Actual management of common bile duct stones: a continuous evolving approach

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J.F. GIGOT

Department of Digestive Surgery
St-Luc University Hospital di Bruxelles
Louvain Medical School

Abstract

The management of common bile duct stones (CBDS) has recently changed regarding either a more precise diagnosis of patients at high-risk to harbor CBDS and either the development of new therapeutic modalities. In patients with preoperative predictive suspicion of CBDS, new non-invasive radiologic and endoscopic investigations are now available, namely 3-D spiral CT-cholangiography and magnetic resonance cholangio-pancreatography on one hand, and endoscopic ultrasonography on the other hand. With the development of laparoscopic surgery, two strategies have emerged in order to maintain the minimally invasive nature of the procedure : perioperative endoscopic sphincterotomy or laparoscopic common bile duct exploration. However, considerable laparoscopic expertise, advanced and expansive technologies are required to achieve successful laparoscopic treatment of CBDS. An appropriate intraoperative strategy is mandatory during laparoscopic common bile duct exploration, with specific indications for the transcystic route and for laparoscopic choledochotomy, according to patient's biliary anatomy and stone's characteristics. A preliminary controlled trial has proved the safety, efficacy and excellent postoperative results of such approach. However, the best option of management for patients with CBDS remains open to discussion and the therapeutic choice should depend on the local hospital availability of technical expertise.
Key Words: Main biliary duct lithiasis, gallbladder lithiasis

Riassunto

Il trattamento della calcolosi della VBP ha di recente subito profondi cambiamenti, sia per il miglioramento della diagnostica che per lo sviluppo di nuove modalità di trattamento. Nei pazienti con criteri preoperatori predittivi di calcolosi della VBP, sono oggi disponibili la colangiografia-TC spirale tridimensionale, la colangiografia-RM e l'ecoendoscopia. Con lo sviluppo della chirurgia laparoscopica, sono attualmente due le principali modalità di approccio: la sfinterotomia endoscopica intraoperatoria e l'esplorazione laparoscopica della VBP. Quest'ultima, per aver successo, richiede una notevole esperienza e la disponibiltà di tutte le moderne tecnologie; è inoltre obbligatorio seguire una tattica chirgica ben precisa, scegliendo l'approccio transcistico o la coledocotomia, a seconda delle caratteristiche anatomiche del paziente e del tipo di calcoli. La sicurezza, l'efficacia e i risultati di questo atteggiamento sono stati dimostrati in un trial preliminare di controllo. Comunque, la discussione sulle diverse opzioni terapeutiche rimane aperta e la scelta dipende anche dealle tecniche disponibili in ogni singolo Centro.
Palole chiave: Calcolosi epato-coledocica e colecistica.

Introduction

While the prevalence of common bile duct stones (CBDS) during cholecystectomy was found a few years ago to be approximately 10-20 % (1-5), the prevalence of CBDS appears to have dropped recently with the advent of laparoscopic cholecystectomy (LC) (6,7). This decline could possibly reflect a different patient population with younger patients operated earlier in the course of symptomatic gallstones disease (6). In the era of LC, the prevalence of CBDS currently averages 6 % (range : 3% to 10%) (8,9-22).

Up to the nineties, therapeutic strategies included open common bile duct exploration (CBDE) or endoscopic sphincterotomy (ES). Comparison between these two approaches have been evaluated in patients with CBDS by 6 differents prospective controlled trials (23-28). In all these studies, the safety and efficacy of both treatments were similar, with a reduced postoperative hospital stay for the endoscopic group in the Neoptolemos (23) and the Targarona (28) series. However, endoscopic treatment has proved its superiority in patients with severe cholangitis (29) and severe biliary pancreatitis (30,31).

Recently, the management of patients with CBDS has again changed regarding either a more precise preoperative detection of CBDS and either with the development of new therapeutic modalities. With the use of laparoscopic surgery, laparoscopic common bile duct exploration has indeed emerged as a new promising approach.

Improvement in preoperative detection of CBDS

Usual *preoperative predictive criterias of CBDS* include clinical (jaundice, cholangitis, ...), biochemical (serum bilirubin and alcaline phosphatases ...) and ultrasonographic (common bile duct diameter > 10 mm, direct visualization of CBDS, ...) and operative variables (CBD diameter > 10-12 mm, cystic duct diameter > 4-5 mm, palpable CBDS) (32). Combination of multiple positive criteras increases the sensitivity of the predictive model to 89.5 % (32). Most of these criterias were determined at the time of open cholecystectomy. But regarding some particularities of the laparoscopic approach (loss of tactile sensation, video-image magnification...), intraoperative criterias like CBD and cystic duct size or palpable CBDS may not be accurately determined during LC. BARKUN et al. (9) identified by multivariate analysis four variables (patients older than 55 years of age, bilirubin level >30 mmol/l, dilated CBD >6 mm at preoperative US and CBDS seen at US) as independent predictors of CBDS. The model yielded probabilities of finding a CBDS that ranged from 18% (no predictor present) to 94% (all four predictors present). This model was subsequently validated in a prospective consecutive series of 49 patients, with a CBDS prevalence of 8% in patients in whom none of the four predictors was pre-

Tab. I - RESULTS OF PREOPERATIVE ERCP/ES BEFORE LC IN PATIENTS WITH CBDS - LITERATURE'S REVIEW.

Author	*Year of publication*	*Patients*	*CBDS suspected*	*CBDS confirmed at ERCP (%)*	*Stone clearance (%)*	*Mortality (%)*	*Complications (%)*	*Residual CBDS (%)*
PONCHON [35]	1989	–	69	50 (72)	44 (88)	1.4	7.2	–
SOUTHERN [6]	1991	1518	63	10 (16)	9 (90)	0	0	–
ALIPERTI [36]	1991	326	31	18 (58)	18 (100)	0	5.5	6.4
GRAVES [37]	1991	304	11	3 (27)	3 (100)	–	–	–
FLOWERS [15]	1992	165	20	8 (40)	8 (100)	0	2.9	–
BAIRD [38]	1992	800	11	3 (27)	3 (100)	0	0	–
LARSON [7]	1992	1983	65	20 (31)	18 (90)	0	0	6.4
NEUHAUS [39]	1992	288	routine ERCP	29 (11)	26 (90)	0	10.3	–
ARREGUI [40]	1992	622	36	17 (47)	11 (65)	0	7.9	–
LILLEMOE [14]	1992	400	31	14 (45)	14 (100)	0	5	–
METCLAF [41]	1992	121	10	7 (70)	7 (100)	–	–	–
BOULAY [42]	1992	-	28	9 (32)	8 (89)	0	0	–
FRANCESCHI [43]	1993	401	47	27 (57)	25 (93)	0	1.9	–
FRAZEE [44]	1993	706	31	18 (62)	18 (100)	0	2	–
GRAHAM [45]	1993	540	36	18 (50)	18 (100)	0	6	–
LEITMAN [46]	1993	573	45	20 (44)	20 (100)	0	6	–
GRACE [21]	1993	300	27	7 (26)	7 (100)	–	–	0.8
VITALE [47]	1993	410	21	17 (81)	7 (100)	0	3.3.	–
WILSON [48]	1993	418	130	45 (35)	–	–	–	–
ROY [49]	1993	475	7	5 (71)	4 (80)	0	–	0.2
MARTIN [50]	1993	–	–	48	41 (85)	2	12	–
SURICK [51]	1993	–	62	27 (43)	20 (74)	0	5	3.7
COTTON [52]	1993	–	–	343	321 (94)	0.9	6.4	–
WIDDISON [53]	1994	286	96	59 (61)	53 (90)	0	1	–
BARKUN [9]	1994	1300	106	50 (47)	45 (90)	0	9	–
MEYER [54]	1994	733	131	58 (44)	55 (95)	0	1	1.8
SALKY [19]	1994	822	61	25 (41)	23 (92)	–	–	–
VOYLES [55]	1994	1050	51	24 (47)	13 (54)	0	2	2
RIEGER [56]	1994	1140	106	56 (53)	53 (95)	0	1.9	0.7
ROBINSON [22]	1995	542	20	10 (50)	19 (95)	–	–	2.4
RIJNA [57]	1995	699	119	35 (29)	–	2	14	–
MILLER [58]	1995	217	37	19 (51)	18 (95)	0	2.7	1.1
KUM [59]	1996	303	46	19 (42)	18 (95)	0	0	–
TANAKA [60]	1996	1138	routine ERCP	46 (4)	43 (93)	0	6.5	–
ZANINOTTO [61]	1996	593	71	44 (62)	37 (84)	0	2.3	–
COPPOLA [62]	1996	407	99	39 (40)	39 (100)	0	2.5	0.7
KORMAN [63]	1996	343	42	27 (64)	27 (100)	0	10	1
BONATSOS [64]	1996	1788	89	54 (61)	53 (98)	0	4.5	–
LIU [65]	1996	481	145	76 (52)	62/67 (92)	0	3.4	–
KULLMAN [66]	1996	630	84	47 (56)	44 (94)	0	3	6 (at IOC)
40 Scries	1989-1996	> 22.822	2084	985 (47 %)	1252 (92 %)	0-2 %	0-10.3 %	0.2-6 %

sent in contrast to 66% in whom two or more predictors were present (9).
Other predictive score, using multivariate statistical analysis, focused on the selection of a "low-risk" group of patients to harbor CBDS, with a prevalence of CBDS between 2% to 4% (33,34). The major purpose of these later scoring systems was to avoid the performance of intraoperative cholangiography (IOC) during cholecystectomy. However, even with the use of these preoperative predictive scoring system in high-risk patients to harbor CBDS and submitted to selective endoscopic retrograde cholangio-pancreatography (ERCP), the rate of negative ERCP examinations ranges between 38 % to 76 %, with an average of 47 % in a compilation of 40 series from the literature (Table I).
New radiologic and endoscopic diagnostic procedures for a non-invasive detection of CBDS have been recently developped, namely 3-D spiral CT-cholangiography, magnetic resonance cholangio-pancreatography (MRCP) and endoscopic ultrasonography.
In patients with a serum bilirubin level less than 2 mgr/dl, *3-D spiral CT-cholangiography* achieves in our experience a sensitivity and a positive predictive value of 90 %, a specificity and a negative predictive value of 99 %. The prevalence of CBDS in this series of 134 consecutive patients undergoing preoperative 3-D spiral CT-cholangiography was 7.5 %. Hazardous biliary anatomical variations were present in 13 % of the patients, and were correctly identified by preoperative 3-D spiral CT-cholangiography in 94 %. We never encountered adverse reactions to biliary contrast agents (67).
Magnetic resonance cholangiography (MRCP) carries an overall accuracy of 94%, a sensitivity of 81 %, a specificity of 98 %, a positive predictive value of 93 % and a negative predictive value of 94 % (68). A clear advantage of MRCP over ERCP is the lack of invasiveness, the absence of adverse effects and a lower failure rate. Finally, MRCP is not limited in patients with jaundice, duodenal stenosis or hepatico-jejunostomy, is not operator-dependent and allow visualization of the biliary tree and pancreatic duct both proximal and distal to the site of obstruction. However, spatial resolution of MRCP techniques should be improved to allow detection of CBDS smaller than 4 mm in diameter (68).

Endoscopic ultrasonography is the most recent, non invasive and sensitive endoscopic technique for the detection of choledocholithiasis before endoscopic or surgical treatment. Amouyal et al. (69) reported a sensitivity of 97 %. The technique is particularly accurate for the diagnosis of small stones in the lower part of the common bile duct (CBD), especially if it is not enlarged. Disadvantages of endoscopic ultrasonography includes operator-dependence, duodenal obstruction, patient's tolerance (which sometimes justifies a general anesthesia) and rare complications such as duodenal perforation. This author recommend that the diagnostic strategy for choledocholithiasis included ultrasound as the first choice (because it is simple to perform) and endoscopic ultrasonography thereafter. ERCP should thus be actually avoided as a diagnostic tool and reserved for therapeutic use.
The use of these new imaging modalities should certainly in the future improve the preoperative detection of CBDS in order to permit an optimal therapeutic choice for each patient. The greater advantage of these innovative techniques is their lack of invasiveness compared to ERCP. However, their major limitations are the lack of availability in most hospitals and the cost of these diagnostic procedures.

Actual therapeutic choice for the management of patients with cbds

Management's options

In case of preoperative diagnosis of CBDS, options for management include (1) preoperative ERCP and ES followed by laparoscopic cholecystectomy, (2) use of conventional open CBDE or more recently (3) laparoscopic CBDE. In order to maintain the minimally invasive nature of laparoscopic cholecystectomy, open CBDE is less and less frequently used (43) and reserved for difficult stones, for situations where LC had to be converted to an open procedure or when laparoscopic surgeons are not trained for laparoscopic CBDE. Finally, two strategies have emerged : perioperative ERCP/ES or laparoscopic CBDE. However, the optimal timing of ERCP/ES remains controversial, with its use before, during or after LC.
In case of intraoperative detection of CBDS at intraoperative cholangiography, options for management include (1) immediate conversion to open CBDE, (2) laparoscopic CBDE during the same session than LC, (3) intraoperative ES, (4) postoperative ES or (5) expectation. Expectant policy is warranted in case of few and small CBDS (< 5 mm) within a non-dilated CBD, because most small stones will pass spontaneously and because the risk of endoscopic or surgical treatment in a normal size CBD is higher.

Perioperative endoscopic sphincterotomy

In a cumulative analysis from 40 series of the literature (Table I), *preoperative ES* achieved a successful ductal clearance in 92 % of the patients, with a very low mortality (between 0-2 %) and complications rate (between 0-10.3 %). The reported incidence of residual CBDS in this review is 2-3 % (range: 0.2-6 %). One of the advantages of performing ERCP preoperatively is the possibility to recognize before LC the patients whose duct can not be cleared endoscopically, allowing the surgeon to

proceed directly to open CBDE or more recently to laparoscopic CBDE. With the combined endoscopic/laparoscopic approach the postoperative hospital stay can be reduced to 2-4 days (9,36,40,53,61,62,65), which is significantly shorter than with open CBDE (9,61,65).

The advantages of *intraoperative ES* include the combined performance of the endo-laparoscopic procedure in a single surgical and anesthetic session, eliminating the need for an extra-procedure on a different occasion, optimization of the patient's compliance, reduction of overall hospital stay and avoidance of overselecting patients for preoperative ERCP based on predictive criterias for CBDS. Disadvantages are reported to be a prolongation of the operative time, team coordination problems (anesthetists, surgeons, endoscopists...), excessive distension of the small bowel caused by air-insufflation during flexible endoscopy and more difficult selective retrograde cannulation of the bile duct in the supine position rather than the typical prone position leading to indesirable injection of the pancreatic duct and an increased risk of acute pancreatitis.

De Palma (70) and Deslandres (71) reported on 15 and 28 patients, respectively, with peroperative ES achieving successful clearance in all, with no mortality nor complications. The mean operative time was doubled compared to simple LC, but the postoperative stay was reduced to 2.5-3 days. On the other hand, COX et al. (72) reported on 13 patients with 2 cannulations failures, a successful clearance rate in 85 % of the patients, and the occurrence of mild pancreatitis in 15 %. However, the team coordination problems and the increased risk of pancreatitis are responsible for a limited diffusion of this technique in the managment of CBDS.

Postoperative ES is an other option of treatment when CBDS are detected at IOC or when laparoscopic or open CBDE fails. Postoperative ERCP results in the lower cost, procedure numbers, hospital days and back-to-work delay in the decision- analysis study reported by Erickson et al. (73). However, the success rate of cannulating the papilla by ERCP is not 100 %, and some patients could require a second anesthesia for subsequent open CBDE (7-14 %) (45,60,74,75). On the other hand, it should be pointed out that at the time of postoperative ERCP, 17 to 40 % of CBDS detected at IOUS during LC are found to have passed spontaneously (37,45,48,74,75). In a cumulative series

Tab. II - RESULTS OF POSTOPERATIVE ERCP/ES IN PATIENTS WITH CBDS AFTER LC - LITERATURE'S REVIEW

Authors	*Year of publication*	*Patients N° of attempt*	*CBDS cleared N*	*(%)*	*Complications (%)*	*OCBDE required*
SOUTHERN [6]	1991	10	10	100	-	0
ALIPERTI [36]	1991	4	4	100	-	0
GRAVES [37]	1991	3	3	100	-	0
BERCI [76]	1991	5	5	100	-	0
TRAVERSO [77]	1991	27	27	100	-	0
BAIRD [38]	1992	4	4	100	-	0
LARSON [7]	1992	4	4	100	-	0
ARREGUI [40]	1992	5	5	100	-	0
BOULAY [42]	1992	8	8	100	-	0
LILLEMOE [14]	1992	3	3	100	-	0
METCLAF [41]	1992	4	4	100	-	0
GRAHAM [45]	1993	11	11	100	4	0
LEITMAN [46]	1993	7	7	100	-	0
COTTON [52]	1993	14	14	100	-	0
VITALE [47]	1993	5	5	100	-	0
WILSON [48]	1993	11	10	91	-	0
ROY [49]	1993	4	4	100	-	0
FRAZEE [44]	1993	19	18	95	-	1
SURICK [51]	1993	4	4	100	-	0
FRANCESCHI [43]	1993	12	12	100	-	0
MANOUKIAN [78]	1993	25	25	100	0	0
KENT [75]	1994	21	21	100	14	0
VOYLES [55]	1994	3	3	100	-	0
RIEGER [56]	1994	8	8	100	-	0
PENCEV [79]	1994	23	23	100	1.8	0
SCHMITT [80]	1995	14	14	100	7	0
KUM [59]	1996	1	1	100	-	0
TANAKA [60]	1996	13	10	77	-	3
KORMAN [63]	1996	6	6	100	-	0
BONATSOS [64]	1996	8	8	100	-	0
KULLMAN [66]	1996	29	29	100	-	0

Tab. III - RESULTS OF ATTEMPTED LAPAROSCOPIC CBDE FOR CBDS : LITERATURE'S REVIEW FROM SERIES ≥ 10

patients	*Year of publication*	*Patients*	*TC*	*Chol*	*Successful stone clearance*	*Conversion to OCBDE*	*Postop. ES*	*Observ.*	*Operative time (min)*	*Major complic. (%)*	*Death*	*Retained stone (%)*	*Postop. hosp stay (days)*
SHAPIRO [92]	1991	16	15	1	15 (100)	–	–	–	240	0	0	0	2.6
BERCI [76]	1991	21	21	–	21 (100)	–	–	–	–	0	0	0	–
SPAW [94]	1991	13	13	–	8 (61)	3	–	2	–	0	0	0	–
SACKIER [17]	1991	35	35	–	21 (60)	8	5	1	–	0	0	–	–
IDO [95]	1992	13	13	–	12 (92)	–	–	ESWL 1	–	0	0	0	THS:9
O'RIORDAN [96]	1992	10	10	–	9 (90)	–	1	–	–	0	0	0	THS:3
BAGNATO [97]	1993	22	18	4	18 (82)	4	–	–	–	0	0	0	TC:3 CH:4.2.
PETELIN [98]	1993	77	77	–	74 (96)	1	2	–	113-146	5.2	1	2 (2.6)	1-2
FERZLI [99]	1994	24	13	11	24 (100)	–	–	–	168	4	0	2 (8)	2.7
FRANKLIN [100]	1994	60	-	60	58 (97)	2	–	–	–	1.7	1	–	1.8-2.8
DION [101]	1994	59	18	41	TC:17 (94) CH:38 (93)	TC:1 CH:3	–	–	TC:150 CH:172	TC:0 CH:17	0	TC:3 (17) CH:3 (7)	TC:6.5 CH:12
CARROLL [84]	1994	88	88	–	82 (93)	3	3	–	139	5.6	1	–	3.7
DROUART [81]	1994	140	70	89	TC:46 (66) CH:84 (94)	3	7	–	–	3	0	2 (1.4)	THS:7.8
DE PAULA [85]	1994	114	102	7	TC:96 (84.3) 95 % CH:7 (100 %)	3	3	–	110	TC:1 CH:8	TC:0 CH:1	TC:1 CH:0	1.7
PHILLIPS [82]	1995	123	123	–	112 (91)	4	5	1	127	3.8	1	4 (3.8)	3.4
STOKER [89]	1995	64	37	27	60 (94)	4	–	–	149	3	0	3 (5)	THS:2.8
LEZOCHE [102]	1995	120	116	39	TC:77 (66) Whole:116 (97)	4	–	–	128	1.7	1	5 (4.3)	–
ROUSH [91]	1995	32	32	–	19 (59)	4	9	–	166	0	0	2 (6)	1.7
KELLEY [103]	1995	24	18	4	22 (91)	–	2	–	–	–	0	–	–
SWANSTROM [104]	1996	18	15	3	18 (100)	–	–	–	122	4	0	2 (4)	TC:34 h CH:52 h
CROCE [105]	1996	32	–	32	31 (97)	1	–	–	180	3	0	1 (3)	THS:7.1
MILLAT [88]	1996	178	126	61	TC:97 (77) 86 % CH:56 (92)	18	TC:6 7 CH:1	–	TC:114 CH:177	2.5	0	0	9
TOTAL:		1283	960	379	1161 (91%)	66 (5%)	44 (3.4%)				6 (0,5%)	30 (2,3%)	

TC : transcystic route, CH : choledochotomy, THS : total hospital study, h: hours.

from the literature of 315 patients undergoing postoperative ES (Table II), the stone clearance rate was 98 %, with a minimal morbidity. Multiple attempts for endoscopic stone clearance were however necessary in 11-36 % of the patients (45,48,49,74,75,80). In the Franceschi's series (43), a 48 % decrease of hospital stay was observed for patients undergoing postoperative ES compared with patients undergoing open CBDE. However, before refering for postoperative ES a patient with CBDS detected at IOUS during LC, it is important to identify the patients in whom endoscopic stone clearance has a higher risk of failure. Unfavorable criterias include anatomy of the papilla (presence of ampullary diverticulum, papilla located in the third duodenum ...), aspect of the common bile duct (tortuous, intrapancreatic stricture...), characteristics of stones (huge stones, intrahepatic stones, impacted stones above a biliary stricture...) and previous history of Billroth II gastrectomy (51,81). In those particular patients, conversion to open CBDE should be considered, except if a trained laparoscopic surgeon is available to achieve laparoscopic CBDE. Finally, when postoperative ES is considered in a patient during LC, it should be recommended to leave a transcystic drain in place allowing the passage of a guide-wire to facilitate effective and safe post-operative endoscopic sphincterotomy (81,82).

Laparoscopic common bile duct exploration.

With the development of laparoscopic technique, the rate of laparoscopic CBDE has progressively increased. The choice between transcystic-duct-CBDE and choledochotomy is guided by (1) CBDS features, such as the number, size and location of stones in the lower or upper part of the CBD, and (2) anatomic characteristics of the cystico-CBD junction (diameter of the cystic duct and the CBD, level and angulation of insertion of the cystic

duct on the CBD...). Large or multiple stones located in the common hepatic duct or in the intrahepatic bile ducts are usually not accessible by transcystic-duct-CBDE. Periquisites for laparoscopic choledochotomy include a dilated common bile duct (at least 7 mm in size) and absence of severe inflammation in the hepatoduodenal ligament.

Laparoscopic CBDE is applicable in 80-91 % of the patients with CBDS (83-86) with a high success rate ranging between 82-94 % (81-83,85-90). The success rate of laparoscopic CBDE increases with experience and a better selection of patients, but decreases in the presence of multiple stones which is the best predictor of failure (91). Mortality is low, between 0-1.5 %, confined to patients over 65 years of age (82). Postoperative complications, generally mild, are noted in 4.4-17 %, with major complications in 0-5.2 % (82,85,92,93). In a cumulative review of 1283 patients treated by laparoscopic CBDE (Table III), a complete stone clearance was achieved in 91 % of the patients, with 5 % requiring conversion to open CBDE and 3.4 % requiring postoperative ES. Retained stones were encountered in 2.3 %, usually cleared by post-operative endoscopic sphincterotomy. Compared to open CBDE, a significant reduction in postoperative hospital stay was obtained with laparoscopic CBDE.

The main advantage of laparoscopic CBDE is the whole treatment of CBDS with a high success rate, in a single surgical and anesthetic session during the same hospital admission, with a low morbidity and a low rate of retained stones.

The technique is particularly appropriate for the younger patients with the potential advantage of maintaining the integrity of the ampulla of Vater. If unsuccessful, laparoscopic CBDE still allows open CBDE or postoperative ES, and for this reason preoperative ERCP/ES should be reserved to patients with serious illness and in elderly ill patients. On the other hand, disadvantages of laparoscopic CBDE include time-consuming procedure, technically demanding operation requiring advanced and expensive technologies, and the need for considerable laparoscopic expertise confined today to highly specialized centers.

The single controlled trial comparing a single-stage laparoscopic management and a 2-stages endoscopic/laparoscopic treatment of patients with CBDS have been recently reported by Cuschieri et al. (106). Equivalent success rate and patient's morbidity were obtained with both options of management, but a shorter hospital stay was encountered with the single-stage laparoscopic treatment, especially in patients submitted to transcystic-duct-CBDE. The authors suggested that in fit patients, the single-stage laparoscopic treatment should be the better option and that ES should be used selectively in those patients in whom laparoscopic bile duct stone extraction has failed. However, this trial could be critizised in some aspects. First of all, successfull ES was achieved in only 79,5% of the patients, probably due to the multicentric recruitement of patients from several institutions with varying experience in endoscopic treatment. On the other hand, the authors stated that after ES, patients were then scheduled to LC during the same hospital admission, but the interval of time between the endoscopic stone extraction and LC was left to the individual surgeons. The mean delay between ES and LC was therefore not specified in this study and this bias of selection could responsible for the main conclusion regarding the advantage of single-stage laparoscopic treatment with a reduced total hospital stay.

Our Personnal Experience

We recently reported our experience with 92 consecutive patients submitted to laparoscopic CBDE for choledocholithiasis (107). A stratified surgical strategy is required during laparoscopic CBDE, with specific indications for the transcystic route or choledochotomy. Transcystic-CBDE should be restricted to patients with small and few stones located in the lower choledochus. Transcystic duct-CBDE was used in 67% of the patients, with a success rate of 63%, while laparoscopic choledochotomy was used in 33% with a success rate of 99.3%. Postoperative ES was required in 4% of our patients for (known) residual CBDS. Additionally, residual CBDS were observed in 2.2% of the patients during a mean follow-up of 18 months, successfully treated by ES in all cases. Conversion to open CBDE was necessary in 17% of the patients, with a progressive decrease with experience. Hospital mortality was 2%, restricted to elderly (over 75 years of age) and high-risk patients. Postoperative complications occured in 15% of the patients, with major complications in 5% of them (known residual CBDS: 3 patients, wound abscess : 1, T-tube fracture during extraction requiring endoscopic removal: 1, and postoperative avulsion of a transcystic drain in an elderly patient : 1). A greater conversion and complications rate were observed in the transcystic group compared to laparoscopic choledochotomy. The postoperative hospital stay was significantly reduced in case of successfull laparoscopic CBDE (6.3 days) compared to converted patients (14 days, $p<0,0001$), especially in the group of patients treated transcystically (5.7 days, $p<0,03$). The postoperative hospital stay was significantly increased in patients with an external biliary drain inserted (7.7 days) compared to patients without external biliary drainage (4.7 days, $p<0,001$). We concluded that external biliary drainage (such as a transcystic drain or a T-tube) should be avoided during laparoscopic CBDE, because it affect the minimally invasive nature of the procedure due to an increase of postoperative hospital stay and inconvenience for the patients. Actually, we use preferably an internal biliary drainage by a fine transpapillary prosthesis, as recently described by De

Paula (85,108) and Curet et al (109). In a preliminary experience of 10 patients treated by this way, we never observed a case of postoperative pancreatitis, mortality was nil and postoperative hospital stay was reduced to 3.5 days. However, these patients require flexible duodenoscopy 3 weeks postoperatively for prosthesis removal. Another disadvantage of this technique is the inability to perform postoperative cholangiography to detect residual CBDS. Primary closure of the choledochus could be another alternative (105).

Conclusions

Actually, the management of patients with choledocholithiasis has changed regarding a better preoperative detection of CBDS due to availability of new non-invasive radiologic and endoscopic investigations and regarding the emergence of new therapeutic options, such as laparoscopic CBDE. To date, open CBDE is used infrequently and restricted to patients converted to open surgery, in case of difficult cholecystectomy or peroperative detection of CBDS at IOC when laparoscopic or endoscopic skills are not available locally. Laparoscopic CBDE has emerged as the most promising treatment for patients with CBDS, being able to clear successfully more than 90% of ductal stones. However, considerable laparoscopic expertise, advanced and expensive technologies are needed to achieve successful laparoscopic treatment of CBDS. A precise intraoperative surgical strategy in mandatory with specific indications for transcystic-duct-CBDE and laparoscopic choledochotomy. Additionnal controlled trials are needed to compare the results of these two approaches before driving definitive conclusions about the most appropriate treatment. In the absence of such definitive data, the therapeutic choice should depend actually on the local hospital availability of technical expertise.

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Autore corrispondente:

J.F. GIGOT, M.D, PH. D.
Department of Digestive Surgery
St-Luc University Hospital
Hippocrate Avenue, 10
B-1200 BRUSSELS - Belgium