



Single-endoscopist Experience: ERCP Results, Complications, and Related factors

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Öz

Tek Endoskopist Deneyimi; ERCP Sonuçları, Komplikasyonlar ve İlgili Faktörler

Amaç: Bu çalışmada, tek endoskopist endoskopik retrograd kolanjiyopankreatografi (ERCP) deneyimimizi, ERCP başarı oranı, komplikasyon oranları ve bunları etkileyen faktörler dahil olmak üzere bildirmeyi amaçlanmıştır.

Gereç ve Yöntem: Merkezimize 2018-2020 yılları arasında ERCP uygulanan 723 hastadan geriye dönük veriler toplandı. 18 yaşın altındaki hastalar, daha önce başka bir merkezde ERCP uygulanan hastalar, rektal steroid olmayan antiinflamatuar ilaçlar kullanan hastalar, sedasyona bağlı komplikasyonları olan hastalar ve pankreatoksik ilaç kullanan hastalar dahil edilmemiştir.

Bulgular: Çalışmaya dahil edilen 573 hastanın yaş ortalaması 58.6 (min. 18- maks. 104) yıl olarak hesaplandı. Kanülasyonun başarısı incelendiğinde hastaların %93.9'una (538/573) hedef kanala ulaşıldığı izlendi. Çalışmamızda ERCP sonrası pankreatit oranı%7, ERCP sonrası kanama %1.2, ERCP sonrası kolanjit oranı%0.9, ERCP sonrası perforasyon oranı%0.5 olduğu görüldü. İşlemden başarılı-başarısız gruplar karşılaştırıldığında başarısız grupta perforasyon ve kolanjitte istatistiksel olarak anlamlı fark mevcuttu (sırasıyla p <0.001- p <0.001).

Sonuç: ERCP ile ilgili komplikasyonları azaltmak ve yönetmek için bazı stratejiler vardır. Bu stratejileri belirlemek için daha büyük çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: ERCP, Sarılık, Komplikasyonlar

Abstract

Single-endoscopist Experience: ERCP Results, Complications, and Related factors

Objective: This study aimed to report our single-endoscopist endoscopic retrograde cholangiopancreatography (ERCP) experience, including ERCP success rate, complication rates and factors affecting them.

Materials and Methods: Retrospective data were collected from 573 patients who underwent ERCP from 2018 to 2020 at our clinic. Patients aged under 18 years, patients who had previously undergone ERCP at another center, patients using rectal non-steroidal anti-inflammatory drugs, patients with sedation-related complications, and patients using pancreatotoxic medication were not included.

Results: The average age of the 573 patients included in the study was calculated as 58.6 (min. 18 - max. 104) years. In the examination of the success of cannulation, target duct was intubated in 93.9% (538/573) of the patients. In our study, the rate of post ERCP pancreatitis was seen 7%, post ERCP bleeding was observed as 1.2%, the rate of post ERCP cholangitis was 0.9%, the post ERCP perforation rate was 0.5%. When we compared the complications between successful and unsuccessful groups, there was a statistically significant difference in perforation and cholangitis (p<0.001 – p<0.001 respectively).

Conclusions: There are some strategies to reduce and manage ERCP-related complications. Larger studies are needed to identify these strategies.

Keywords: ERCP, Jaundice, Complications

INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is an important method in the diagnosis and especially the treatment of pancreaticobiliary tract diseases. ERCP is performed with a side-viewing duodenoscope that allows identification of the major/minor papillae and periampullary area. Bile duct cannulated under endoscopic and fluoroscopic guidance. The role of ERCP has evolved from a diagnostic to a mainly therapeutic intervention due to advances in other imaging methods, including magnetic resonance imaging (MRI) and / or magnetic resonance cholangiopancreatography (MRCP) and endoscopic ultrasound (EUS). ERCP, although minimally invasive procedure, can lead to very serious complications (1).

ERCP is indicated in many benign (stone, sludge, cholangitis, Oddi sphincter dysfunction (SOD), pancreatitis) and malignant (periampullary tumor, cholangiocellular tumor) diseases of pancreaticobiliary tract (2,3).

The ERCP procedure has very important complications related to sedation and the procedure itself. Post-ERCP complications are very important causes of morbidity. Post-ERCP complications can sometimes even cause mortality. Multiple studies have evaluated the incidence of post-ERCP complications. ERCP specific complications include pancreatitis, bleeding, infections/sepsis and perforation (4-7).

ERCP also has sedation-related complications (hypoventilation, airway obstruction, hypoxemia, hypercarbia, hypotension, vasovagal episodes, arrhythmias and aspiration) (8,9).

Even in experienced endoscopists, many complications can occur at varying rates after the ERCP procedure.

In this study, we aimed to report our single-endoscopist ERCP experience, including ERCP success rate, complication rates and factors affecting them. We aimed to compare our results with the literature and develop strategies to reduce and manage complications.

METHODS

Seven hundred twenty-three patients who presented to our hospital Gastroenterology Clinic between July 2018 and March 2020 were included in our study.

Patients aged under 18 years, patients who had previously undergone ERCP at another center, patients using rectal non-steroidal anti-inflammatory drugs (NSAIDs) to reduce the risk of post ERCP pancreatitis, patients with sedation-related complications, and patients using pancreatotoxic medication (e.g., azathioprine, estrogen, valproic acid) were not included. Data of five hundred seventy-three patients were analyzed (Figure 1).

Table 1. The indications for ERCP

	Number	Frequency (%)
Cholelithiasis	478	83.4
Malign	42	7.3
Suspicion of SOD	39	6.8
Others	6	1
Total	573	100

Table 2. Post ERCP complications

	+	-
Pancreatitis	40 (7%)	533
Perforation	3 (0.5%)	570
Bleeding	7 (1.2%)	566
Cholangitis	5 (0.9%)	568

ERCP Procedures

All patients' ERCP procedures were performed by a single endoscopist using standard guidewire cannulation technique, by continuously monitoring the vital signs under propofol and midazolam sedation applied by an anesthetist. All patients underwent MRCP before the procedure. Also, all patients received antibiotic therapy, including Gram-negative enteric bacteria, based on age and kidney values (except for the suspicion of SOD group). In patients whose initial cannulation technique failed, the pre-cut sphincterotomy technique was performed using a needle-knife sphincterotome. As the pre-cut method, the classical needle-tipped sphincterotome method was used in most patients. A suprapapillary fistulotomy technique was used in eligible patients. Endoscopic sphincterotomy and stroking the common bile duct with a balloon catheter were performed for all patients in the successful group. Biliary stenting was performed for 14.6% (79/538) of the patients. Prophylactic pancreatic duct stenting was not performed for any patient. None of the patients received rectal indomethacin before or after the procedure to reduce the risk of post ERCP pancreatitis. All patients underwent standard hydration at the time of the procedure and in the first 8 hours, depending on their cardiac, renal, and hemodynamic status before the procedure. Standard hydration was given via intravenous lactated Ringer solution (1.5 cc/kg/h) during ERCP, and for 8 h after ERCP without a bolus. All patients were discharged 24th hours later after if the clinical and laboratory tests showed there were no complications.

Data Collection

Patient characteristics and ERCP-related information were evaluated retrospectively. Information during ERCP was re-

corded on the same day after the procedure. Patient characteristics such as age, sex, additional comorbid diseases, history of previous gastrointestinal surgery, history of pancreatitis, and indications for ERCP were collected. ERCP related information such as the cannulation method, total procedure time, total cannulation time, inadvertent pancreatic canal cannulation (IPDC), pancreatic canal contrast injection, presence of diverticula, and post ERCP complications (pancreatitis, bleeding, cholangitis and perforation) were collected.

Outcomes and Definitions

The primary aim of the study was to report our single-center ERCP experience through ERCP success rates, complication rate and factors affecting them.

Cannulation time was determined as from the first touch of the papilla until the target entered the duct.

Processing time was accepted as the time from when the oral cavity was entered with the duodenoscope until the time it exited from the oral cavity.

Previous surgery history considered procedures such as sleeve gastrectomy, Roux-en-Y, and Billroth II.

Pancreatic duct contrast injection was defined as the removal of opaque material up to one or more pancreatic tails or pancreatic acinar opacification.

Previous history of pancreatitis attack was accepted as at least 1 month before ERCP procedure. Clinical definition and classification of post-ERCP complications were evaluated according to the Cotton's study (10).

Statistical Analysis

Data analysis was performed using the IBM SPSS Statistics for Windows, version 20.0 (IBM Corp. Armonk, NY, USA). Descriptive statistics are summarized as frequencies and percentages for categorical variables and mean and standard deviation for continuous variables. Student's t-test was used to compare parametric data matching normal distribution in independent samples. We analyzed the relationships between post-ERCP complications and clinicopathologic features through using the Chi-square test or Fisher's exact test. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The average age of the 573 patients included in the study was calculated as 58.6 (min. 18 - max. 104) years. Of the 573 patients, 239 (41.7%) were male and 334 (58,3 %) were female. ERCP indications are shown in the table below (Table 1). There were rare causes (such as bile leakage, hydatid cyst opening to the biliary tract, benign biliary strictures, indeterminate biliary strictures, and cystic diseases of the pancreas) in 1% of patients. In the malignancy group, there were 24 cholangiocellular carcinomas, 11 pancreatic cancers and seven periampullary tumors.

Table 3. The relationship between post ERCP pancreatic (PEP) and clinicopathologic features

		PEP	PEP	Total	P
		Yes	No		
Sex	F	31	303	334	
	M	9	230	239	
Total		40	533	573	<0.05
Procedure time	<15 min	8	422	430	
	>15 min	32	111	143	
Total		40	533	573	<0.05
Cannulation time	<5 min	2	508	510	
	>5 min	38	25	63	
Total		40	533	573	<0.05
Diverticulum	Yes	10	87	97	
	No	30	446	476	
Total		40	533	573	0.158
SOD suspicion	Yes	7	32	39	
	No	33	501	534	
Total		40	533	573	<0.05
Pancreatic duct contrast injection	Yes	5	2	7	
	No	35	531	566	
Total		40	533	573	<0.05
IPDC	Yes	23	10	33	
	No	17	523	540	
Total		40	533	573	<0.05
Hyperlipidemia	Yes	6	28	34	
	No	34	505	539	
Total		40	533	573	<0.05

In the examination of the success of cannulation, target duct was intubated in 93.9% (538/573) of the patients. One or more revisions were needed in the failed group. The procedure was concluded with standard guidewire cannulation technique for 80.6% of the patients. For 19.4% of patients, a needle-knife sphincterotomy was needed. Periampullary diverticulum was observed in 16.9% of patients.

Table 4. Relationship between post ERCP cholangitis and clinicopathologic features

		Post ERCP cholangitis		Total	P
		Yes	No		
Procedure time	<15 min	0	430	430	
	>15 min	5	138	143	
Total		5	568	573	<0.05
Cannulation time	<5 min	0	510	510	
	>5 min	5	58	63	
Total		5	568	573	<0.05
Diverticulum	Yes	0	97	97	
	No	5	471	476	
Total		5	568	573	0.595
Precut sphincterotomy	Yes	2	109	111	
	No	3	459	462	
Total		5	568	573	0.250
Choledoch cannulation	Yes	0	538	538	
	No	5	30	35	
Total		5	568	573	<0.05
Malignant	Yes	2	40	42	
	No	3	528	531	
Total		5	568	573	<0.05

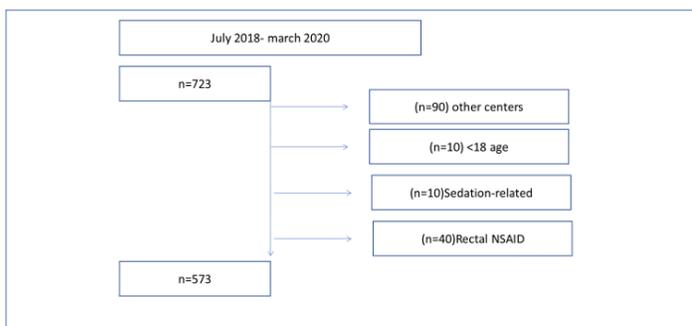


Figure 1. Study design

ERCP complications are shown in the Table 2.

In our study, the risk of PEP was significantly higher in the female sex ($p<0.05$), in those with longer cannulation time

and total procedure time ($p<0.05$), in patients who underwent ERCP due to suspicion of SOD ($p<0.05$). The presence of diverticulum did not increase the risk of PEP ($p=0.158$). Pancreatic duct contrast injection was observed to significantly increase the risk of PEP ($p<0.05$), and inadvertent cannulation of the pancreatic duct (IPDC) significantly increased the risk of PEP ($p<0.05$) (Table 3).

In our study, the most important risk factor for post ERCP cholangitis was incomplete or unsuccessful biliary drainage ($p<0.05$). Five patients with post ERCP cholangitis failed drainage. Prolonged procedure time and cannulation time also significantly posed a risk for post ERCP cholangitis ($p<0.05$). In our study, malignancy was seen as a risk factor for post ERCP cholangitis ($p<0.05$). Two of five patients with post ERCP cholangitis were patient with malignancy. Hilar obstructions were present. It was observed as a significant risk factor, possibly because it caused unsuccessful drainage. The presence of diverticulum and precut papillotomy was not found to be a significant risk factor for post ERCP cholangitis ($p=0.595$, $p=0.250$, respectively) (Table 4).

In our study, no significant factor was observed for post ERCP bleeding regarding cannulation time and processing time ($p = 0.999$, $p = 0.201$, respectively). The presence of diverticulum and precut papillotomy technique was also not considered as a significant risk factor for post ERCP bleeding ($p=0.999$, $p=0.999$, respectively). Three of seven patients with bleeding had chronic renal failure, which was observed to be a significant risk factor for post ERCP bleeding ($p<0.05$), possibly due to platelet dysfunction effect. Cirrhosis was also found to be a significant risk factor for post ERCP bleeding ($p<0.05$). From seven patients, five had coronary artery disease and / or congestive heart failure. Coronary artery disease and congestive heart failure were also found to be significant risk factors for post ERCP bleeding ($p<0.05$) (Table 5).

In our study, it was observed that there was a significant risk for post ERCP perforation with prolonged cannulation time ($p<0.05$). There was no significant relationship between the presence of diverticulum and precut sphincterotomy in terms of post ERCP perforation risk ($p=0.427$, $p=0.477$ respectively) (Table 6).

DISCUSSION

ERCP is a standard procedure for the management of pancreaticobiliary disorders. Due to the development of non-invasive methods, ERCP has shifted from the diagnostic side to the therapeutic side. ERCP is usually considered as an effective and safe method. Post-ERCP complication rates vary significantly. The overall post-ERCP complication rate in a Chinese study was 7.9 % (8). British study reported it as 5 % (6). Common post-ERCP complications are pancreatitis, bleeding, infection, and perforation (6,8,11).

Table 5. Relationship between post ERCP bleeding and clinicopathologic features

		Post ERCP bleeding		Total	P
		Yes	No		
Procedure time	<15 min	7	423	530	0.201
	>15 min	0	143	143	
Total		7	566	573	
Cannulation time	<5 min	7	503	510	0,999
	>5 min	0	63	63	
Total		7	566	573	
Diverticulum	Yes	1	96	97	0,999
	No	6	470	476	
Total		7	566	573	
Precut sphincterotomy	Yes	1	110	111	0,999
	No	6	456	462	
Total		7	566	573	
Chronic renal failure	Yes	3	17	20	<0.05
	No	4	549	553	
Total		7	566	573	
Cirrhosis	Yes	1	1	2	<0.05
	No	6	565	571	
Total		7	566	573	
CHF/CAD	Yes	5	81	86	<0.05
	No	2	485	487	
Total		7	566	573	

*CHF/CAD (Congestive heart failure / Coronary artery disease)

Post- ERCP pancreatitis (PEP) is the most common complication. The incidence range of PEP is from 1.6% to 15 % (5,6,8,12-15). The consensus definition and classification of PEP were described in 1991 by Cotton et al. (10). The mechanisms of PEP are not clear, but several have been suggested in the literature. Mechanical trauma, chemical injury, hydrostatic injury, thermal injury, infection, and allergy were described (16,17). A crucial step in preventing PEP is patient selection to identify high-risk patients for PEP. Female sex, younger age

Table 6. Relationship between perforation and clinicopathologic features

		Perforation		Total	P
		Yes	No		
Procedure time	<15 min	1	429	430	0.155
	>15 min	2	141	143	
Total		3	570	573	
Cannulation time	<5 dk	1	509	510	<0.05
	>5 dk	2	61	63	
Total		3	570	573	
Diverticulum	Yes	1	96	97	0.427
	No	2	474	476	
Total		3	570	573	
Precut sphincterotomy	Yes	1	110	111	0.477
	No	2	460	462	
Total		3	570	573	

(<60 years), clinical suspicion of SOD, the absence of chronic pancreatitis, difficult cannulation, precut sphincterotomy, repetitive and aggressive pancreatography, ampullectomy, and pancreatic duct wire passage were defined as risk factors in multivariate analyses (13,18-20). In our study, the rate of post ERCP pancreatitis was 7% (n=40). Ninety percent (n=36) of PEPs had mild, 2.5% (n=1) moderate, 7.5% (n=3) had severe pancreatitis. None of our patients received rectal indomethacin before or during the procedure. Protective pancreatic duct stenting was not performed in any of our patients to prevent post ERCP pancreatitis. Standard hydration was given to our patients during and after the procedure for 8 hours. In our study, in accordance with the literature; female sex, suspicion of SOD, long procedure and cannulation time, significantly increased the risk of PEP. Many studies accepted the termination period of the procedure as 10-30 minutes (21-23). In terms of the use of electrocautery, pure or blended current does not affect the risk of PEP (24). Blended current was used for all patients in our study. A meta-analysis demonstrated that guidewire assisted cannulation significantly decreased the incidence of PEP (25). In our study, guide wire assisted cannulation was used for all patients. Case volume and trainee participation have been suggested to affect the risk of PEP, but study results have been inconsistent with some studies suggesting increased risk for PEP (26,27), whereas other failed to demonstrate an increased rate of PEP with trainee participation (28). The patient volume of our center is > 300 per year.

The most common infection after ERCP is cholangitis (29). The most common bacteria in the biliary tract are Gram-negative organisms (30,31). The most important risk factor for post-ERCP infection is incomplete or failed biliary drainage (32,33). Prior history of liver transplantation or incomplete biliary drainage are the highest risk groups for post-ERCP cholangitis (30). In our study, the rate of post-ERCP cholangitis was 0.9% (n=5). In our study, in accordance with the literature; Incomplete or failed drainage was observed to increase the risk of post-ERCP cholangitis. Several strategies are recommended to reduce the risk of post-ERCP cholangitis. Prophylactic preprocedural antibiotics is recommended for patients with a history of liver transplantation or suspected biliary obstruction, sclerosing cholangitis, expected difficulty with complete biliary drainage, pancreatic pseudocysts and immunocompromised status (29).

Bleeding is another complication associated with ERCP, ranging from oozing to severe bleeding. Post-ERCP bleeding is in 0.3-2% of cases (4,32,34). In our study, post-ERCP bleeding was observed as 1.2% (n=7). Before the procedure, all patients were prepared to have $\text{inr} < 1.5$ and platelets ≥ 50000 mm³. Antiplatelet agents were stopped 3 days before the procedure for all patients. As much as possible, the sphincterotomy procedure was performed on the duodenal papilla at the 11-1 o'clock position which is thought to be the region with the least vascularization (35). Several factors which were described to increase the risk of post-ERCP bleeding included coagulopathy, anticoagulation medication within 3 day of endoscopic sphincterotomy, cholangitis before ERCP, bleeding during initial endoscopic sphincterotomy and lower a case volume (18,34,36). It was suggested in another study that liver cirrhosis, dilated common bile ducts, periampullary diverticulum, precut sphincterotomy appeared to increase the risk of post-sphincterotomy bleeding (18). In our study, contrary the literature, we did not find any correlation between ERCP technique or cannulation or procedure time and post-ERCP risk. The choice of electrosurgical current for biliary sphincterotomy has been another source of research. There are two types of electrosurgical current, pure current and blended current. Blended current is a mixture of cutting and coagulation thus it causes more coagulation and heating. A meta-analysis has shown that pure current is associated with more episodes of bleeding (37,38). The use of a partially closed sphincterotome was not associated with a reduction in bleeding risk (39).

Post-ERCP perforation is reported in less than 1% of cases (27,28,40). In our study, the post-ERCP perforation rate was 0.5% (n=3). One of the patients had periampullary perforation, one had a pancreatic duct injury, and the last one had retroperitoneal gas alone. Severe abdominal pain, leukocytosis, fever, tachycardia, and sometimes back pain are among the ten most common clinical findings (29). In a retrospective study of 12,427 patients undergoing ERCP, the post-ERCP per-

foration rate 0.6% (28). The most common causes are guide-wire manipulation (32%), sphincterotomy (15%), endoscope manipulation (11%), cannulation (11%), stent placement (9%), and stricture dilation (7%) (28). Procedure-related risk factors for perforation include difficult cannulation, sphincterotomy, prolonged procedure, biliary structure dilation, intramural injection of contrast material, and precut sphincterotomy (28,31,41,42). In our study, in accordance with the literature, we saw that the risk of post-ERCP perforation increased with cannulation time. Contrary to the literature, we found that it was unrelated to pre-cut sphincterotomy.

Limitations

The patient populations could have also been included a group given rectal indomethacin and their PEP ratios could be compared. Besides the processing time and the cannulation time, the number of cannulations could also be added. PEP risk could be compared by creating groups that received aggressive hydration and pancreatic stenting. Studies with larger patient samples are needed to confirm risk factors for less common complications such as cholangitis, perforation. The findings of this study need to be further confirmed in prospective studies. The overall complication rate could not be established because complications related to sedation were not considered. Larger, prospective multicenter studies are needed to determine the overall efficacy and reliability of ERCP and post-ERCP complications and associated factors.

CONCLUSIONS

We thought that there might be some important points in the development of post-ERCP pancreatitis (although pre-operative NSAID prophylaxis and prophylactic pancreatic stent not being treated) and other complications. For example, the intramural part, which is the last part of the choledochal duct and opens to the papilla after joining with the pancreatic main duct, is about 2 cm. While we used conventional guide-wire technique, we performed partial sphincterotomy after the guidewire was advanced 2 cm in the first stage. Then we continued to push the guidewire proximal to the bile duct. Thus, we think that we prevent accidental or unnecessary pancreatic cannulation. another important point: we gave the contrast agent when the guidewire passed proximal to the intramural part of the choledochal canal. So, we thought we bypassed the level of pancreatic duct opening. Another important point: we kept the process time and cannulation time as short as possible. If we think the process will fail, we made the pre-cut and postponed it to the next session.

It seems that ERCP will always play the most critical role in pancreaticobiliary diseases. Erpc complications occur even with highly experienced endoscopists who should know the risks of ERCP complications and must always be prepared for their management. There are some strategies to reduce and manage ERCP-related complications. Larger studies are needed to identify these strategies.

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Externally peer reviewed.

Conflict of Interest

The authors declare that they have no conflict of interests regarding content of this article.

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Ethical Declaration

Ethical approval was obtained from Kahramanmaraş Sütçü İmam University Clinical Research Ethical Committee with date 22.07.2020 and number 14, and Helsinki Declaration rules were followed to conduct this study.

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