3136 cases over 10 years

Sabri Selçuk ATAMANALP<sup>1</sup>, Mehmet İlhan YILDIRGAN<sup>1</sup>, Abdulmecit KANTARCI<sup>2</sup>

**Aim:** Endoscopic retrograde cholangiopancreatography (ERCP) has an important place in the diagnosis and treatment of hepatobiliary and pancreatic diseases. This study discusses the outcomes of 3664 ERCPs in 3136 patients over the course of 10 years.

**Materials and methods:** The records of 3664 ERCPs of 3136 patients, performed between January 2000 and January 2010, were retrospectively evaluated.

**Results:** The age range was 4-94 years (mean: 55.1 years), and 1816 patients (57.9%) were female. The most common indication was the presence of obstructive jaundice and/or a high serum bilirubin level (2289 patients, 73.0%). The average ERCP duration was 16.5 min (range: 5-45 min). A repeat ERCP was needed in 528 patients (16.8%), and cannulation was successful in 2965 patients (94.5%). Endoscopic sphincterotomy was performed in 2797 patients (89.2%), biliary balloon application in 2768 (88.3%), and stone extraction in 2231 (71.1%). Complications occurred in 118 patients (3.8%), and the most common complication was acute pancreatitis (54 patients, 1.7%). In this series, 5 patients (0.2%) died.

**Conclusion:** Despite its associated morbidity and risk of mortality, ERCP is a reliable method in diagnosing and treating hepatobiliary and pancreatic diseases.

**Key words:** Endoscopy, endoscopic retrograde cholangiopancreatography, general surgeon

### Endoskopik retrograd kolanjiyopankreatografi (ERCP): 10 yılda 3136 olgunun sonuçları

**Amaç:** Endoskopik retrograd kolanjiyopankreatografi (ERCP) karaciğer-safra sistemi ve pankreas hastalıklarının tanı ve tedavisinde önemli bir yere sahiptir. Bu çalışma, 10 yıllık bir sürede 3136 hastada uygulanan 3664 ERCP'nin sonuçlarını tartışmaktadır.

**Yöntem ve gereç:** Ocak 2000-Ocak 2010 arasında 3136 hastada yapılan 3664 ERCP'nin kayıtları retrospektif olarak değerlendirildi.

**Bulgular:** Yaş dağılımı 4-94 arasındaydı (ortalama 55,1 yıl) ve 1816 hasta (% 57,9) kadındı. En sık endikasyon tıkanma sarılığı ve/veya yüksek serum bilirübin düzeyi varlığıydı (2289 hasta, % 73,0). Ortalama ERCP süresi 16,5 dakikaydı (dağılım: 5-45 dakika). Tekrarlanan ERCP 528 hastada (% 16,8) gerekti ve kanülasyon 2965 hastada (% 94,5) başarılıydı. Endoskopik sfinkterotomi 2797 hastada (% 89,2), biliyer balon uygulaması 2768'inde (% 88,3) ve taş çıkarılması 2231'inde (% 71,1) uygulandı. Komplikasyon 118 hastada (% 3,8) ortaya çıktı ve en sık komplikasyon akut pankreatitti (54 hasta, % 1,7). Bu seride 5 hasta (% 0,2) öldü.

**Sonuç:** Morbidite ve mortalitesine rağmen ERCP, karaciğer-safra sistemi ve pankreas hastalığının tanı ve tedavisinde güvenilir bir yöntemdir.

**Anahtar sözcükler:** Endoskopi, endoskopik retrograd kolanjiyopankreatografi, genel cerrah

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## Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) is a useful technique for the diagnosis and treatment of hepatobiliary and pancreatic diseases (1,2). Despite technological progress, ERCP is associated with several complications, including pancreatitis, hemorrhage, perforation, cholangitis, and cardiopulmonary events, that occur in up to 10% of patients. ERCP has a mortality rate of up to 1% (2).

Although ERCP usually falls within the domain of gastroenterologists, it can be performed safely by trained surgeons (3). The purpose of this study was to discuss the outcomes of 3664 ERCP procedures performed in a general surgery department on 3136 patients over 10 years.

## Materials and methods

In the General Surgery Department of Atatürk University Medical School, 3664 ERCPs were performed on 3136 patients by general surgeons between January 2000 and January 2010. The records of the patients were retrospectively reviewed for age and gender, indications for ERCP, duration of the procedure, success of ERCP, type and number of additional therapeutic endoscopic procedures, and associated morbidity and mortality of ERCP and other endoscopic procedures.

After a 6- to 8-h starvation period, 5 mg of midazolam (Dormicum) and 30 mg of pethidine (Aldolan) were administered intravenously before ERCP, and additional doses were applied when needed. All patients were followed with pulse oximetry during the procedures.

The following devices were used for ERCP and other endoscopic procedures: Olympus TJF 240, Storz 13881 PKS, Fujinon ED 450 XT 5 flexible duodenoscopes, Olympus UES-10, and Storz Autocon 50 electrocauters, with various ERCP catheters, sphincterotomes, balloons, lithotripters, forceps, and coagulation electrodes. All procedures were performed by trained general surgery professors.

The outpatients who underwent diagnostic ERCP were discharged after a 4- to 6-h follow-up, and the patients who underwent additional endoscopic therapeutic procedures were hospitalized for 1 day.

The patients were told to call if any problems occurred. Patients with complications were hospitalized, and the appropriate medical and/or surgical treatments were performed.

## Results

The age range of the patients was 4-94 years (mean: 55.1 years). Of 3136 patients, 1816 (57.9%) were female, and 1320 (42.1%) were male.

The most common indications for ERCP were the presence of obstructive jaundice and/or high serum bilirubin level in 2289 patients (73.0%), high serum cholestatic enzyme levels without obstructive jaundice in 1052 patients (33.5%), and choledochal stones in 997 patients (31.8%) (Table 1). At least 1 of the serum cholestatic enzyme levels (AST, ALT, GGT, or ALP) was high in a total 2951 patients (94.1%).

The average ERCP procedure duration was 16.5 min (range: 5-45 min). ERCP was performed once in 2608 patients (83.2%), twice in 440 (14.0%), and 3 times in 88 (2.8%); therefore, there were a total of 3664 ERCPs performed in 3136 patients. Cannulation was successful in 2965 patients (94.5%) and impossible in 171 patients. The most common causes of unsuccessful cannulation were patient intolerance and premedication problems ( $n = 53$ , 31.0%) (Table 2). Precut sphincterotomies were needed in 465 patients (14.8%), 336 of which were needle-knife sphincterotomies, while the others were transpancreatic sphincterotomies.

Additional therapeutic endoscopic procedures were performed on 2913 patients (92.9%), including endoscopic sphincterotomy in 2797 patients (89.2%), biliary balloon application in 2768 (88.3%), biliary stone extraction in 2231 (71.1%), biliary stenting in 113 (3.6%) (nonmetallic stents in 110 cases and metallic stents in 3 cases; main indications: biliary leakage, biliary malignancy, or biliary stenosis), biliary basket lithotripter application in 78 (2.5%), and biliary or papillary dilatation in 27 (0.9%).

After excluding 910 patients (29.0%) with serum amylase level elevation, post-ERCP complications were seen in 118 patients (3.8%). The most common complication was acute pancreatitis, which was seen in 54 patients (1.7%) (Table 3). Additionally, 5 patients (0.2%) died. Causes of death included

Table 1. Indications for ERCP.

Indication	Patients*	%
Obstructive jaundice and/or high serum bilirubin level	2289	73.0
High serum cholestatic enzyme levels without obstructive jaundice	1052	33.5
Choledochal stone	997	31.8
Wide choledoch	301	9.6
Hepatic cyst (hydatid or alveolar)	182	5.8
Pancreatitis	159	5.1
Cholangitis	101	3.2
Pancreatic tumor	43	1.4
Biliary leakage	42	1.3
Papillary tumor	29	0.9
Choledochal or biliary tract tumor	17	0.5
Hepatic tumor	12	0.4
Pancreatic leakage	7	0.2
Choledochal cyst	6	0.2
Pancreatic cyst	2	0.1

\*In some patients more than one

Table 2. Causes of unsuccessful cannulation.

Cause	Patients	%
Patient intolerance or premedication problems	53	31.0
Stenosis of pylorus or duodenal bulbs	37	21.6
Presence of gastrectomy	28	16.4
Complete papillary obstruction	17	9.9
Presence of food in the stomach	14	8.2
Breaking down of the instruments	13	7.6
Papillary position abnormality	9	5.3
Total	171	100.0

perforation and peritonitis in 3 surgically treated patients and premedication problems in 2 patients.

## Discussion

ERCP is an important procedure for the diagnosis and treatment of hepatobiliary and pancreatic diseases. ERCP can provide direct visualization and

clear images of the hepatobiliary and pancreatic ducts. It also has diagnostic importance and therapeutic value for most diseases of these systems (1,2).

Cholestasis, with abnormal liver function or cholestatic tests, and cholestatic jaundice are common indications for diagnostic ERCP (4,5). Some authors describe ERCP as the gold standard for the diagnosis

Table 3. Complications of ERCP.

Complication	Patients*	%
Serum amylase level elevation	910	29.0
<2 times	568	18.1
>2 times	342	10.9
Acute pancreatitis	54	1.7
Surgical treatment requirement	17	0.5
Pseudocyst development	6	0.2
Bleeding	22	0.7
Transfusion requirement	3	0.1
Perforation	18	0.6
Surgical treatment requirement	10	0.3
Acute cholangitis	13	0.4
Surgical treatment requirement	5	0.2
Major premedication problems	11	0.4

\*In some patients more than one

of biliary obstruction because of the limited diagnostic yield of other modalities (4,6). Nevertheless, because less invasive diagnostic modalities are available, such as magnetic resonance cholangiopancreatography (MRCP), ERCP's role as the gold standard has been reevaluated (4). Currently, some authors use MRCP as their first choice; diagnostic ERCP is performed only when there is a suspected hepatobiliary-pancreatic disease in the absence of abnormal images. MRCP is performed to avoid unnecessary trauma in patients, and authors define ERCP as a safe, efficacious therapeutic procedure (1,7). Their use of ERCP is generally parallel to our practice.

Although ERCP is used successfully in the diagnosis of choledocholithiasis, the question of the best candidate for ERCP is still unresolved. Scaffidi et al. (6) showed a 28% false negative rate and an 11% false positive rate for MRCP in the diagnosis of choledochal stones. When combined with endoscopic sphincterotomy (ES), ERCP is the most likely primary treatment for choledocholithiasis (1,4,5), which is in agreement with our clinical experience with 2231 patients. ERCP/ES has

been shown to be highly effective in detecting and removing choledochal stones before laparoscopic cholecystectomy (8,9). ERCP helps to diagnose, and when combined with ES and/or biliary stenting to manage, postcholecystectomy residual choledochal stones and postoperative biliary complications such as bile duct injuries with bile leakage or stricture (10-13), which is compatible with our practice in 42 of the patients in this study. Although the role of ERCP in acute biliary pancreatitis remains controversial, ERCP is widely used both in the diagnosis and, when combined with biliary/pancreatic ES and/or stenting, the treatment of mild-moderate or severe gallstone-associated acute pancreatitis (14-17). ERCP is also used to diagnose and manage traumatic acute pancreatitis (18), which is in agreement with our application in 159 patients. ERCP is also used in the screening, diagnosis, preoperative evaluation, and palliative treatment of bile duct and pancreatic cancers (19-21), as was shown in 89 patients in the present study. Similarly, ERCP is utilized in patients with suspected biliary atresia, avoiding unnecessary surgical procedures in almost 25% of cases (22). ERCP is also used in the diagnosis and treatment

of hepatobiliary disorders, some of which include hydatid disease, alveolar echinococcosis, fascioliasis, hemobilia, biloma, and hepatic malignancies (23-27), as demonstrated in our practice in 200 patients. The indications of ERCP shown in our sample are similar to those reported in the literature.

Because most ERCP complications occur during the first 4-6 h (2,28), outpatient diagnostic ERCP is thought to be a feasible and safe approach (28). This was also true in the present study. On the other hand, average ERCP duration was reported as 18 min by Penalzoza-Ramirez et al. (2). A similar average duration of 16.5 min was determined in our study.

The overall success rate of ERCP has ranged from 79.6% (1) to 94.6% (2); this range is compatible with our success rate of 94.5%. On the other hand, precut sphincterotomy was used in 0.3% of patients by Huang et al. (1), 14.8% by Penalzoza-Ramirez et al. (2), and 7.1% by Rabago et al. (28). Precut sphincterotomy was required in 14.8% of our patients. Although precut sphincterotomy has a morbidity rate itself (29), it may increase the ERCP success rate; this was shown by Huang et al. (1) and Wang et al. (30) as well as in our study. The major reasons for cannulation failure in ERCP include the following: obstruction due to tumor of the papilla, biliary tract, or duodenum; papillary constriction due to inflammation; stenosis of the duodenal bulb; papillary location abnormalities, including location in or around a diverticulum; and history of a gastrectomy with Billroth II or Roux-en-Y reconstruction (1,2,5). Incomplete papillary obstruction or constriction problems may be solved with precut sphincterotomy (1,21), as performed in our study. While balloon dilatation or antiinflammatory medication may be helpful in cases with duodenal stenosis, clip-assisted ERCP may be effective in patients with intradiverticular papilla (31). Finally, ERCP may be carried out using an end- or oblique-viewing endoscope or laparoscopy-assisted transjejunal method in cases with Roux-en-Y reconstruction (32,33). On the other hand,

pregnancy is a limitation of ERCP, and therapeutic nonradiation ERCP with wire-guided cannulation may be performed in selected pregnant women (34).

Complications associated with ERCP have been reported at as high as 12.1%, with a mean of 4.0% (1,2,28,35,36). Major complications are seen in patients with severe and incapacitating systemic diseases, obesity, known or suspected bile duct stones, pancreatic manometry, and complex procedures (35). Acute pancreatitis is the most common complication after ERCP, with reported frequencies that range from 0.9% to 4.4%. Predictors of acute pancreatitis include the presence of pancreatic duct catheterization, roentgenography, sphincterotomy, or suspected sphincter of Oddi dysfunction (1,2,28,35-37). Bleeding risk during ERCP is 0.3%-1.3%, and this rate is even higher with sphincterotomy and in patients undergoing anticoagulant therapy (1,2,35,36,38). The risk of perforation during ERCP is 0.3%-1.3%, and, like the risk of bleeding, it is higher with sphincterotomy, stenting, and biliary or gastric Roux-en-Y diversion (1,2,35,36). Acute cholangitis is seen in 0.4%-1.8% of ERCP patients, and this rate is even higher in patients with incomplete biliary obstruction (1,2,28,36). On the other hand, premedication problems, such as intolerance to sedation, arrhythmias, and respiratory or cardiac arrest, may develop in 0.5%-1.0% of cases (2), while systemic air embolism is a rare complication of ERCP (39). The rate of mortality associated with ERCP has been reported at up to 1.0% with a mean of 0.4% (1,28). In our study, when serum amylase level elevation was excluded, the complication and mortality rates were on the lower end of the rates reported in the literature. In our experiences, general surgeons may have some advantages in recognizing and treating the surgically treated complications of ERCP.

In conclusion, despite its associated morbidity and risk of mortality, ERCP is a reliable method in diagnosing and treating hepatobiliary and pancreatic diseases.

## References

1. Huang LY, Liu YX, Wu CR, Cui J, Zhang B. Application of endoscopic retrograde cholangiopancreatography in biliary-pancreatic diseases. *Chinese Med J* 2009; 122: 2967-72.
2. Penalzoza-Ramirez A, Leal-Buitrago C, Rodriguez-Hernandez A. Adverse events of ERCP at San Jose Hospital of Bogota (Colombia). *Rev Esp Enferm Dig* 2009; 101: 837-49.

3. Jones WB, Roettger RH, Cobb WS, Carnobell AM. Endoscopic retrograde cholangiopancreatography in general surgery: how much are we outsourcing? *Am Surg* 2009; 75: 1050-3.
4. Malahias ME, Bsis E. Are all surgical referrals for endoscopic retrograde cholangiopancreatography necessary? *Saudi J Gastroenterol* 2009; 15: 66.
5. Keil R, Snajdauf J, Rygl M, Pycha K, Kotalova R, Drabek J et al. Diagnostic efficacy of ERCP in cholestatic infants and neonates – a retrospective study on a large series. *Endoscopy* 2010; 42: 121-6.
6. Scaffidi MG, Luigiano C, Consolo P, Pellicano R, Giacobbe G, Gaeta M et al. Magnetic resonance cholangio-pancreatography versus endoscopic retrograde cholangio-pancreatography in the diagnosis of common bile duct stones: a prospective comparative study. *Minerva Med* 2009; 100: 341-8.
7. Sakai Y, Tsuyuguchi T, Ishihara T, Yukisawa S, Ohara T, Tsuboi M et al. Is ERCP really necessary in case of suspected spontaneous passage of bile duct stones? *World J Gastroenterol* 2009; 15: 3283-7.
8. Rogers SJ, Cello JP, Horn JK, Siperstein AE, Schechter WP, Campbell AR et al. Prospective randomized trial of LC+LCBDE vs ERCP/S+LC for common bile duct stone disease. *Arch Surg* 2010; 145: 28-33.
9. Salman B, Yilmaz U, Kerem M, Bedirli A, Sare M, Sakrak O et al. The timing of laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreatography in cholelithiasis coexisting with choledocholithiasis. *J Hepatobiliary Pancreat Surg* 2009; 16: 832-6.
10. Zerem E, Omerovic S. Minimally invasive management of biliary complications after laparoscopic cholecystectomy. *Eur J Intern Med* 2009; 20: 686-9.
11. Adel-Raouf A, Hamdy E, El-Hanefy E, El-Ebidy G. Endoscopic management of postoperative bile duct injuries: a single center experience. *Saudi J Gastroenterol* 2010; 16: 19-24.
12. Sakai Y, Tsuyuguchi T, Ishihara T, Sugiyama H, Miyakawa K, Yukisawa S et al. The usefulness of endoscopic transpapillary procedure in post-cholecystectomy bile duct stricture and post-cholecystectomy bile leakage. *Hepatogastroenterology* 2009; 56: 978-83.
13. Aksoz K, Unsal B, Yoruk G, Buyrac Z, Hacıyanlı M, Akpınar Z et al. Endoscopic sphincterotomy alone in the management of low-grade biliary leaks due to cholecystectomy. *Dig Endosc* 2009; 21: 158-61.
14. Neri V, Fersini A, Ambrosi A, Tartaglia N, Valentino TP. Diagnostic evaluation prior to cholecystectomy in mild-moderate acute biliary pancreatitis. *Ann Ital Chir* 2009; 80: 363-7.
15. van Santvoort HC, Besselink MG, de Vries AC, Boermeester MA, Fischer K, Bollen TL et al. Early endoscopic retrograde cholangiopancreatography in predicted severe acute biliary pancreatitis: a prospective multicenter study. *Ann Surg* 2009; 250: 68-75.
16. Horakova M, Vadovicova I, Katuscak I, Janik J, Makovnik P, Sadlonova J. Consideration of endoscopic retrograde cholangiopancreatography in cases of acute biliary pancreatitis. *Bratisl Lek Listy* 2009; 110: 553-8.
17. Shrode CW, Kahaleh M. Early ERCP in acute gallstone pancreatitis without cholangitis: a need for systematic biliary sphincterotomy? *J Pancreas* 2009; 10: 701-2.
18. Rogers SJ, Cello JP, Schechter WP. Endoscopic retrograde cholangiopancreatography in patients with pancreatic trauma. *J Trauma* 2009; 68: 538-44.
19. Tanaka K, Kida M. Role of endoscopy in screening of early pancreatic cancer and bile duct cancer. *Dig Endosc* 2009; 21: S97-S100.
20. Baron TH, Kozarek RA. Preoperative biliary stents in pancreatic cancer – proceed with caution. *N Engl J Med* 2010; 362: 170-2.
21. Gronroos JM, Gullichsen R, Laine S, Salminen P. Endoscopic palliation of malignant obstructive jaundice in extremely elderly patients: plastic stent is enough. *Minim Invasive Ther Allied Technol* 2010; 19: 122-4.
22. Petersen C, Meier PN, Schneider A, Turowski C, Pfister ED, Manns MP et al. Endoscopic retrograde cholangiopancreatography prior to explorative laparotomy avoids unnecessary surgery in patients suspected for biliary atresia. *J Hepatol* 2009; 51: 1055-60.
23. Ozturk G, Polat KY, Yildirgan MI, Aydinli B, Atamanalp SS, Aydin U. Endoscopic retrograde cholangiopancreatography in hepatic alveolar echinococcosis. *JGH* 2009; 24: 1365-9.
24. Ozturk G, Yildirgan MI, Atamanalp SS, Basoglu M, Aydinli B, Polat KY et al. An algorithm for the treatment of the biliary complications of hepatic hydatid disease. *Turk J Med Sci* 2009; 39: 671-85.
25. Atamanalp SS, Polat P, Ozturk G, Aslan OB. Cysto-biliary rupture in hepatic hydatid disease: magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography findings. *EAJM* 2009; 41: 208.
26. Moghadami M, Mardani M. Fasciola hepatica: a cause of obstructive jaundice in an elderly man from Iran. *Saudi J Gastroenterol* 2008; 14: 208-10.
27. Hendriks MP, Wanten GJ, Drenth JPH. Management of hemobilia and pancreatitis after liver biopsy: a key role for endoscopic retrograde cholangiopancreatography. *Liver Transplant* 2009; 15: 1653-4.
28. Rabago L, Guerra I, Moran M, Quintanilla E, Collado D, Chico I et al. Is outpatient ERCP suitable, feasible, and safe? The experience of a Spanish community hospital. *Surg Endosc* 2010; 24: 1701-6.
29. Tham TCK, Vandervoort J. Needle-knife sphincterotomy and post-ERCP pancreatitis: time to lower the threshold for the needle. *Gastrointest Endosc* 2010; 71: 272-4.

30. Wang P, Zhang W, Liu F, Li ZS, Ren X, Fan ZN et al. Success and complication rates of two precut techniques, transpancreatic sphincterotomy and needle-knife sphincterotomy for bile duct cannulation. *J Gastrointest Surg* 2010; 14: 697-704.
31. Ustundag Y, Karakaya K, Aydemir S. Biliary cannulation facilitated by endoscopic clip assistance in the setting of intradiverticular papilla. *Turk J Gastroenterol* 2009; 20: 279-81.
32. Kikuyama M, Sasada Y, Matsuhashi T, Ota Y, Nakahodo J. ERCP after Roux-en-Y reconstruction can be carried out using an oblique-viewing endoscope with an overtube. *Dig Endosc* 2009; 21: 180-4.
33. Lopes TL, Clements RH, Wilcox CM. Laparoscopy-assisted transjejunal ERCP in a patient with Roux-en-Y reconstruction following partial gastrectomy. *J Laparoendosc Adv Surg Tech A* 2010; 20: 55-8.
34. Akcakaya A, Ozkan OV, Okan I, Kocaman O, Sahin M. Endoscopic retrograde cholangiopancreatography during pregnancy without radiation. *World J Gastroenterol* 2009; 15: 3649-52.
35. Cotton PB, Garrow DA, Gallagher J, Romagnuolo J. Risk factors for complications after ERCP: a multivariate analysis of 11,497 procedures over 12 years. *Gastrointest Endosc* 2009; 70: 80-8.
36. Ryan ME. ERCP complication rates: how low can we go? *Gastrointest Endosc* 2009; 70: 89-91.
37. Matsubayashi H, Fukutomi A, Kanemoto H, Maeda A, Matsunaga K, Uesaka K et al. Risk of pancreatitis after endoscopic retrograde cholangiopancreatography and endoscopic biliary drainage. *HPB* 2009; 11: 222-8.
38. Tsou YK, Lin CH, Liu NJ, Tanh JH, Sung KF, Cheng CL, Lee CS. Treating delayed endoscopic sphincterotomy-induced bleeding: epinephrine injection with or without thermotherapy. *World J Gastroenterol* 2009; 15: 4823-8.
39. Romberg C. Systemic air embolism after ERCP: a case report and review of the literature. *Gastrointest Endosc* 2009; 70: 1043-5.