

Operative cholangiography during laparoscopic cholecystectomy: considerations about routine or selective policy

G. PISANO, S. LICHERI, C. DAZZI, E. ERDAS, M. POMATA, G.M. DANIELE

SUMMARY: Operative cholangiography during laparoscopic cholecystectomy: consideration over routine or selective policy.

G. PISANO, S. LICHERI, C. DAZZI, E. ERDAS, M. POMATA,
G.M. DANIELE

Operative cholangiography (OC) during laparoscopic cholecystectomy (LC) is still a matter of debate regarding its routine or selective use.

The present report is based upon a series of 30 selective cholangiographies performed in 290 LC during the years 1999-2004. Indications to OC were decided according to clinical data, liver chemistries, ultrasonographic (US) and intraoperative findings. In cases of unequivocal common bile duct (CBD) stones, a preoperative ERCP was performed and OC was not applied to confirm clearing of the biliary tract. OC was successful in 26 cases (86,6%): in 18 cases a normal cholangiogram was obtained and in 3 cases stones were detected into CBD. These patients underwent a postoperative successful ERCP at a variable interval of time. In 4 cases cholangiograms showed a delayed transit and in a single case a lack of contrast into the duodenum. Such occurrence was due to morphine derivatives employed during anesthesia.

The Authors evaluate advantages and drawbacks of routine and selective OC according to personal and other Authors experience. Decision on selective or routine policy should be taken according to each surgeon experience and local facilities. Each laparoscopic surgeon must be able to perform and interpret an OC, specially if he has in mind to develop competence in laparoscopic CBD exploration.

RIASSUNTO: Considerazioni sull'impiego routinario o selettivo della colangiografia intra operatoria nel corso della Colecistectomia Laparoscopica

G. PISANO, S. LICHERI, C. DAZZI, E. ERDAS, M. POMATA,
G.M. DANIELE

La colangiografia intraoperatoria (CIO) in corso di colecistectomia laparoscopica (CL) divide ancora l'opinione dei vari Autori in merito al suo impiego di routine ovvero solo in casi selezionati. Scopo del presente lavoro è quello di prendere in esame i pregi e i difetti di tale metodica d'indagine, alla luce dell'esperienza personale e dei contributi scientifici sull'argomento.

La casistica presentata riguarda 30 CIO effettuate con criterio selettivo su 290 CL nel corso degli anni 1999-2004. Le indicazioni alla CIO erano rappresentate dalla valutazione complessiva di elementi clinici, dati di laboratorio, reperti ecografici e riscontro intraoperatorio. Nei casi certi di una calcolosi della via biliare principale (VBP) è stata effettuata una endoscopia preoperatoria con estrazione dei calcoli, cui non ha fatto seguito una CIO. Essa è stata limitata pertanto ai casi sospetti. La CIO è risultata fattibile in 26 casi (86,6%): in 18 di essi il colangiogramma è risultato normale, mentre in 3 casi è stata riconosciuta una calcolosi della VBP. Il trattamento successivo è consistito in una bonifica endoscopica postoperatoria. Nella valutazione della CIO sono stati rilevati inoltre 4 casi di ritardato transito del contrasto in duodeno e un caso di completo arresto. Tali fenomeni, risultati senza conseguenze, sono stati attribuiti all'uso di farmaci morfino-simili.

Gli Autori concludono che la decisione di praticare la CIO di principio o in casi selezionati deve essere affidata alle capacità e all'esperienza del singolo chirurgo in rapporto agli strumenti tecnici a sua disposizione. La CIO diventa un prerequisito fondamentale per chi intende dedicarsi alla chirurgia laparoscopica della VBP.

KEY WORDS: Operative cholangiography - Laparoscopic cholecystectomy - Biliary injuries.
Colangiografia intraoperatoria - Colecistectomia laparoscopica - Lesioni della via biliare.

Introduction

Before the validation of laparoscopic cholecystectomy (LC), routine operative cholangiography (OC) had a widespread acceptance during surgical interven-

tions on the biliary tract to recognize biliary anomalies and at the same time to discover unsuspected common bile duct stones or confirm clinical evidence of them. In both cases the following step was the surgical treatment of common bile duct (CBD) stones through a transduodenal sphincterotomy or a choledochotomy, according to Schools trends (1-3).

Endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic sphincterotomy impaired the

Università degli Studi di Cagliari
Dipartimento di Scienze Chirurgiche e Trapianti d'Organo
Sezione di Chirurgia Generale II
(Direttore: Prof. G.M. Daniele)

© Copyright 2005, CIC Edizioni Internazionali, Roma

role of OC during open cholecystectomy, but it was really the development of LC that further reduced its acceptance in gallbladder and the biliary surgery.

Aim of this paper is to analyze the actual role of OC during LC through the personal experience in LC, evaluating advantages and drawbacks of the procedure.

Patients and methods

The study is based on the retrospective evaluation of OC performed in our Institution in a series of 290 patients who underwent LC from January 1999 to December 2004. Very important premise is that, for several reasons, in our Department LC was started just at the beginning of 1999, later than most Italian surgical institutions. OC was not performed as a routine policy, but only as selective procedure. All the cases submitted to OC were evaluated to discover if in clinical history there were signs of stones in the CBD (e.g. jaundice, fever), or symptoms of recent pancreatitis; at the same time, laboratory data were checked for cholestasis indexes, amylases and lipases. Ultrasonography was evaluated for number and size of gallbladder stones and for dilatation of CBD. If suspicion was very high or in case of unequivocal signs of CBD stones, ERCP and endoscopic sphincterotomy were performed few days before LC therefore; such cases are excluded from the present series and OC was not adopted to confirm clearing of the biliary tract. In a few cases with normal clinical, laboratory and US findings, OC was performed because of cystic or CBD dilatation discovered intraoperatively.

Cystic duct cannulation was performed after clipping and incision of the duct, followed by the introduction of the cholangiography catheter (Origin, Applied Medical). If necessary, a moderate Trendelenburg position was adopted to obtain opacification of the intrahepatic biliary tree. All the cholangiograms were performed first in a dynamic phase on the fluoroscopic monitor (Philips, BV 25) and then through a X-ray film. The following items were evaluated considering both the fluoroscopy phase and the static film:

- intra and extrahepatic caliber of the biliary tract;
- presence of filling defects in the hepatocholedocus;
- lack or delay contrast medium transit in the duodenum;
- biliary tract anomalies.

Both dynamic and static cholangiographies were examined by the operating surgeons, without interpretation of the radiologists. Normal radiological findings were defined when intra and extrahepatic biliary tracts were clearly visualized, with normal size and no filling defects, together with a good passage of contrast medium into the duodenum.

Time was recorded between cystic duct cannulation and removal of the catheter from the duct. In case of normal findings, only postoperative day hospital stay was recorded; in case of pathologic findings, the next clinical course was evaluated (endoscopic sphincterotomy, complications, etc.).

All the patients were submitted to clinical and US control at one month; further evaluations were scheduled according to emerging data.

Results

From January 1999 to December 2004 at our Institution a total of 30 OC on a series of 290 LC were attempted (10,3%). Tables 1 and 2 report respectively

TABLE 1 - LAPAROSCOPIC CHOLECYSTECTOMIES AND OPERATIVE CHOLANGIOGRAPHIES (YEARS 1999-2004). EPIDEMIOLOGIC DATA.

Laparoscopic cholecystectomies (LC)	290
Operative cholangiographies (OC)	30 (10,3%)
Males	10
Mean age	56,4 ys(range 43-73)
Females	20
Mean age	54,3 ys(range 34-81)

TABLE 2 - INCIDENCE AND PERCENTAGE OF OC IN RELATION TO NUMBER OF LC PER YEAR.

	1999	2000	2001	2002	2003	2004	Total
LC	41	44	49	55	53	48	290
OC No	4 (9,1%)	6 (12,2%)	3 (5,4%)	6 (11,3%)	11 (22,9%)	30 (10,3%)	

TABLE 3 - INDICATIONS TO OC IN 30 CASES OF LC*.

Clinical history	10
Liver chemistries	14
Ultrasonography	13
Intraoperative findings	3

*In some cases more than one indication.

the epidemiologic data and the incidence of OC on LC by years. Indications to OC are depicted in Table 3: they are distinguished according to clinical data, liver chemistries (i.e., elevated indexes of cholestasis), ultrasonographic findings (dilatation of main biliary tract); in a few cases OC was performed for the presence of a large cystic duct or a seemingly dilated common bile duct. In some patients there was more than one indication.

The procedure was successful in 26 cases (86.6%). Failure to incannulate was due to a narrow cystic duct

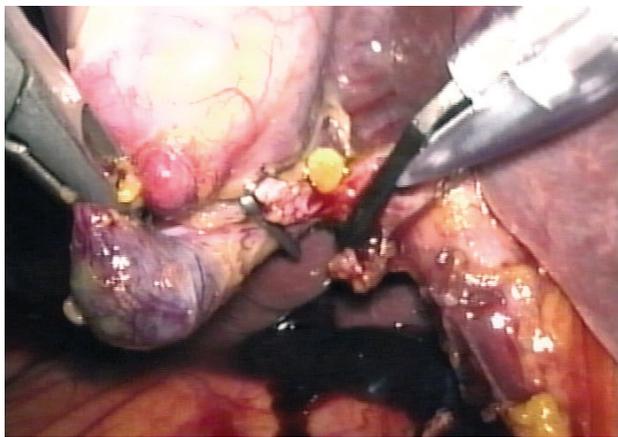


Fig. 1 - A small yellow stone is escaping from the incision on the cystic duct.

in two cases, to a malfunctioning system in a third case and to an impacted stone in the last case: the stone was dislodged after removal of the catheter, but X-ray film was not obtainable (Fig. 1).

Twenty six cases are so useful for our study. Results are depicted in the Table 4.

The time necessary to perform OC was on average 11 minutes, ranging from a minimum of 5 to a maximum of 21 minutes. Normal radiological findings were present in 18 cases and no other measure was taken: these patients, as well as those with unsuccessful OC, were discharged within 48 hours from LC. No accessory duct, nor abnormality of biliary tract was found. We noticed 4 cases with delay and 1 case of lack of transit of contrast medium in the duo-

TABLE 4 - FINDINGS AND THERAPEUTIC CONSEQUENCES OF 26 SUCCESSFUL OC.

Normal cholangiogram	18
CBD stones	3 (postoperative endoscopy)
Ductal anomalies	no
Delayed transit in duodenum	4
Lack of transit	1
Total	26



Fig. 2 - Good opacification of the biliary tree without passage of contrast medium into the duodenum.

denum (Fig. 2), but no intraoperative measure was taken. Liver chemistries were checked the day following the operation, searching for elevation of cholestasis indexes: no abnormality was found. Ultrasonography as well, performed in the postoperative days, did not detect any dilatation of the biliary tract. Explanation of this phenomenon was attributed to the use of morphine derivatives during anesthesia.

Three patients (11,5%) were found to harbour CBD stones with a preserved flow in the duodenum; also in these cases no operative measure was taken. The patients underwent postoperative endoscopic sphincterotomy with removal of stones at a distance respectively of 7, 19 and 40 days; the post-endoscopic course was uneventful and the patients were discharged within 3 days.

In two patients with normal OC, small stones were milked from the cystic duct after its incision; so that we found three cases with stones removed from the cystic duct, including the case where OC was unsuccessful.

The postoperative clinical and US controls at one month from discharge showed normal size of the main biliary tract with no suspicion of retained or missed stones. At the moment the follow up is negative with a minimum of 1 month and a maximum of 60 months (average 28 months).

Discussion

Since its introduction by Mirizzi in 1932, OC found wide acceptance or strong opposition, but it has been the advent of LC that made its role questionable. Actually there are as many Authors who support the mandatory application of routine OC (4-10) as those who believe it unnecessary if not dangerous (11-18).

In the present series OC was adopted in selected cases, that is in those patients where suspicion of CBD stones was consistent but not so strong enough to decide for a preoperative endoscopy. We already said that patients with unequivocal signs of choledochal lithiasis underwent endoscopic removal of stones before LC and in such cases OC was not performed. OC was rather performed for patients who had previous history of cholestatic jaundice, which faded during the hospital stay, mild signs of cholestatic indexes and moderate dilatation of the main biliary tract. In a few cases OC was performed for intraoperative finding of a dilated cystic duct.

Our attitude had minor but consistent changes during the previous years. At the beginning of the present experience, OC was not adopted as safely as it is at the moment. In fact, when LC was started in our Institution at the beginning of 1999, it did not seem wise adding a further procedure to a new operation which was not mastered completely as open cholecystectomy (19). Most likely this very reason explains why for many other Authors OC was not the routine procedure at the beginning of the laparoscopic experience, even when biliary iatrogenic injuries appeared to occur with greater frequency if compared to traditional surgery (6, 20). On the other

side, for the same reason, supporters of OC advocated its use as a very effective tool in eliminating the risks of biliary injuries, specially in case of aberrant ducts and vasculobiliary anomalies (4-8, 21, 22).

The present study cannot add much on this matter: in our series of 26 OC no anomalies were detected nor lesions of the biliary tract. We did have cases of biliary lesions in the whole series of 290 LC where OC was not performed. It is difficult to say if in such cases a routine OC could have avoided such complications; truly the safest way to recognize a biliary anomaly and prevent a lesion is a careful preparation and recognition of all the structures in the hepatic pedicle, (2, 23, 24).

Moreover, if it is true that OC is helpful in case of confusion between cystic and CBD, it can not recognize lesions during the phase of gallbladder detachment, just because the investigation has already been performed (24).

Objections to OC include the possibility that the procedure itself can be responsible of a lesion of the main biliary tract in the attempts to cannulate the cystic duct (11, 17). Such occurrence has never been observed in the present series even if in a few cases avulsion of the cystic duct has been described without too severe consequences (11, 23-26).

The success rate of OC in the present report has been of 86.6 %, which seems a little lower with the rates reported during routine procedures (5-7, 25, 27), but in order of the results of selective series (11-13).

In the same time it is true that several minutes are to be wasted when OC is performed, specially when the radiological equipment is not at the top standard: Cuschieri and coworkers, for instance, report very different results when performing OC with traditional mobile X-ray machine and modern fluorocholangiography intensifier (6). Few minutes are really necessary to perform OC when experience of the operators and radiologic facilities are at their best (22). But this does not apply to all the places where LC are done. In our experience, for instance, the average time required to accomplish an OC was 11 minutes which is good enough if compared to other studies with up to 24 minutes of increased operating time (25, 26).

The other important point to analyse refers to the role of OC in detecting CBD stones. In our series OC revealed 3 cases of stones within the main biliary tract, which corresponds to 11,5% of successful cholangiographies. Such rate, which can not be considered negligible, comes from a selected and not from the whole series. On this behalf, some Authors believe that the small percentage of stones detectable by OC does not justify in terms of cost its routine application which appear reasonable only in very selected cases (13). Again, if stones are found, this

does not mean they will surely cause symptoms, because many of them can pass spontaneously into the duodenum. Other objection to OC is that, in spite the finding of stones, in many cases no procedure will be taken because not all the surgeons are capable to remove them during a laparoscopic procedure: so it is wiser to leave these patients to a following operative endoscopy (11, 19). This is true also in our personal experience: balance between technical skills and total equipment necessary in these cases, does not warrant at the moment to perform a safe laparoscopic CBD exploration, which is however foreseen in the coming years. In this view OC seems a necessary prerequisite, because a frequent application of such technique enables to acquire the confidence for a safer approach to the hepatic pedicle. In this regard, simple cystic duct incision may be helpful to remove small stones eventually located into its lumen. Such is our personal experience in three cases: through the preliminary incision for the catheter introduction, few small stones were seen escaping from the duct and some were milked with atraumatic forceps. In two cases a normal OC was then performed, while in the other OC was not successful. The emerging issue is that only through an OC all this manoeuvre could be realized, may be preventing a possible outcome of a later pancreatitis. Preliminary cystic duct incision with this purpose, even without OC, has already been advocated by Soper and Dunnegan (26).

The last issue to discuss is related to radiograms interpretation. No doubt that OC is unuseful without visualization of the biliary tree including transit of the contrast into the duodenum. Cholangiogram interpretation in the present paper depended on the operating surgeon and such position is commonly shared by most of the Authors (6, 8, 9, 20, 23). The surgeon should pay particular attention to two points: 1) correct recognition of the main intrahepatic branches, and 2) passage of the contrast into the duodenum. It is not always easy to obtain a complete opacification of segmental and subsegmental branches of main biliary ducts, but what is important is to realize if "something is missing on the hepatic map": this is an alarm signal which helps the operator to avoid a major biliary injury (8, 23). We already observed in our results a few cases of delayed or even lacking transit of contrast in the duodenum: in such circumstances surgeon should be aware on the use of morphine derivatives by the anesthetist and at the same time should evaluate preoperative liver chemistry and US together with cholangiography data. Such appraisal entrust him to plan a postoperative ERCP or instead an immediate CBD exploration or a conversion.

Conclusions

OC is feasible in the majority of cases submitted to LC. The procedure is not associated with lesions of the biliary tract nor with complications. In the majority of LC routine application of OC is not indispensable to prevent biliary lesions; the best way to prevent such damage is thorough preparation of the cystic duct and recognition of all the structures before

clipping and incision. In several occasions (most frequently not the easier ones) an OC is really necessary. Every laparoscopic surgeon should be capable to perform and interpret a cholangiogram: such competence is strictly connected with the common use of procedure. If a surgeon feels to engage himself in biliary laparoscopic surgery, OC becomes an important preliminary step before attempting CBD exploration.

References

1. Stefanini P, Carboni M, Patrassi N, De Bernardinis G, Negro P, Loriga P. Transduodenal sphincteroplasty. Its use in the treatment of lithiasis and benign obstruction of the common duct. *Am J Surg* 1974; 128: 672-677.
2. Hunter JG. Laparoscopic cholecystectomy and the common bile duct. *Surg Endosc* 1994; 8: 285-286.
3. Moreaux J. Traditional surgical management of common bile duct stones: a prospective study during a 20-year experience. *Am J Surg* 1995; 169: 220-226.
4. Philips EH, Berci G, Carroll B, Daykhovsky L, Sackier J, Paz-Partlow M. The importance of intraoperative cholangiography during laparoscopic cholecystectomy. *Am Surg* 1990; 12: 792-795.
5. Corbitt JD Jr, Yusem S O. Laparoscopic cholecystectomy with operative cholangiogram. *Surg Endosc* 1994; 8: 292-295.
6. Cuschieri A, Shimi S, Banting S, Nathanson L K, Pietrabissa A. Intraoperative cholangiography during laparoscopic cholecystectomy. Routine vs selective policy. *Surg Endosc* 1994; 8: 302-305.
7. Khalili TM, Phillips EH, Berci G, Carroll BJ, Gabbay J, Hiatt JR. Final score in laparoscopic cholecystectomy. Cholangiogram 1207, no cholangiogram 116. *Surg Endosc* 1997; 11: 1095-1098.
8. Hautefeuille P. Lire l'anatomie des cholangiogrammes. *J Chir* 1998; 135: 275-278.
9. Borie F, Millat B. Cholangiographie peropératoire par laparoscopie. Comment et pourquoi la faire? *J Chir* 2002; 139: 135-140.
10. Vezakis A, Davides D, Ammori BJ, Martin IG, Larvin M, McMahon M J. Intraoperative cholangiography during laparoscopic cholecystectomy. *Surg Endosc* 2000; 14: 1118-1122.
11. Gregg RO. The case for selective cholangiography. *Am J Surg* 1988; 155: 540-545.
12. Pasquale MD, Nauta RJ. Selective vs routine use of intraoperative cholangiography. An argument. *Arch Surg* 1989; 124: 1041-1042.
13. Huguier M, Bornet P, Charpak Y, Houry S, Chastang C. Selective contraindications based on multivariate analysis for operative cholangiography in biliary lithiasis. *Surg Gynecol Obst* 1991; 172: 470-474.
14. Salky B, Bauer J. Intravenous cholangiography, ERCP, and selective operative cholangiography in the performance of laparoscopic cholecystectomy. *Surg Endosc* 1994; 8: 289-291.
15. Taylor OM, Royston CMS, Sedman PC, Arulampalam T, Mancey Jones B, Wellwood J. Laparoscopic cholecystectomy without operative cholangiogram: 2038 cases over a 5-year period in two district general hospital. *Ann R Coll Surg* 1997; 79: 376-380.
16. Manson J. Intraoperative cholangiography during laparoscopic cholecystectomy. *Surg Endosc* 2002; 16: 1117-1118.
17. Bassi M. Lesioni delle vie biliari da indebito cateterismo duttale per colangiografia (prevenzione e terapia). *Chir Ital* 2003; 55: 41-44.
18. Vons C. Is systematic cholangiography during laparoscopic cholecystectomy really necessary? *J Chir* 2003; 140: 350-352.
19. Thompson MH. Cholangiography and laparoscopic cholecystectomy. *Br J Surg* 1996; 83: 724-725.
20. Carroll BJ. The laparoscopic cholangiogram of doom. *Surg Endosc* 1995; 9: 1029-1031.
21. Brandt CP, Eckhauser ML. Rare bile duct anomalies: a case report and implications for laparoscopic cholecystectomy. *Surg Endosc* 1994; 8: 329-331.
22. Ludwig K, Bernhardt J, Steffen H, Lorenz D. Contribution of intraoperative cholangiography to incidence and outcome of common bile duct injuries during laparoscopic cholecystectomy. *Surg Endosc* 2002; 16: 1098-1104.
23. Woods MS, Traverso LW, Kozarek RA, Donohue JH, Fletcher DR, Hunter JG, Oddsdottir M, Rossi RL, Tsao J, Windsor J. Biliary tract complications of laparoscopic cholecystectomy are detected more frequently with routine intraoperative cholangiography. *Surg Endosc* 1995; 9: 1076-1080.
24. Nuzzo G. Le lesioni iatrogene della via biliare principale. Relazione biennale 104° Congresso della Società Italiana di Chirurgia, Roma, 13-16 ottobre 2002.
25. Millat B, Deleuze A, de Saxce B, de Seguin C, Fingerhut A. Routine intraoperative cholangiography is feasible and efficient during laparoscopic cholecystectomy. *Hepato-Gastroenterology* 1997; 44: 22-27.
26. Soper NJ, Dunnegan DL. Routine versus selective intraoperative cholangiography during laparoscopic cholecystectomy. *World J Surg* 1992; 16: 1133-1140.
27. Lezoche E, Paganini A, Guerrieri M, Carlei F, Lomanto D, Sottili M, Nardovino M. Technique and results of routine dynamic cholangiography during 528 consecutive laparoscopic cholecystectomies. *Surg Endosc* 1994; 8: 1443-1447.

