

# Does the Time of Day have an Effect on the Success and Complications of ERCP?

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**Abstract: Background:** In ERCP, if modifiable risk factors can be minimized, indirectly, the rates of complications will also decrease.

**Objective:** In the present study, the aim is to investigate whether the timing of ERCP (morning versus afternoon) was associated with the success of cannulation and procedure-related complications in patients with bile duct stones undergoing ERCP.

**Materials and Methods:** This is a retrospective study of patients who underwent ERCP for common bile duct (CBD) stones. We compared the complication rate and the success of CBD cannulation between procedures conducted in the morning and those carried out in the afternoon during ERCP.

**Result:** A total of 402 patients were enrolled. The mean age of patients was  $64.4 \pm 19$  years with a total bilirubin value of  $7.5 \pm 11.6$  mg/dL, direct bilirubin value of  $4.9 \pm 8.6$  mg/dL, and CBD of  $11 \pm 2.4$  mm. 201 (50%) of the patients underwent ERCP in the morning and 201 (50%) in the afternoon. The rates of post-ERCP pancreatitis, bleeding, and the success of cannulation were 5.5%, 10%, and 96.5% in the morning ERCP group and 5%, 13.4%, and 93% in the afternoon ERCP group, respectively. There were no statistically significant differences between groups in post-ERCP pancreatitis ( $p=0.606$ ), bleeding ( $p=0.277$ ), and the success of CBD cannulation ( $p=0.117$ ).

**Conclusion:** Between morning and afternoon ERCP procedures, no statistically significant difference was detected.

**Keywords:** ERCP, Ampulla vateri cannulation, ERCP complication, Time-of-day, ERCP timing, Cholangitis, Choledocholithiasis.

## INTRODUCTION

For the past five decades, endoscopic retrograde cholangiopancreatography (ERCP) has been employed for the assessment of bile ducts and pancreatic ducts, as well as for the treatment of related pathologies [1, 2]. The emergence of several complications after ERCP, including pancreatitis, bleeding, perforation, and cholangitis, suggests the need for careful evaluation of patients for the indication of the procedure [3, 4]. With the recent technological advances, endoscopic ultrasonography (EUS) and magnetic resonance cholangiopancreatography (MRCP) has become widespread use and are preferred for diagnostic purposes due to their similar sensitivity and a lower rate of complications compared to ERCP in the majority of pancreaticobiliary disorders [5]. The reported incidence of complications associated with therapeutic ERCP as high as 8.4% and a mortality of 0.33% led to a quest for new approaches to minimize these rates [6]. Age, gender, common bile duct (CBD) diameter, bilirubin level, balloon dilation of the biliary sphincter, pancreatic duct injection/cannulation, pancreatic sphincterotomy, precut sphincterotomy, and periampullary diverticulum have been determined to affect the incidence of complications after ERCP and the success of the procedure [7]. Reducing potential risk factors would result in decreased rates of complications [8]. Therefore, it is

critical to determine whether the timing of the procedure is a risk factor. The aim of this study is to investigate whether the timing of ERCP (morning versus afternoon) had any effect on the success of cannulation and procedure-related complications in patients with comparable risk factors.

## MATERIALS AND METHODS

A total of 402 ERCP performed for common bile duct stone in our institution from January 2017-December 2021 were retrospectively analyzed. Patients' age, gender, CBD diameter, total/direct bilirubin levels, and also whether biliary sphincter balloon dilatation, pancreatic duct injection/cannulation, pancreatic sphincterotomy, precut sphincterotomy were performed during the procedure, and the presence of periampullary diverticulum all of these findings had been entered into the hospital record system. ERCP procedures were performed by the same physicians with the same series of duodenoscopes. All the physicians performing the ERCP had 15 years of experience with 350-400 ERCP procedures per year. In cases of difficult biliary cannulation, firstly, guide wire cannulation was attempted as a salvage technique. In cases where biliary cannulation was unsuccessful, the standard contrast-assisted cannulation technique was performed. Exclusion criteria are listed in Table 1. The institutional ethics committee has approved the study (approval no.: 2021000365-1).

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Patients were divided into two groups according to the start time for each ERCP procedure: morning (prior to 12:00 PM) and afternoon (after 12:00 PM). Study groups were not statistically significantly different concerning factors that could influence the success of the procedure. ERCP complications and the success of CBD cannulation were compared between the groups. Post-ERCP complications were scored based on their severity [9].

## STATISTICAL ANALYSIS

The data analysis was carried out using SPSS 15.0 for Windows. Continuous variables were assessed for variance among groups using either one-way analysis of variance or Student's t-test, as appropriate. For categorical variables, the Chi-square test was employed. Significance was determined by a p-value less than 0.05.

## RESULT

A total of 402 patients, 194 (48.2%) and 208 (51.8%) male were included in the study. The mean age was  $64.4 \pm 19$  years, the mean total bilirubin and direct bilirubin levels were  $7.5 \pm 11.6$  mg/dl and  $4.9 \pm 8.6$  mg/dl, respectively. 201 (50%) of the 402 procedures were performed in the morning, and the remaining were performed in the afternoon. There was no statistically significant difference between the morning and the afternoon groups in terms of age, gender, and bilirubin levels. The mean

CBD width in the morning and afternoon groups was  $10.4 \pm 3.2$  mm and  $10.1 \pm 2.6$  mm, respectively ( $p: 0.243$ ) (Table 2). There was no statistical difference between the two groups in terms of demographic features, ERCP indications, and factors impacting cannulation success (common bile duct width, age, surgical history). There was no difference in procedural success or complications between patients with similar characteristics between groups ( $p: 0.117$ ).

The success of CBD cannulation and the complications are summarized in Table 3. There was no mortality in either group. Regarding complications and cannulation success rates, no differences were observed between the groups.

The cannulation procedures used in patients and their distribution in the morning and afternoon were shown in Table 4.

**Table 1.** Exclusion and Termination Criteria.

1)	Under 18 years of age.
2)	Findings suggestive of pancreatic biliary malignancy.
3)	Suspected malignancy during the procedure .
4)	Risk factors for ERCP complications (eg, use of medications that increase the tendency for bleeding, hematological disease, liver cirrhosis, chronic renal disease).
5)	History of any previous papillary intervention .
6)	Inadequate documentation of procedure starting time.

**Table 2.** Comparison of Factors Affecting ERCP Success by Day Code.

	Morning		Afternoon		Totally		Test statistic	p
	Mean $\pm$ SD	Mean (min.-max.)	Mean $\pm$ SD	Mean (min.- max.)	Mean $\pm$ SD	Mean (min.- max.)		
Age (years)	$65,7 \pm 19,1$	68 (7-97)	$63,1 \pm 18,9$	66 (20 - 96)	$64,4 \pm 19$	67 (7 - 97)	U=18485,000	0,141
CBD width (mm)	$10,4 \pm 3,2$	10 (1-24)	$10,1 \pm 2,6$	10 (5 - 20)	$10,3 \pm 2,9$	10 (1 - 24)	U=19323,500	0,243
Total bilirubin (mg/dl)	$7,9 \pm 12,7$	1,4 (0,2 -74)	$7,1 \pm 10,3$	1,7 (0 - 47)	$7,5 \pm 11,6$	1,6 (0 - 74)	U=20841,500	0,581
Direct bilirubin (mg/dl)	$5,1 \pm 9,2$	1,1 (0,1 - 68)	$4,7 \pm 8$	1 (0 - 48)	$4,9 \pm 8,6$	1 (0 - 68)	U=20473,000	0,815

**Table 3.** Evaluation of Complications by Day Code.

	Day Code		Test statistic	p
	Morning	Afternoon		
<b>PostERCP Pancreatitis</b>				
No	190 (94,5)	191 (95)	$\chi^2 = 0,497$	0,481
Yes	11 (5,5)	10 (5)		
<b>Bleeding</b>				
No	181 (90)	174 (86,6)	$\chi^2 = 1,181$	0,277
Yes	20 (10)	27 (13,4)		

Continue

Continue

<b>Perforation</b>				
No	201 (100)	200 (99,5)	$\chi^2 = 1,002$	0,317
Yes	0 (0)	1 (0,5)		
<b>Cholangitis</b>				
No	199 (99)	199 (99)		0,688 <sup>f</sup>
Yes	2 (1)	2 (1)		
<b>Mortality</b>				
No	201 (100)	201 (100)		
Yes	0 (0)	0 (0)		
<b>Success</b>				
No	7 (3,5)	14 (7)	$\chi^2 = 2,462$	0,117
Yes	194 (96,5)	187 (93)		
<b>Bleeding Score</b>				
No	182 (90,5)	174 (86,6)	$\chi^2 = 3,761$	0,153
Mild	19 (9,5)	24 (11,9)		
Moderate	0 (0)	3 (1,5)		
<b>Pancreatitis Score</b>				
No	190 (94,5)	191 (95)	$\chi^2 = 1,003$	0,606
Mild	11 (4,5)	9 (4,5)		
Moderate	0 (0)	1 (0,5)		

Table 4. Comparison of Trading Techniques by Day Code.

	Day Code		Test Statistic	p
	Morning	Afternoon		
<b>Fistulotomy</b>				
No	182 (90,5)	176 (87,6)	$\chi^2 = 0,919$	0,338
Yes	19 (9,5)	25 (12,4)		
<b>Biliary Sphincter Balloon Dilation</b>				
No	57 (28,4)	53 (26,4)	$\chi^2 = 0,200$	0,655
Yes	144 (71,6)	148 (73,6)		
<b>Pancreatic Cannulation</b>				
No	150 (74,6)	159 (79,1)	$\chi^2 = 1,133$	0,287
Yes	51 (25,4)	42 (20,9)		
<b>Pancreatic Sphincterotomy</b>				
No	190 (94,5)	190 (94,5)	$\chi^2 = 0,000$	1,000
Yes	11 (5,5)	11 (5,5)		
<b>Success</b>				
No	7 (3,5)	14 (7)	$\chi^2 = 2,462$	0,117
Yes	194 (96,5)	187 (93)		
<b>Biliary Stent</b>				
No	170 (84,6)	165 (82,1)	$\chi^2 = 0,448$	0,503
Yes	31 (15,4)	36 (17,9)		
<b>Pancreatic Stent</b>				
No	196 (97,5)	192 (95,5)	$\chi^2 = 1,184$	0,277
Yes	5 (2,5)	9 (4,5)		

## DISCUSSION

The key finding of our study was that the time of the ERCP procedure did not affect the success of CBD cannulation, success rate, and complications. Even though there was no statistically significant difference, while the rate of CBD cannulation was 96.5% in patients who were processed in the morning, this rate was 93% in patients who were processed in the afternoon. This rate is similar to traditional cannulation rates [10-12].

In the English literature, the technical success rate is variable in patients who underwent ERCP for choledocholithiasis. Rates ranging from 80.5% to 100% have been recorded in studies using large patient populations [13, 14]. In our study, high procedural success was achieved in both groups, but the morning group's success was higher than the afternoon group's, even though the difference was not statistically significant. The inclusion of patients with CBD stones in the study, which was performed by endoscopists with 15 years of experience and a similar number of ERCPs per year, and the large number of exclusion criteria caused the number of cases to be low. Thus, the influence of doing the procedure in the morning or afternoon, success in cannulation can be more clearly proven in research involving larger populations. Emerging as a result of biliary and pancreatic sphincterotomy, bleeding is a common complication. In our study, during and after ERCP procedure, bleeding rates were greater in the afternoon than the morning procedures (10% vs 13.4%), and all patients in the morning group who experienced bleeding were treated with epinephrine injection during the procedure. In addition to higher bleeding rates in the afternoon group, serious bleeding was seen (necessitating transfusion, requiring reprocessing, causing hypotension and tachycardia) only in the afternoon group. Our bleeding rates were significantly higher than those reported in the literature. Bleeding is the most common complication of ERCP after pancreatitis, and its incidence varies between 1% and 2% [6, 10, 11, 15].

Cholangitis, anticoagulant drug usage, and coagulopathies are all known to promote bleeding [16, 17]. There was no coagulopathy or anticoagulant drug use in any of the individuals. In 18 (4.4%) of the patients, pus drainage occurred during the procedure. Since extracorporeal shock wave lithotripsy (ESWL) cannot be applied in the treatment of patients with cholangitis with large CBD stones in our clinic, larger sphincterotomy was needed to remove these stones, which may explain the high prevalence of bleeding compared to the literature [18]. Post-ERCP pancreatitis is the most common complication of ERCP [19]. Our post-ERCP pancreatitis rates were found to be similar to those reported in the literature [3, 9, 10]. The incidence of post-ERCP pancreatitis varies between 1,6 and 5,4%. 0, 4–0, 7% of patients who acquire pancreatitis get severe life-threatening pancreatitis [13]. While there was no statistically significant difference in post-ERCP pancreatitis outcomes between the groups, it is worth noting that occurrences were more frequent in the morning group. This may be due to the higher pancreatic cannulation rate in the morning group. Among the complications of ERCP, perforation occurs, with an incidence ranging from 0.5%

to 2.1% [8, 20]. Perforation occurred in only one patient, who was in the afternoon group. Cholangitis developed in 0.99% of the participants, which is consistent with previous studies [21].

The number of patients who developed cholangitis was equal in the morning and afternoon groups. The results of this study add information about endoscopic workload and its impact on endoscopic outcome measures. The rate of ERCP success and post-ERCP complications in a sizable community setting was unaffected by the time of day or the workload of the endoscopist [22, 23]. It has been reported that, later start times were observed to have a negative impact on the sensitivity and diagnostic precision of fine needle aspiration during endoscopic ultrasonography for solid pancreatic lesions [22]. In evaluating the effect of the time-of-day ERCP procedure, no difference was found in terms of biliary cannulation success, ERCP completion rates, or significant side effects between morning ERCP and afternoon [24, 25].

## CONCLUSION

In conclusion, our study did not demonstrate a statistically significant difference in ERCP procedures between the morning and afternoon. Nevertheless, gaining insight into ERCP risk factors can contribute to the prevention or mitigation of associated complications.

## AUTHORS' CONTRIBUTION

- **Berk Baş:** Conceived and designed the analysis, collected the data, contributed data and analysis tools, performed the analysis, wrote the paper.
- **Omer Kuçukdemirci:** Wrote the paper, correspondence.
- **Muge Ustaoglu:** Critical feedbacks and supervision.
- **Beytullah Yildirim:** Critical revision.

## CONFLICT OF INTEREST

Declared none.

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