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Original Article

Clearance Rate of Common Bile Duct During First ERCP Attempt in Patients with Choledocholithiasis at a Tertiary Care Hospital

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Abstract

Objective: The aim of this study was to determine clearance rate of common bile duct stone during first ERCP attempt in patients with choledocholithiasis at a tertiary care hospital.

Methods: This was a retrospective study conducted from January 2017 to December 2020 at department of Gastroenterology, Lahore General Hospital. All the patient with naive papilla who had common bile duct stone on the basis of ultrasonography/ CT/ MRCP were included in the study. Data were retrieved from the endoscopic suite database. Information regarding patient's demographics and clinical variables like age, gender along with the number of CBD stones, CBD width, existence of periampullary diverticula, impaction of the stone and sphincter management, stone removal methods and stone clearance rate were noted. Statistical Package for Social Sciences (SPSS) version 24 was used for the purpose of statistical analysis. P-value <0.05 was taken as significant.

Results: We retrospectively reviewed the data of 496 patients, who had undergone ERCP for choledocholithiasis. The mean age of patients was 49.18 ±14.70 years. There were 336 (67.7%) females and 160 (32.3%) males. Two hundred sixty (52.4%) patients had single stone, while remaining 236 (47.6%) had multiple stones. In 422 (85.1%) patients, cannulations with wire were achieved, fifty-two (10.5%) patients underwent cannulation with double wire technique, and 17 (3.4%) underwent precut cannulation. Out of 496 patients, sphincterotomy was done in 495 (99.8%) and sphincteroplasty with CRE balloon dilatation was done in 228 (46%) patients. Stone was successfully retrieved during first ERCP in 421 (84.9%), unsuccessful ERCP in 72 (14.3%) and 3 patients had to undergo surgery. Accessories used for stone extraction were balloon, dormia basket and cholangioscopy in 482 (97.2%), 10 (2%) and 4 (0.8%) patients respectively.

Conclusion: During initial attempts at ERCP, the stone extraction rate typically is around 84.9%. This is largely dependent on the proficiency of the performing physician.

Keywords: ERCP, Common bile ducts SPSS

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Introduction

Cholelithiasis, a condition characterized by the presence of gallstones, is widespread across both Western and Eastern nations, impacting up to 20% of the general population.[1] Among individuals diagnosed with cholelithiasis, approximately 11% to 21% concurrently exhibit stones in the common bile duct (CBD).[2] Research examining the natural progression of choledocholithiasis suggests that between 21% and 34% of CBD stones may undergo spontaneous migration, while the remainder persist, causing obstruction in the distal bile duct.[3]

ERCP stands as a valuable procedure for both diagnosing and treating a range of pancreaticobiliary conditions, including both benign and malignant ailments. In particular, it has replaced surgery as the first line therapy for choledocholithiasis. Numerous endoscopic methods exist to enable immediate, safe, and efficient extraction of bile duct stones. A common approach involves using endoscopic sphincterotomy along balloon catheters and/ or baskets, which serves as the standard technique for stone removal in the majority of cases.[4-6] Biliary stenting can serve as a temporary solution to sustain biliary drainage in situations where extraction methods have proven unsuccessful in completely removing common bile duct (CBD) stones.[7] Approximately 15% of patients with CBD stones have "difficult stones," meaning that

the biliary system cannot be cleared using conventional methods. Failed biliary clearance is associated with features such as irregular, round, or impacted stones, presence of periampullary diverticula or biliary stricture, stones > 1.5 cm, number of stones > 3, intrahepatic duct stones and stone size to bile duct diameter ratio >1.08,9. In patients with difficult CBD stones, techniques like extracorporeal shock wave lithotripsy, cholangioscopic guided laser, or electrohydraulic lithotripsy can also be used. However, these techniques are typically costly, time-consuming, difficult technically and usually require delicate equipment.[10]

ERCP itself is a technically challenging procedure with relatively high complication rates. ERCP has been associated with a number of problems, and the endoscopist's skill level is a key factor in the procedure's success. According to the American Society for Gastrointestinal Endoscopy, achieving competency in duct cannulation or basic therapy requires a minimum of 80% success rate.[11] Additionally, research has shown that before doing the procedure on their own, endoscopists should complete at least 200 ERCPs as trainees.[12,13]

The aim of this study was to determine the success of stone removal at first ERCP attempt and to determine the factors related to failed ductal clearance.

Methods

After taking ethical approval from institutional review board, a retrospective study was conducted from January 2017 to December 2020 at the Department of Gastroenterology, Lahore General Hospital. All the patients with naive papilla that had common bile duct stones diagnosed on ultrasonography/ CT/ MRCP/EUS were included in the study. Patients with a history of sphincterotomy, Mirizzi syndrome, intrahepatic biliary or pancreatic duct stones, pancreaticobiliary malignancy, gastrointestinal hemorrhage, coagulopathy and multiorgan dysfunction due to suppurative cholangitis and those who needed cholangioscopic extraction, percutaneous transhepatic cholangiography or open surgery, were excluded. Data was retrieved from the endoscopic suite database and patient records. Information regarding patient's demographics and clinical variables like age, gender along with number, size, shape and location of CBD stones, CBD diameter, presence of periampullary diverticula, impacted stone, and biliary stricture distal to the stone and stone removal methods (Sphincterotomy, Sphincteroplasty balloon, basket or stents) and the outcome of ERCP were noted. A periampullary diverticulum was defined as a diverticulum within a radius of 2 to 3 cm from the ampulla and that did not encompass the ampulla.

ERCP procedure and Stone Extraction techniques: All procedures were performed under endoscopist directed propofol induced sedation by trained nurses. Six experienced pancreaticobiliary endoscopists performed all the procedures using an Olympus video duodenoscope. All the endoscopists involved in the study had been performing independent ERCPs for more than 3 years with more than 100 ERCP procedures per year. The ERCP procedure is performed in our center as follows: the CBD is cannulated selectively or with double wire technique or using precut technique either by fistulotomy with needle knife sphincterotome or as transpapillary septotomy with standard sphincterotome, followed by placement of a guidewire into the CBD. Sphincterotomy is then performed using an endoscopic sphincterotome either alone or followed by small or large balloon sphincteroplasty depending upon size of stone and CBD diameter as per the judgement of the endoscopist. Existing stones in the biliary system are extracted with an extraction balloon or stone extraction basket. In case of any stricture distal to the stone, balloon dilation with 6, 8 or 10-mm balloon is performed before extraction. Biliary clearance is then confirmed by obtaining an occlusion cholangiogram. In some cases, when CBD clearance could not be confirmed, 7-Fr or 10-Fr straight or double-pigtail plastic stents were placed for biliary drainage. The type and number of stents were determined by the endoscopist according to the size of free space in the CBD.

Statistical analysis: Statistical Package for Social Sciences (SPSS) version 24 was used to analyze all the data. For quantitative variables such as age and stone diameter, the mean and standard deviation were computed, while frequency and percentages were calculated for categorical variables such as gender, bilirubin level, presence of CBD stone, duct clearance, sphincteroplasty, balloon, stent, basket, stricture, and ERCP outcome. To determine the relationship between baseline features and complete duct clearance on the first ERCP attempt, a comparison was made. The chi-square test was used with a significance level of $P < 0.05$.

Results

We retrospectively reviewed the data of 496 patients, who had undergone ERCP for choledocholithiasis. In our study, the mean age of patient was 49.18 ±14.70 years. The minimum age was 16 and the maximum age was 90 years. There were 336 (67.7%) females and 160 (32.3%) males. The male to female ratio was 1:2.1. Two hundred sixty (52.4%) patients had single stone, while remaining 236 (47.6%) had multiple stones. Incidentally, periampullary diverticula were present in 46 (9.3%) patients. In 422 (85.1%) patients, cannulation with wire was achieved, fifty-two (10.5%) patients underwent cannulation with double wire technique, and 17 (3.4%) underwent precut cannulation. CBD stricture

was present in 478 (96.4%). Out of 496 patients, sphincterotomy was done in 495 (99.8%) and sphincteroplasty with CRE balloon dilatation was done in 228 (46%) patients. Stone was successfully retrieved during first ERCP in 421 (84.9%), unsuccessful ERCP in 72 (14.3%) and 3 patients had to undergo surgery. Accessories used for stone extraction were balloon, dormia basket and cholangioscopy in 482 (97.2%), 10 (2%) and 4 (0.8%) patients respectively.

Table 1: *Basic demographic and clinical details.*

Gender	Frequency	Percentage
Male	160	32.3
Female	336	67.7
Number of stones		
Single	260	52.4
Multiple	236	47.6
Periampullary diverticula		
Yes	46	9.3
No	450	90.7
CBD stricture		
Yes	18	3.6
No	478	96.4

Table 2: *ERCP procedure details.*

Procedure	Frequency	Percentage
Cannulation with guidewire	422	85.1
Double wire technique	52	10.5
Precut cannulation	17	3.4
Sphincterotomy performed	495	99.8
Sphincteroplasty with CRE balloon	228	46
Stent placed	84	16.9
Stent not placed	412	83.1
OUTCOME		
Stone successfully retrieved	421	84.8
Stone not retrieved	72	14.5
Surgery	3	0.7

Stent was placed in 84 (16.9%) patients. The success rates among 421 patients that had single stone and multiple stones were 220 (52.2%) and 201 (47.74%) respectively and this difference was statistically not significant. The success rates among 421 patient who had cannulation with wire, double wire technique and precut cannulation were 372 (out of 425), 36 (out of 54) and 13 (out of 17) respectively. This difference was statistically significant. Out of 478 patients without CBD stricture the success rate of stone removal in first attempt was in 411 patients and in 63 patients stone couldn't be retrieved. Out of 18 patients without stricture, the success rate of stone removal was 10/18 patients (P value=0.003). Amongst patients who had to undergo sphincteroplasty, the success rate was 199/228 (P value = 0.228). The mean age of patients in whom the stone was successfully retrieved was 48.61±14.56 years. The mean age of patients in whom the stone couldn't be successfully retrieved was 52.28±15.37 years. This difference was insignificant (P value=0.052). Out of 482 patients in whom stone extraction balloon was used, the stone was successfully removed in 415 (86%) patients, with dormia basket the success rate was 4/10 (40%) and with cholangioscopy 2/4 (50%) (P value=0.001).

Table 3: *comparison of number of stones and outcome*

Number of stone	Stone retrieved	Stone not retrieved	Surgery
Single	220	37	3
Multiple	201	34	0
Total	421	71	3
P value > 0.05			

Table 4: *comparison of different procedure and outcome*

ERCP procedure	Stone retrieved	Stone not retrieved	Surgery
Cannulation with wire	372	50	3
Double wire technique	36	18	0
Precut cannulation	13	4	0
Total	421	73	3
P value= 0.001			

Discussion

ERCP is a widely used endoscopic procedure. Specifically, its use has significantly grown following its successful application in the treatment of a variety of biliopancreatic diseases. The experience with endoscopic extraction on the first try in a Lahore tertiary care hospital was documented in the current study. In endoscopic retrograde cholangiopancreatography (ERCP), endoscopic sphincterotomy is the standard procedure for treating common bile duct (CBD) stones. Balloon or basket catheters are used to retrieve the stones. Four stages are needed to complete this treatment schematically: (1) using the endoscope to reach the papilla; (2) cannulating the CBD; (3) carrying out an endoscopic sphincterotomy (ES); and (4) using balloon or basket catheters to remove the stones. In 80–90% of cases, this method results in the stone removal.[14,15]

In our study, the success rate of stone retrieval after first ERCP was 84.9%. Another study reported similar success rate of stone extraction during the first attempt at ERCP (81.08%). (9) In a research by Nalankilli et al., pre-procedure imaging was done for every patient and 478 procedures, including therapeutic ERCP, were carried out. Wire-guided biliary cannulation was used throughout all procedures, and a 97% success rate in stone extraction was attained.[16] In the majority of patients, full duct clearance was also noted on the initial ERCP

attempt. Numerous recent studies that have demonstrated the effectiveness of ERCP for removing stones in CBD are consistent with these findings.[16] In most of the patients, complete duct clearance was also noted on the initial ERCP attempt. Numerous recent studies that report on the effectiveness of ERCP for CBD stone clearance corroborate these findings .[9,16,17]

Sabbah et al., on the other hand, found that 61.9% of the cases had a very poor CBD clearance rate. Of the 5,226 ERCPs that were conducted, 2,028 instances (94.9%) resulted in successful stone removal.[19] Similar to this, Gnawali et al. found that 46 patients (59%), had extremely poor complete stone clearance on the first attempt.[8]

In our study, the mean age of patients in whom the stone was successfully retrieved was 48.61±14.56 years. The mean age of patients in whom the stone couldn't be successfully retrieved was 52.28±15.37 years. This difference was insignificant (P value=0.052). Samad et al. reported a significant association of complete duct clearance on first ERCP attempt with age and stone diameter.[9] However, we didn't account stone diameter as outcome variable.

We observed, out of 482 patients in whom stone extraction balloon was used, the stone was successfully removed in 415 (86%) patients, with dormia basket the success rate was 4/10 (40%) and with cholangioscopy 2/4 (50%) (P value=0.001). These results are in line with the earlier study, which found that 46 (9.58%) of the stones removed by basket and 434 (90.42%) of the stones removed by balloon.[9]

In our study, the success rates among 421 patient who had cannulation with wire, double wire technique and precut cannulation were 372 (out of 425), 36 (out of 54) and 13 (out of 17) respectively (P value < 0.05). Another study compared the rate of successful cannulation in double guide wire technique and precut cannulation were 91.2% vs 91.9%. The two groups did not significantly differ from one another.[20] Precutting was carried out in 194 cases (9.4% of the cases) in another study.[19]

In a recent study, endoscopic sphincterotomy was performed in 142 patients (78.45%).[18] According to Samad et al. of the 592 patients who had sphincteroplasty procedures, 44 (7.4%) had full duct clearance (72.72%), while 12 patients had stent implantation (27.27%).[9] In our study, the Stent was placed in 84 (16.9%) patients and among patients who had to undergo sphincteroplasty, the success rate was 199/228 (P value= 0.228). The ESGE authorizes the use of endoscopic papillary large-balloon dilation in conjunction with restricted sphincterotomy as the initial method for removing challenging CBD stones.[21]

The fact that the results of the ERCP procedures were assessed by specialists who are not involved in the operations and that the history notes we examined were probably methodically written are the two main advantages of our audit.

Conclusion

The first attempt stone extraction rate in our practice is approximately 84.9%; this is correlated with ERCP proficiency.

Conflict of Interest: None

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