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Laparoscopic cholecystectomy with operative cholangiogram

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Abstract. Intraoperative cholangiography was successfully performed in 99% of 525 consecutive laparoscopic cholecystectomies. There were 386 chronic, 54 acute, 44 fibrotic, 19 gangrenous, and 22 hydrops cases. Unsuspected common duct stones were identified in 5% of patients. Routine cholangiography to clarify the biliary anatomy, however, was of greater significance than the discovery of unsuspected common duct stones.

Key words: Intraoperative cholangiograms – Common duct stones

Laparoscopic cholecystectomy is rapidly becoming the technique of choice because of the dramatic reductions in pain, scarring, hospitalization, and disability. Routine intraoperative cholangiography has been advocated by some surgeons, while others perform it selectively, based upon certain preoperative or intraoperative findings. Laparoscopic cholecystectomy differs from open cholecystectomy and routine intraoperative cholangiography is strongly advocated.

Materials and methods

All patients presenting with gallbladder disease were treated by laparoscopic cholecystectomy. No patients were excluded from this series, which included acute, chronic, fibrotic, gangrenous, and hydrops gallbladders (Table 1). Cholangiograms were done in every case despite preoperative findings. After dissection of the cystic duct and artery, an Endoclip (United States Surgical Corp.) was applied to the cystic duct adjacent to the gallbladder neck. Four clips were placed on the cystic artery but it was not divided prior to cholangiography. If the cystic duct is completely divided the intact artery will prevent its retraction and allow for later ligation. The second surgeon, or assistant, on the patient's right incises the cystic duct using curved microscissors introduced through the most lateral port. The duct is dilated with the scissors, if necessary. The scissors are removed and a Taut catheter contained within an Olsen cholangiogram clamp is placed into the cystic duct. The clamp is advanced on the catheter and closed over the duct to stabilize the catheter and prevent extravasation of contrast. An alternate technique performed from the left side of the table consists of placing a 14-gauge intracath below the right subcostal area in line with the cystic duct. A #5 French or Reddick catheter is then passed down the sheath. The cystic duct is incised via the upper midline port and the catheter is guided into the duct. The catheter is secured with an Endoclip or a new cholangiogram clamp designed for this purpose (American Hydro-Surgical, Delray Beach, FL).

The patient is placed in the Trendelenburg position to allow filling of the hepatic radicals. Fluoroscopy is simultaneously observed by the surgeon and the radiologist through a remote unit in the X-ray department. Two-way communication available between the operating room and the radiology department allows discussion of any abnormal findings. Indeterminate lesions are resolved by additional injections or manipulations of the clamp holding the Taut catheter. Hard-copy films are made for the patient's file. After the anatomy is clear, the cystic duct is triply ligated and cholecystectomy is completed, as elsewhere described [7, 9], provided no common duct stones are identified.

Results

Of 525 cases, 3 were opened because of adhesions and 6 because of severe acute disease, fibrosis or abscess (1.5% conversion rate).

Because of improved skill and operative cholangiogram technique as well as cholangiography experience, only two of these nine early patients would have to be opened if operated upon now. Cholangiograms were attempted in the remaining 516 and were successful in 511 (99%). Early in the series three ducts could not be

Table 1. 525 Consecutive laparoscopic cholecystectomies

386 chronic
54 acute
44 fibrotic
19 gangrenous
22 hydrops

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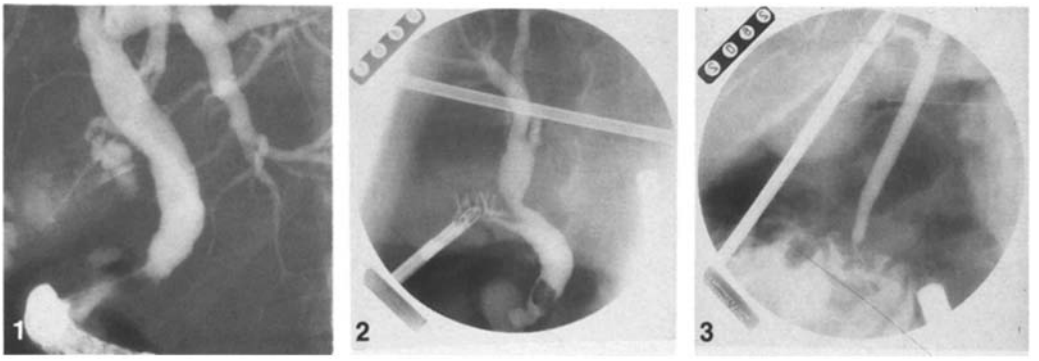


Fig. 1. Preoperative ERCP showing apparent absence of stone preoperatively.

Fig. 2. Common duct with large retained stone after preoperative ERCP.

Fig. 3. Small stone in distal common duct following preoperative ERCP.

cannulated due to either their small caliber or small valves. These ducts were obstructed by stones and could not be cannulated even after the stones were "milked" out. Two ducts could not be cannulated because of severe inflammation. In the last 225 patients cholangiograms were obtained in 100% of the cases.

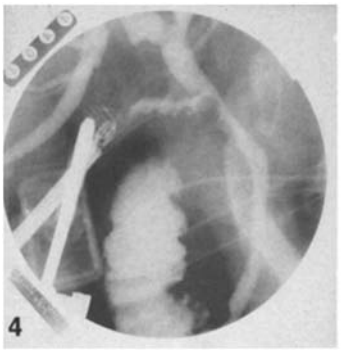
Unsuspected common duct stones were identified in a total of 29 patients, or 5%, of the total laparoscopic cholecystectomy patients. Early in the series 12 patients had stones successfully removed by post-operative ERCP. Two other patients in the early series refused ERCP, were followed, and presumably spontaneously passed their stones. One patient in the first 100 of the series was found to have a 2-cm stone impacted in an apparent diverticulum of the common duct. The gastroenterologist thought this was not amenable to endoscopic extraction and, therefore, this case was converted to an open procedure with standard common duct exploration. Had this situation occurred after the first 100 cases, it would have been treated laparoscopically. In the last 225 of the 525 cases, all unsuspected common duct stones, with or without preoperative ERCP, were treated laparoscopically. Even in the latter part of the series, preoperative ERCP was used liberally if the liver function tests were abnormal or if the bile ducts appeared to be dilated on ultrasonography. Operative cholangiograms in the latter portion of the series found 10 patients with retained stones which had been missed (Fig. 1) or could not be removed preoperatively. These 10 patients with preoperative ERCP had intraoperative cholangiograms revealing a large retained stone in five patients and multiple stones in five patients (Figs. 1, 2). The smaller stones (Fig. 3) were successfully removed in the latter part of the series by a second ERCP post-operatively in two patients, and eight other patients successfully underwent laparoscopic common duct exploration with removal of the stone. Three of these eight patients successfully underwent choledochotomy with removal of the stones. Three patients were treated by passing a choledochoscope into the common duct via the cystic duct and retrieving the stone with a basket. One patient had laparoscopic electrohydrolic lithotripsy via the common duct. Another of the eight patients was found to have Mirizzi's syndrome (Fig. 4) and was also treated laparoscopically via the common duct by electrohydrolic lithotripsy (Fig. 5). Four additional patients, without preoperative ERCP and with normal preoperative studies, were found to have common bile duct stones (Figs. 6, 7). All four of these patients had their stones removed via the cystic duct with a basket passed blindly without the choledochoscope. Total laparoscopic common duct explorations were 12; of which 8 had preoperative ERCP; 3 were treated by laparoscopic choledochotomy (Fig. 8), and 9 were treated by removal of the stone with a blind basket or the choledochoscope via the cystic duct.

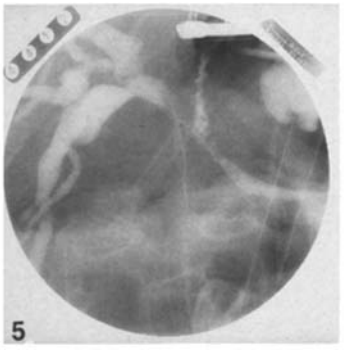
In summary, of the total of 29 patients with unsuspected common duct stones (10 with preoperative ERCP, 19 without preoperative ERCP) 1 patient was opened, 2 patients were observed, 14 patients underwent post-operative ERCP, and 12 patients underwent laparoscopic removal of their common duct stone.

Distorted or confusing anatomy was frequently encountered (Figs. 9, 10). Shortened cystic ducts are common in acute cases. In a few patients, the common duct was initially misidentified as the cystic duct. The cystic–common duct junction was sometimes unclear. Extremely long cystic ducts were common. The length of the duct could better be assessed by cholangiography than by tedious, potentially hazardous, dissection of the common duct. All clips were placed on the cystic artery prior to the intraoperative cholangiogram. The operative cholangiogram identified a clip partly occluding the common duct in one patient, allowing its removal at the time of laparoscopy, thus avoiding a permanent injury. In one patient an incision was made at the cystic–common duct junction. A T-tube was put in place in this patient rather than suturing in this area. Had a cholangiogram not been obtained, the common duct may have been divided.

Discussion

The role of cholangiography during open cholecystectomy has been controversial [2, 8, 10]. These same issues must be addressed during laparoscopic chole-





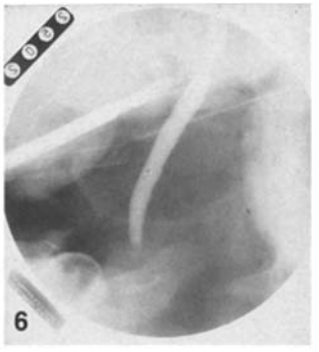
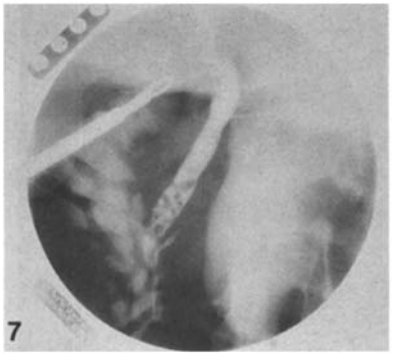


Fig. 4. Mirizzi's syndrome.

Fig. 5. Common duct after removal of cystic duct stone (Mirizzi's syndrome).

Fig. 6. Single stone in distal common duct.



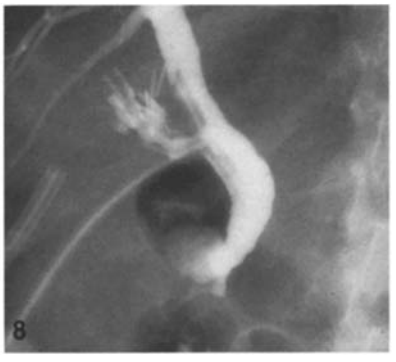
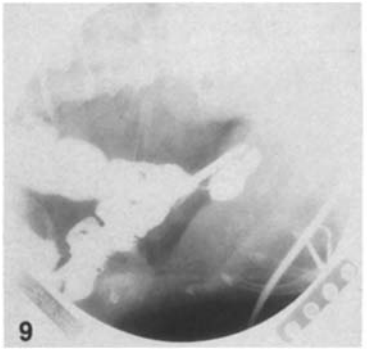


Fig. 7. Multiple stones in distal common duct.

Fig. 8. T-tube in place after laparoscopic removal of multiple stones.



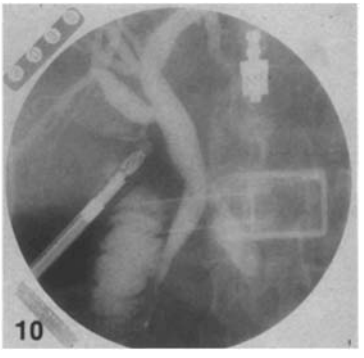


Fig. 9. Fistula between fundus of gallbladder and colon.

Fig. 10. Cystic duct attached to right hepatic duct.

cystectomy. Laparoscopic cholecystectomy, however, appears to be an entirely different procedure than open cholecystectomy because of the two-dimensional approach and lack of tactile sensation except via the instrumentation.

Preoperative elevation of bilirubin, alkaline phosphatase, or amylase indicates the absolute need for cholangiography. If laparoscopic patients with common duct stones are to be managed by ERCP, it is preferable to address the common duct pathology preoperatively. If the problem cannot be resolved preoperatively, an open or laparoscopic common duct exploration can be done at the time of cholecystectomy, depending on the skill of the surgeon. In the last 500 patients of this series, no open choledocholithotomies have been required. Since patients in this series still had retained stones following ERCP, it is clearly prudent to obtain follow-up intraoperative studies in all patients.

Patients with normal liver functions may be selectively studied; however, intraoperative cholangiography is strongly encouraged. Routine cholangiography has been reported to show a 0.5% to 12% incidence of stones [1, 5]. The 5% rate in this series probably reflects the relatively liberal use of preoperative ERCP.

An excellent gastroenterology department may successfully remove most unsuspected stones with postop ERCP. In the absence of this support, a positive cholangiogram might trigger conversion of the operation to an open common duct exploration in the inexperienced surgeon. If the patient with a positive cholangiogram were observed or the cholangiogram was omitted and the patient later became jaundiced, a second operation would then be needed if an endoscopic papillotomy was not available or was unsuccessful. With laparoscopic experience and in this series, laparoscopic CDE is performed, avoiding open biliary surgery in most cases (the last 500 of 525 cases.)

Intraoperative cholangiography is an important adjunct to cholecystectomy and is a skill which must be developed. Cholangiography is easier to perform laparoscopically than through a minilap incision, with little experience. Total operating time in this series averaged 47 min. The cholangiography took less than 5 min. Surgeons should make every effort to become adept so that they will have the confidence and ability to obtain a good study when it is essential. Failure to do a cholangiogram has been associated with common duct injuries [4, 6]. Although safe cholecystectomy may be performed without use of this modality, cholangiography acts as a significant adjuvant to cholecystectomy.

More important than unsuspected common duct stones is the verification of the anatomy during laparoscopic cholecystectomy. Common duct injuries are the most serious in biliary surgery. Obviously, great effort must be made to avoid these complications. True anatomic variations are rare [3], but distorted anatomy was common in this series. A cholangiogram through the cystic duct or the lower end of the gallbladder clarifies the anatomy and allows dissection and ligation of the cystic duct to proceed with confidence and safety. The dynamic fluoroscopic study was most helpful in all cases but static films are better than not performing the study. Even though sophisticated equipment is not available, the surgeon should become familiar with the modalities his hospital has to offer. If a significant number of cases are being performed, purchase of a portable fluoroscopic X-ray unit should be considered.

Whenever possible, an assistant knowledgeable in laparoscopy is of great value as a consultant while the anatomy is identified. The assistant is in an ideal position to do the cholangiogram but is even more valuable as a skilled observer alert to the possibility of arterial or ductal injury. The team approach, combined with routine cholangiography, resulted in no open cases due to arterial bleeding, common duct injuries, or other complications in this series with the exception of the second case performed, which had venous bleeding — which could now, with more experience, have been controlled laparoscopically.

Conclusion

Routine intraoperative cholangiography during laparoscopic cholecystectomy has a 5% yield of unsuspected common duct stones. Of more importance, however, is the avoidance of common duct injury by the accurate identification of the biliary anatomy. A skilled assistant as a consultant is of additional benefit if arterial injuries, common duct injuries, and other complications relative to unusual anatomy are to be avoided. The absence of significant complications in 525 consecutive cases recommends this meticulous approach.

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