

Results of Endoscopic Retrograd Cholangio Pancreatography in the Treatment of Choledocholithiasis Disease

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Abstract

Original Research Article

Introduction: ERCP has become the standard treatment for common bile duct (MBD) stones. Its effectiveness can exceed 90% of the cases. However, the diameter and number of stones represent a difficulty for ERCP, which limits its effectiveness. The purpose of our work is to study the success rate of ERCP in the treatment of primary bile duct stones and to establish the frequency and possible risk factors for complications. **Materials and methods:** 208 patients were included from May 2015 to August 2018. 2 groups were studied: Group I (n = 128): patients with less than 3 gallstones and the largest diameter was less than 15 mm, while group II (n = 80) represented those with multiple stones (> 3) or large gallstones (≥ 15 mm). We compared the results of ERCP and the correlated factors of complications between two groups. We used the chi-square test and Fisher's test for the study with $p < 0.05$. **Results:** The success rate in a single catheterization was 92.2% in group I versus 74% (59/80) in group II ($p = 0.01$). The overall success rate after complementary technique and / or secondary maneuvers was 93.7% in group 1 versus 80.7% in group 2 ($p = 0.02$). The overall rate success was 90 % in our study. The short-term complication rate was 7% (9/128) in group 1 versus 11.25% (9/80) in group 2 ($p = 0.21$). The complication risk factor was Wirsung's cannulation for pancreatitis ($p = 0.02$) and haemorrhage precut ($p = 0.03$). The study did not show a significant difference in complications between the two groups ($p = 0.21$). **Conclusion:** ERCP is the standard treatment for choledocholithiasis disease. In our study, the success rate was 90% with a complication rate of 9.6%, which corresponds to the literature. The size and number of gallstones have an impact on the success rate but not on the complications.

Keywords: ERCP- Common Bile Duct Stones-Sphincteroclasys-sphincteroplasty pancreatitis-hemorrhage-cholangitis.

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INTRODUCTION

Endoscopic Retrograde Cholangio-Pancreatography (ERCP) was introduced by Mccune in 1968[1], in 1974 by Classen and Demling in Germany [2] and Kawai in Japan [3]. They had simultaneously communicated the first endoscopic sphincterotomies, which were made possible by the development and refinement of the side-view duodenoscope and the creation of the diathermic sphincterotome.

Although these techniques have been used in different biliary and pancreatic pathologies, they have probably been most useful in choledocholithiasis. However, the diameter and number of calculations represent a difficulty for the ERCP that limits its effectiveness.

The purpose of our work is to study the success rate of ERCP in the treatment of the main bile ducts lithiasis and to determine the frequency and potential risk factors for complications.

MATERIALS AND METHODS

This is a retrospective study of patients treated for common bile duct (CBD) stones, conducted in the Department of Digestive Functional Explorations (EFD-HGE) at the Ibn Sina University Hospital in Rabat, for a period of three years from May 2015 to August 2018.

The information was collected on an exploitation sheet (annex) from medical files provided by the EFD-HGE service. The data were processed by the SPSS version 20 software and the Excel version 2007. The SPSS software was useful for the production of frequency tables, as well as for obtaining descriptive and analytical statistics. The quantitative values were expressed as an average \pm standard deviation and analyzed using the Student t-test. The qualitative variables were expressed in percentages and numbers and analyzed using the chi-square test.

Complications associated factors (Young age < 40 years, female gender, history of pancreatitis, sphincteroclasty, sphincteroplasty, cannulation failure, precutting, passage through wirsung, the vacuity of VBP at ERCP, and the duration of ERCP) for pancreatitis, and (Thrombocytopenia, TP < 60, cirrhosis of the liver, cholangitis, and precutting) for hemorrhage, were analyzed using the Fisher exact. A p-value < 0.05 was selected as statistically significant

Excel was mainly used to customize the format of the graphs. 230 ERCPs were selected for 208 patients with 15 patients who were subsequently resumed for further treatment and 7 patients who had a recurrence of their lithiasis.

In our study, patients were divided into two groups

- **Group I:** represented patients with 1 to 2 biliary stones with the largest diameter less than 15mm.
- **Group II:** represented patients with a larger stone (stone whose size is ≥ 15 mm) and/or a multiples choledocholal stones (≥ 3 stones).

All ERCPs were performed under general anesthesia

The cannulation of CBD was performed by a guide wire mounted on a sphincterotome. In case of failure, a papillary precut or infundibulotomy was performed, the biliary tract can also be approached through the Kehr drain if it's already there, or finally and in some cases, the main biliary duct was approached through the opening of the cystic duct when the ERCP was performed at the same time as the operation, during a cholecystectomy. The size, location, number of stones, and diameter of the CBD were obtained by cholangiography.

Efficiency or success was defined by the clearance of the CBD during the fluoroscopy control at the end of the procedure. In case of failure of extraction by the standard technique (use of an extraction balloon, or a Dormia basket after a sphincterotomy, or a precut), additional manoeuvres have been introduced depending on the case: a mechanical lithotripsy, a sphincteroplasty, a sphincteroclasty. A naso-biliary drain or a plastic biliary prosthesis has been placed in case of incomplete vacuity of the CBD, which allows the patient to be resumed later in the days or weeks following the first procedure to try to complete the extraction of the residual stone or stones. In case of total failure, the patient is referred for surgical treatment. Overall success was achieved after resumption and/or additional manoeuvres.

Hospital monitoring for at least 24 hours is required to detect any early complications, clinical and biological monitoring is planned within one month of the endoscopic procedure. Early complications have been reported: acute pancreatitis, perforation, papillary bleeding, and cholangitis.

Pancreatitis was defined as the onset of abdominal pain within 24 hours after ERCP associated with lipaseemia $\geq N$. Mild bleeding was defined as bleeding during ERCP controlled by an injection of adrenaline and/or balloon compression. Severe bleeding has been defined as bleeding that required transfusion and/or surgical hemostasis

RESULTS

Epidemiological characteristics

We divided our patients in two groups:

Group I: had 61.5% (128) patients.

Group II: had 38.5% (80) patients.

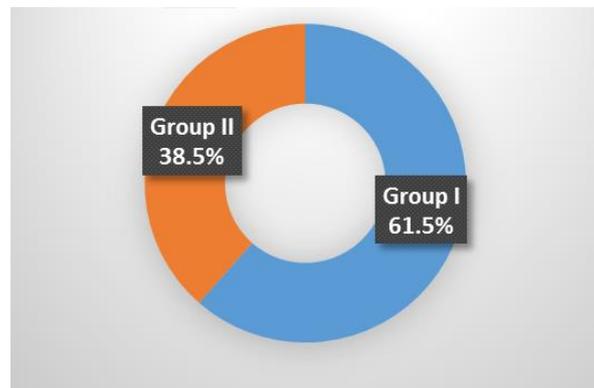


Fig-1: Population distribution

- The average age of all our patients was 57.37 years ± 14 [22-95 years].

In Group I: the average age was 54.75 years ± 15 [22-87 years].

In Group II: the average age was 61.46 years ± 14 [28-95 years] (p=0.008 significant).

- Women accounted for 74.5% (155/208) of the total population and men for 25.5% (53/208). Which corresponds to :

78.1% (100/128) of Women and 21.9% (28/128) of Men in Group I

68.8% (55/80) of Women and 31.2% (25/80) of Men in Group II (p=0.4 non-significant).

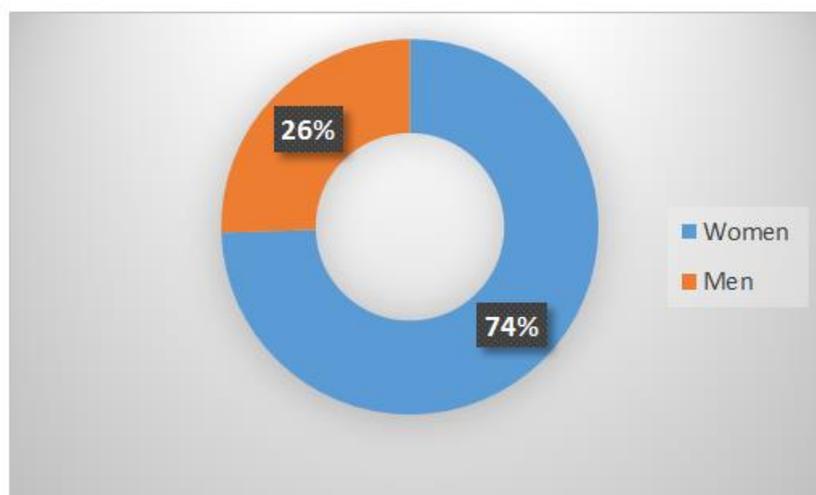


Fig-2: Gender distribution

Co-morbidities represented 20% (42/208) of all our patients, they are grouped in Table I:

In Group I: 19.6% (24/128) of patients

In Group II: 22.5% (18/80) (p=0.8).

Table-I: Epidemiological characteristics

Epidemiological characteristics	Total of patients	Groupe I	Group II	P
Number of patients	208	128	80	
Age	57.37 ans \pm 14	54.75 ans \pm 15	61.46 ans \pm 14	0.008
Gender : -women	74,5%(155)	78,1%(100)	68,8%(55)	0.3
-Men	25.5%(53)	21,9%(28)	21,2%(25)	
Co-morbidities:	20%(42/208)	19,6%(24/128)	22,5%(18/80)	0.8
High blood pressure	6.2%(13/208)	6,2%(8/128)	6,2%(5/80)	0.8
Diabetes	5,7%(12/208)	5,5%(7/128)	6,2%(5/80)	0.7
Liver cirrhosis	4,3%(9/208)	3,9%(5/128)	5%(4/80)	0.7
Prior Cholecystectomy	47,5%(99/208)	48,1%(52/128)	58,7%(47/80)	0.5
previous history of pancreatitis	4,3%(9/208)	4,6%(5/128)	5%(4/80)	0.8
Patient under platelet inhibitor	2%(4/208)	2,7%(3/128)	1,2%(1/80)	0.4

N.B.: the values were expressed as an average \pm standard deviations, headcount and percentages (%).

Clinical characteristics

Clinical signs were present in 62.5% (130/208) of patients. Biliary colic and jaundice were the most common symptoms with frequencies of 26% (54/208) and 25% (52/208) respectively in the general population.

Cholangitis was found in 8.2% (17/208) of patients.

Pancreatitis was found in 6.3% (13/208) of patients.

These clinical characteristics are shown in Figure 3.

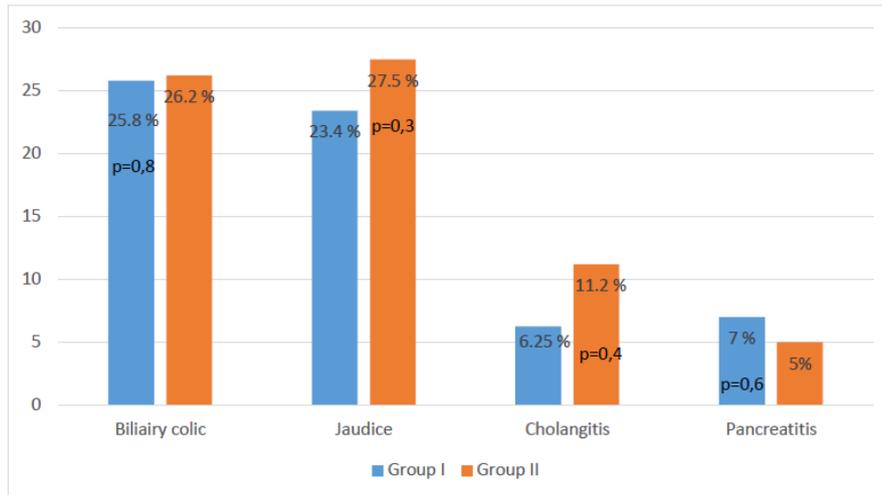


Fig-3: Clinical characteristics

Biological characteristics

The biological assessment carried out before the ERCP showed cytolytic with an increase in AST in 37% (77/208) of cases and ALT in 41% (85/208) of cases, cholestasis with an increase in GGT in 43.2% (90/208) of cases and ALP in 60% (125/208) of cases, a high bilirubin level in 27.9% (58/208) of cases. Thrombocytopenia was observed in 2% (4/208) patients, low TP rate (<70%) in 7.7% (16/208) patients, hyperleukocytosis in 14% (29/208) patients, and increased CRP in 11.6% (24/208) patients. The blood test was normal in 8.2% (17/208) of cases.

Radiological characteristics

Ultrasound made it possible to diagnose the lithiasis of the main biliary duct in 49% (102/208) of

cases; or 52% (65/128) of patients in Group I versus 46.2% (37/80) in Group II ($p=0.3$).

CT was required to confirm the diagnosis and classify associated pancreatitis in 34.6% (72/208) of cases; or 32% (41/128) of patients in Group I versus 38.7% (31/80) in Group II ($p=0.7$).

Bili-MRI was performed in 39% (82/208) of patients; 38% (52/128) of patients in Group I versus 37.5% (30/80) in Group II ($p=0.9$).

Echo-endoscopy was performed in 10% (23/228) of patients; that is 11% (14/128) of patients in Group I versus 11.2% (9/80) in Group II ($p=0.6$).

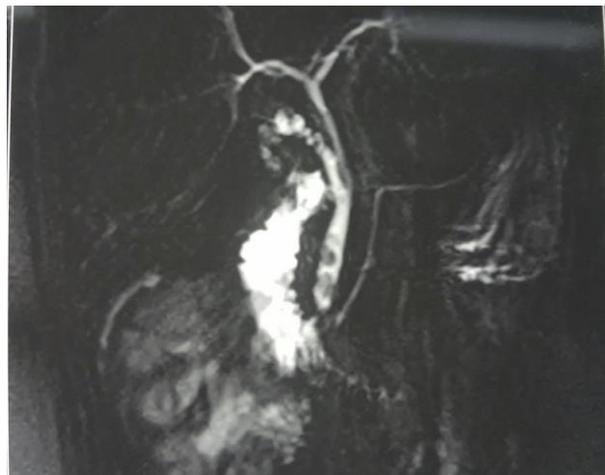


Fig-4: MRI showing two incomplete images of the lower bile duct in relation to calculations

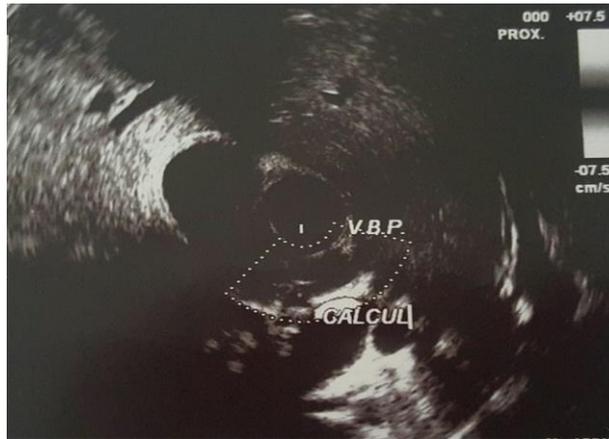


Fig-5: Endoscopic ultrasound view showing a calculation of the lower bile duct responsible for its dilation

Extraction technique

All patients underwent tracheal intubation.

The common bile duct (CBD) approach was performed by

- A catheterization mounted on a guide wire in 87% (200/230) of the ERCPs.
- After an infundibulotomy in 6% (14/230) of the ERCPs.
- After a papilla precut in 1.7%(4/230) of the ERCPs.

- Through the kehr drain in 3% (7/230) of the ERCPs.
- And through the opening of the cystic duct during a cholecystectomy performed at the same time as the endoscopic procedure in 1.7% (4/230) of ERCPs.

Sphincterotomy was performed in 74.1% (170/230) of the ERCPs, and sphincteroclasys was performed in 2.3% (5/230) of the ERCPs. The average duration of the ERCP was 27.73± 14.8[10-90min], and the average duration of hospitalization was 24 hours

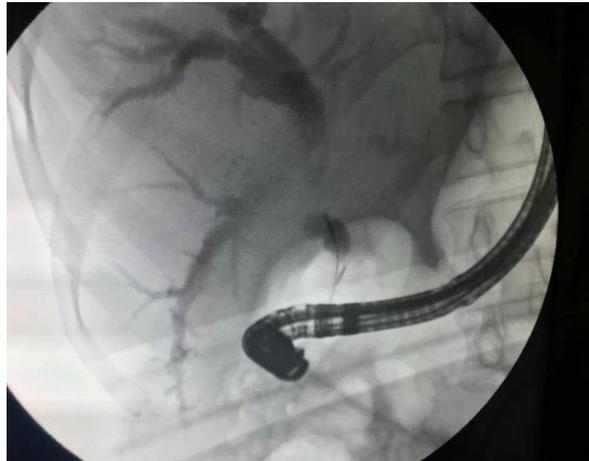


Fig-6: X-ray view showing a choledoccal stone with dilation of the proximal part of the main bile duct and both right and left bile ducts

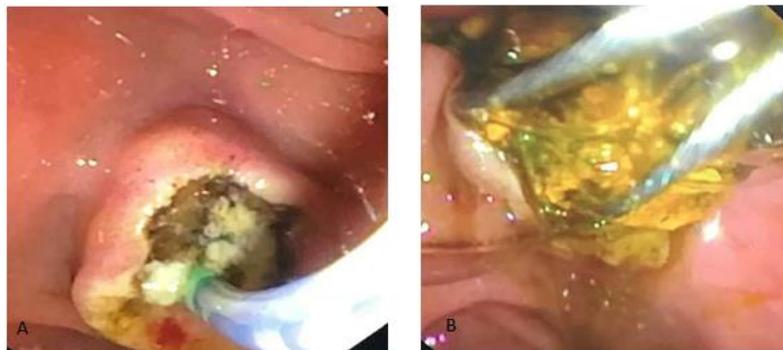


Fig-7: Images showing the extraction of the stone after sphincterotomy by: A: Balloon. B: Extraction basket.

Complementary maneuvers

Additional maneuvers were required to ensure clearance of the common bile duct in 12.5% (26/208) of cases. The frequency of their use was higher in Group II 21.2% (17/80) compared to Group I 7% (9/128) with a significant difference ($p=0.01$).

The biliary prosthesis and the mechanical lithotripsy were the most commonly used maneuvers with frequencies of 5.2% (11/208), 3.3% (7/208) respectively. These additional maneuvers are summarized in Table II.

Table-II: Comparison of the frequency of complementary maneuvers used in the two Groups:

Complementary Maneuvers	Frequency of use%		P
	Group I	Group II	
Prosthesis	3,9%(5/128)	7,5%(6/80)	
Mechanical lithotripsy	0%	8.7%(7/80)	
Dilation of ES	1,5%(2/128)	2,5%(2/80)	
Naso-biliary drain	0%	2.5%(2/80)	
Sphincteroplasty	1,5%(2/128)	0%	
Totale of maneuvers	7%(9/128)	21,2%(17/80)	0.01

Results of ERCP

The success rate for a single catheterization was 92.2% (118/128) in Group I versus 74% (59/80) in Group II ($p=0.01$). The overall success rate after revision and/or secondary maneuvers was 93.7% (120/128) in Group I versus 80.2% (65/80) in Group II ($p=0.02$). Only one patient was referred for surgical treatment and belonged to Group I. And 9.6% (20/208) were lost sight of.

Note that

- In Group I, no calculation was found in 23.3% (28/128) of patients versus 3.7% (3/80) of patients in Group II ($p=0.001$).
- In Group I, 24.2% (29/128) of patients had papillo-Odditis versus 10% (8/80) of patients in Group II ($p=0.03$).

N.B.: papillo-Odditis is determined by the absence of biliary tract clearance after 10 min after fluoroscopy.

Complications

Frequency

The overall rate of short-term complications was 9.6% (19/208) in the general population.

- In Group I, the complication rate was 8.5% (11/128) of patients.
- In Group II, the complication rate was 10% (8/80).

There were no significant differences ($p=0.2$) between the two groups

All these complications are represented in Table III.

Table-III: Comparison of Complication Rates by Population Group:

Complications	Total Population	Group I	Group II	P
Pancreatitis	2.8%(6/208)	2%(3/128)	3,7%(3/80)	
Bleeding	5.2%(11/208)	4.1%(6/128)	6,2%(5/80)	
Cholangitis	0,4%(1/208)	0,9%(1/128)	0%	
Perforation	0.4%(1/208)	0,9%(1/128)	0%	
Total short term complications	9.6%(19/208)	8,5%(11/128)	10%(8/80)	0.2

Note: Three cases of mortality have been reported: one after 3 months following ERCP following severe stage E pancreatitis complicated by false pancreatic cysts. The second death was due to a severe cholangitis complicated by septic shock, and for which the procedure could not bring any benefit. The third death was due to severe acute pancreatitis stage E associated with cholangitis whose operation could not bring any benefit.

Contributing factors

- In our study, only the passage through Wirsung is a contributing factor for pancreatitis ($p=0.02$), and only precutting ($p=0.03$) is a factor for bleeding (See Table IV).
- Two cases of perforation were reported in the two-group group. ERCP was performed in the emergency room or one of the patients, chronically dialyzed, woke up during the procedure, they underwent emergency surgery.

Table-IV: Contributing factors to complications

Contributing factors for pancreatitis		Contributing factors for haemorrhage	
Young age <40ans	p=0.25	Thrombopenia (PLT<100.000)	p=0.6
Feminin gender	P=0.9	TP<60	p=0.1
Prior for pancreatitis	p=0.9	Cholangitis	p=0.5
Sphincteroclasia	p=0.8	Cirrhosis	p=0.4
sphincteroplasty	P=0.9	Precutting	p=0.03
Failure of canulation	P=0.9		
Precutting	P=0.9		
Passage through Wirsung	p=0.02		
Opacification of wirsung	p=0.4		
Vacuity of MBD in ERCP (Thin MBD)	p=0.9		
ERCP duration	P=0.8		

Note: 2 patients were on antiplatelet drug and did not have any bleeding.

DISCUSSION

Lithogenesis corresponds to the formation of stones. It most often occurs in the gallbladder; subsequently one or more of the stones formed migrate to the MBD, then they are secondary stones, or, it occurs in the VBP itself, then they are primary stones, as it's the case with black and brown pigment stones. There are 3 main types of stones: cholesterol mixed or pigmented.

Mixed calculations are essentially made of cholesterol and share the same Physiopathology of cholesterol stones. Both of them represent about 80% of the calculations [4].

Gallstone is a frequent condition, with a prevalence of 50,000 to 100,000 per million inhabitants. In the United States, it is estimated that 12% of the adult population have calculations.

Descriptive epidemiological studies have shown that the distribution of lithiasis is influenced by age, sex and ethnicity. Diet probably plays a role. Parity, obesity, certain diseases and drugs are also important risk factors [5].

ERCP is a reference technique in the diagnosis and treatment of biliopancreatic disorders. Its indications have changed: ERCP is now rarely used for diagnostic applications and most often precedes an endoscopic therapeutic procedure.

The endoscopic objective is to achieve adequate biliary drainage and remove the obstruction. In this way the infection is controlled and when the patient's conditions allow, the final treatment, whether endoscopic or surgical, is carried out.

In the hands of experts, this target exceeds 90% and can reach 98% [6,7]. In literature, the success rate varied from 42%-98% depending on the difficulty.

According to a study carried out at the Rabat Military Hospital [8]:

- The success rate after a single catheterization was 90% in Group I vs 64% in Group II.
 - The overall success rate after revision and/or use of secondary maneuvers was 96% in Group I vs 92% in Group II.
- According to a Tunisian study by Gargouri and *et al.*[9]:
- The success rate after a single catheterization was 65% in Group I vs 42% in Group II.
 - The overall success rate after resumption and/or use of secondary manoeuvres was 96% in Group I vs 88% in Group II.

In our study

- The success rate in a single catheterization was 92.2% in Group I vs 74% in Group II.
- The overall success rate after resumption and/or use of secondary manoeuvres was 93.7% in Group I vs 80.2% in Group II.

The main success predictor is the size of the stone [10]. However, in case of giant or disproportionate lithiasis with the diameter of the bile duct, we can try to catch the calculation with a Dormia basket and fragment it with a mechanical lithotripter. Mechanical Lithotripsy (ML) allows clearance of CBD in 79 to 92% of cases [11].

In our study, the ML was used in 3.3% of cases and allowed the CBD to be emptied. Other techniques can be proposed, in particular, the widening of the endoscopic sphincterotomy, on the other hand, it exposes to a bleeding risk [12], and we can also try a sphincteroplasty which consists in dilating the papilla after sphincterotomy with a balloon 12 to 20 mm in diameter. The rate of complications seems to be the same as in cases of sphincterotomy or even decreased for some authors [13, 14].

At the end of these techniques, if extraction is not possible, electrohydraulic or laser lithotripsy can be attempted when the equipment is available, which was not the case in our study. In some cases, extracorporeal lithotripsy can also be performed. If these means are not available, surgical intervention may be used. When it is not possible to extract all the bile duct stones, and in some selected cases with a high surgical risk, some authors recommend establishing a temporary drainage with a naso-biliary catheter or a prosthesis; this avoids complications secondary to the impact of the stones and allows in a second endoscopy the total extraction of the common bile duct stones [15, 16]. In our study the biliary prosthesis was used in 5.2% of cases, and the naso-biliary drain in 1.3% of cases.

Indications

ERCP continues to play a major role in the therapeutic management of biliary and pancreatic pathologies dominated by lithiasic disease and stenosing tumors. Its diagnosis indication has decreased significantly since the advent of non-invasive imaging techniques [8].

Endoscopic treatment of bile duct stones is indicated in both residual and recurrent (neoformed) lithiasis. In comparison with surgical exploration of the biliary tract, which was the only treatment before. Endoscopic extraction of the stones is harmless, simple and cost effective [16].

In case of cholangitis, especially in the absence of a favourable evolution after antibiotic use, urgent decompression of the bile ducts is necessary and it is carried out by endoscopic methods, or in case of failure or impossibility of the endoscopic way, by percutaneous radiological method [17, 18].

In case of severe acute pancreatitis, ES should be performed after confirmation of CBD stones (by EUS or bili-MRI) within 72 hours of the onset of symptoms. Endoscopic treatment is not indicated in the acute phase of AP, in cases of non-severe AP without icteric cholestasis; in this case, CBD stones should be found and treated later before or during cholecystectomy [19].

Finally, in the case of giant stones or multiple calculations of CBD, endoscopic treatment is considered first-line because it seems more effective than laparoscopic surgical treatment performed at the same time as the cholecystectomy [20]. It can be performed before, during, or after cholecystectomy depending on the case. Although there is much information in the literature on the combination of laparoscopic cholecystectomy and ERCP, prospective studies are still lacking to determine the most appropriate approach [21, 22].

Complications

Like all invasive procedures, ERCP and sphincterotomy present risks and potential complications [23, 24]. These immediate complications include acute pancreatitis, bleeding, perforation, and cholangitis. The complication rate is close to 7%, and varies between 4% and 9.8%, mortality varies from 0.4 to 0.7%, reflecting a lower morbidity and mortality rate than surgical treatment. Indeed, the morbidity rate varies from (13-33) % and the mortality rate from (0-4) % in conventional surgery [25, 26, 27]. In laparoscopy, the morbidity rate is (4.4-12.1) %, and the mortality rate is (0-1.5) %, which is comparable to endoscopic treatment [28-30].

In our study, the complication rate was 9.1%. Except for one case of acute necrotizing pancreatitis and one case of perforation, the rest are minor complications, all treated in a conservative manner. Acute pancreatitis is the most common and dangerous complication. Indeed, an incidence of pancreatitis post-ERCP ranging from 1.3% to 15.1% has been reported in the literature [31, 32, 33]. Which is consistent with our results where we had a post-ERCP pancreatitis rate of 2.8%.

The incidence of bleeding ranged from 1.1% to 4% according to literature data [48, 35, 36, 37, 38, 39]. In our study, bleeding was the most frequent complication with an incidence of 5.8%. These were bleedings occurring during the ERCP rapidly stopping after injection of adrenaline or balloon compression, as the case may be.

Cholangitis was for 1% of complications [32, 35] and is thought to be related to bile contamination by digestive bacteria during ERCP. In our study we had only one case of cholangitis (0.5%). Perforation is a very rare or even exceptional complication with an incidence ranging from 0.1% to 1% [39-41]. In our study, two cases of perforation were reported; one of them was inherent to anesthesia, and which were operated on urgently.

CONCLUSION

ERCP remains the first line treatment for the main biliary tract lithiasis. Indeed, it allows reaching a clearance of the biliary tract in 90% to 98% according to the literature data with a complication rate that remains rare and varies between 4% and 9.8%. It is to be considered as "retrograde endoscopic surgery" and has been enriched in recent years by the Endoscopic Papillary Large Balloon Dilatation technique, which, combined or not with the mechanical lithotripsy, allows the clearance of VBP in the vast majority of cases of "difficult calculations".

In our study the success rate was 90% with a complication rate of 9.6%. Hemorrhage and pancreatitis were the most frequent complications with frequencies

of 5.2% and 2.8% respectively. The factors associated with complications were the passage into Wirsung ($p=0.02$) for pancreatitis and precutting ($p=0.03$) for bleeding. Three cases of mortality were reported in our study. In addition, prospective and multicentric Moroccan studies are needed to confirm these results and provide more information.

REFERENCES

- McCune WS, Shorb PE, Moscovitz H. Endoscopic cannulation of the ampulla of Vater: a preliminary report. *Annals of surgery*. 1968 May;167(5):752.
- Classen M, Demling L. Endoskopische sphinkterotomie der papilla Vateri und steinextraktion aus dem ductus choledochus. *DMW-Deutsche Medizinische Wochenschrift*. 1974 Mar;99(11):496-7.
- Kawai K, Akasaka Y, Murakami K, Tada M, Kohli Y, Nakajima M. Endoscopic sphincterotomy of the ampulla of Vater. *Gastrointestinal endoscopy*. 1974 May 1;20(4):148-51.
- Serge Erlinger. « La lithiase biliaire ». *Gastroenterol Clin Biol*. 2002; 26 :1018-1025.
- Capron JP, Dupas JL, Capron-Chivrac D. Les facteurs associés à la lithiase biliaire cholestérolique. *Gastroenterol Clin Biol*. 1980;4:63-77.
- Freitas ML, Bell RL, Duffy AJ. Choledocholithiasis: Evolving standards for diagnosis and management. *World JGastroenterol*. 2006; 12: 3162-3167.
- Rogers SJ, Cello Jp, Horn JK, Siperstein AE, Schercter Wp, Campbell AR, Mackersie RC, Rodas A, Kreuwel HT, Harris HW. Prospective randomized trial of LC+LCBDE vs ERCP/S+LC for common bile duct stone disease. *Arch surgery*. 2010. 145:28-33.
- Tarik BBADI. Traitement Endoscopique De L'Empierrement Choledocien Et De Gros Calculs : Taux de succès, Facteurs associés et complications. Université Mohammed V-Faculté de médecine et de Pharmacie-Rabat. Thèse N° :405 :2016.
- Gargouri D, Snoussi I, Belhadj N, Ouekaa A, Elloumi H, Kochlef A, Kilani A, Romani M, Kharrat J, Ghorbel A. Evaluation des résultats du traitement endoscopique dans la prise en charge de l'empierrement et des gros calculs cholédocien. *Endoscopy*. 2007 Mar;39(03):A32.
- Lauri A, Horton R, Davidson B, Burroughs A, Dooley JS. Endoscopic extraction of bil duct stones: management related to stone size. *Gut*. 1993; 34: 1718-21.
- Garg PK, Tandon RK, Ahuja V, Makharia GK, Batra Y. Predictors of unsuccessful mechanical lithotripsy and endoscopic clearance of large bile duct stones. *Gastrointestinal endoscopy*. 2004 May 1;59(6):601-5.
- Kalinsky E, Prat F, Boyer J, Pelletier G, Fritsch J, Choury AD, Person B, Buffet C. Endoscopic sphincteroclasie for choledocholithiasis of the principal bile duct. Short-term results and follow-up. *Gastroenterologie clinique et biologique*. 1999 Feb;23(2):187-94.
- Liu Y, Su P, Lin Y, Lin S, Xiao K, Chen P, An S, Bai Y, Zhi F. Endoscopic sphincterotomy plus balloon dilation versus endoscopic sphincterotomy for choledocholithiasis: A meta-analysis. *Journal of gastroenterology and hepatology*. 2013 Jun;28(6):937-45.
- Feng Y, Zhu H, Chen X, Xu S, Cheng W, Ni J, Shi R. Comparison of endoscopic papillary large balloon dilation and endoscopic sphincterotomy for retrieval of choledocholithiasis: a meta-analysis of randomized controlled trials. *Journal of gastroenterology*. 2012 Jun 1;47(6):655-63.
- Anselmi M, Cobo RO, Benavides CL, Pacheco FR. Esfinterotomía endoscópica: indicaciones, éxitos, fracasos y complicaciones precoces. *Rev Chil Cir*. 1998;50:268-75.
- Castillo P, Karelovic S. Diagnóstico y tratamiento endoscópico de la colédocolitiasis. *Cuadernos de Cirugía*. 2018 May 11;14(1):12-7.
- Leese T, Neoptolemos JP, Baker AR, Carr-Locke DL. Management of acute cholangitis and the impact of endoscopic sphincterotomy. *British Journal of Surgery*. 1986 Dec;73(12):988-92.
- Lai EC, Paterson IA, Tam PC, Choi TK, Fan ST, Wong J. Severe acute cholangitis: the role of emergency nasobiliary drainage. *Surgery*. 1990 Mar;107(3):268-72.
- Williams EJ, Green J, Beckingham I, Parks R, Martin D, Lombard M. Guidelines on the management of common bile duct stones (CBDS). *Gut*. 2008 Jul 1;57(7):1004-21.
- Strömberg C, Nilsson M, Leijonmarck CE. Stone clearance and risk factors for failure in laparoscopic transcystic exploration of the common bile duct. *Surgical endoscopy*. 2008 May 1;22(5):1194-9.
- Miller RE, Kimmelstiel FM, Winkler WP. Management of common bile duct stones in the era of laparoscopic cholecystectomy. *The American journal of surgery*. 1995 Feb 1;169(2):273-6.

22. Cotton PB. Endoscopic retrograde cholangiopancreatography and laparoscopic cholecystectomy. *The American journal of surgery*. 1993 Apr 1;165(4):474-8.
23. Castaing D. Surgical anatomy of the biliary tract. *HPB*. 2008 Apr;10(2):72-6.
24. Cotton PB, Lehman G, Vennes J, Geenen JE, Russell RC, Meyers WC, Liguory C, Nickl N. Endoscopic sphincterotomy complications and their management: an attempt at consensus. *Gastrointestinal endoscopy*. 1991 May 1;37(3):383-93.
25. Rat P. Lithiase de la voie biliaire principale: Résultats de la chirurgie ouverte. *Lyon chir*. 1997; 93: 1-2.
26. Houdart F, Lecomte P, Perniceni, Simon JF, Salmeron M. One hundred and twenty-five consecutive choledocotomies for suspicion of lithiasis without mortality. Current status of complications of surgery of the main bile duct. In *Annales de chirurgie*. 1992 ; 6(10):928-931. Elsevier.
27. Meyer C. Résultats de la chirurgie traditionnelle dans le traitement de la lithiase de la voie biliaire principale: à propos de 670 cas. *Lyon Chir*. 1997;93:3-9.
28. Elfares F, Ait Boulbaroud M, Mehhane M, Moumen M. La lithiase de la voie biliaire principale sous principale sous coelioscopie communication. Deuxième journée nationale de la coelioscopie. 1996 May;11.
29. Molassoko JM, Cheyrou E, Coblenca JF, Bedirici Y, Brochard M, Msika S. Traitement chirurgical de la lithiase biliaire par laparoscopie chez les sujets de plus de 75 ans. Evaluation de la morbidité post-opératoire et de la consommation d'analgésiques. *Gastroentérologie clinique et biologique*. 1996;20:A-224.
30. Regairaz C. Le traitement coelioscopique de la lithiase de la voie biliaire principale: une chirurgie de routine. *Lyon Chir*. 1995;91:4-20.
31. Wang P, Li ZS, Liu F, Ren X, Lu NH, Fan ZN, Huang Q, Zhang X, He LP, Sun WS, Zhao Q. Risk factors for ERCP-related complications: a prospective multicenter study. *The American journal of gastroenterology*. 2009 Jan;104(1):31.
32. Menecier D. «Hepato web,» 2011. [En ligne]. Available: http://www.hepatoweb.com/Pancreas_anatomie.php
33. Williams EJ, Taylor S, Fairclough P, Hamlyn A, Logan RF, Martin D, Riley SA, Veitch P, Wilkinson ML, Williamson PR, Lombard M. Risk factors for complication following ERCP; results of a large-scale, prospective multicenter study. *Endoscopy*. 2007 Sep;39(09):793-801.
34. Marc Barthet, Laurent Heyries, Ariadne Desjeux. Complications à court terme de la cholangio-pancréatographie rétrograde endoscopique (CPRE) diagnostique et thérapeutique. *Gastroenterol Clin Biol*. 2002. 26:980-87.
35. Andriulli A, Loperfido S, Napolitano G, Nitro G, Valvano MR, Spirito F, Pilotto A, Forlano R. Incidence rates of post-ERCP complications : a systematic survey of prospective studies. *Am J Gastroenterol*. 2007. 102 : 1781-8.
36. Heyries L, Barthet M, Miranda C, Bernard JP, Sahel J. Intubation pancréatique per endoscopique dans la pancréatite chronique calcifiante. *Gastroenterol Clin Biol*. 1999. 23: 469-76.
37. Loperfido S, Angelini G, Benedetti G, Chilovi F, Costan F, De Berardinis F, De Bernardin M, Ederle A, Fina P, Fratton A. Major early complications from diagnostic and therapeutic ERCP: prospective multicenter study. *Gastrointest Endosc*. 1998. 48: 1-10.
38. Masci E, Toti G, Mariani A, Curioni S, Lomazzi A, Dinelli M, Minoli G, Crosta C, Comin U, Fertitta A, Prada A. Complications of diagnostic and therapeutic ERCP: a prospective multicenter study. *The American journal of gastroenterology*. 2001 Feb;96(2):417.
39. Enns R, Eloubeidi MA, Mergener K, Jowell PS, Branch MS, Pappas TM, Baillie J. ERCP-related perforations : risk factors and management *Endoscopy*. 2002. 34 :293-8.
40. Fatima J, Baron TH, Topazian MD, Houghton SG, Iqbal CW, Ott BJ, Farley DR, Farnell MB, Sarr MG. Pancreaticobiliary and duodenal perforations after perampullary endoscopic procedures: diagnosis and management. *Archives of Surgery*. 2007 May 1;142(5):448-55.
41. Martin DF, Tweedle DE. Retroperitoneal perforation during ERCP and endoscopic sphincterotomy: causes, clinical features and management. *Endoscopy*. 1990 Jul;22(04):174-5.