Results of cholecystectomy without intraoperative cholangiography

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Background: To determine if cholecystectomy can be performed satisfactorily without the use of adjunctive intraoperative cholangiography (IOC), we planned a retrospective analysis at a Canadian university teaching hospital. **Methods:** General operative morbidity and mortality (in particular, occurrences and complications of missed choledocholithiasis and reoperations for same, and occurrences of bile duct injuries and bile leaks) were noted and analyzed for a consecutive series of cholecystectomies from a single practice, carried out without IOC. **Main results:** In general, choledocholithiasis could be identified and treated before the operation; missed cases were infrequent and were treatable without reoperation. No major injuries to the bile duct were encountered. **Conclusions:** IOC appears to be optional with cholecystectomy; cholecystectomy can be performed without IOC safely in the defined setting, without related major complications from missed choledocholithiasis or excess occurrence of bile-duct injury.

Contexte : Pour déterminer s'il est possible de pratiquer une cholécystectomie satisfaisante sans avoir à recourir à une cholangiographie intraopératoire (CIO) d'appoint, nous avons planifié une analyse rétrospective à un hôpital universitaire canadien. **Méthodes :** On a noté la morbidité et la mortalité opératoires générales (en particulier, les occurrences et les complications de cholédocholithiase ratée et des nouvelles opérations pour la même cause, les occurrences de lésions du cholédoque et les fuites de bile) et on les a analysées pour une série consécutive de cholécystectomies d'une seule pratique, réalisés sans CIO. **Principaux résultats :** En général, on a pu identifier et traiter la cholédocholithiase avant l'intervention; les cas non repérés étaient peu fréquents et ont pu être traités sans une nouvelle intervention. On n'a constaté aucune lésion majeure du cholédoque. **Conclusions :** La CIO semble facultative avec la cholécystectomie, qu'il est possible de pratiquer sans CIO en toute sécurité, dans le contexte défini, sans complication majeure connexe à la suite d'une cholédocholithiase non repérée ou de l'occurrence excessive de lésions du cholédoque.

Common duct stones are associated with cholelithiasis in as many as 20% of cholecystectomies (CCs). Intraoperative cholangiography (IOC) was described initially to identify choledocholithiasis (CDL) and to thereby help limit reoperations for missed duct stones. A secondary role for IOC in prevention or early recognition of bile duct injuries occurring at the time of CC was later postulated. The necessity for IOC was not universally accepted in the era of open CC or with the emergence of laparoscopic cholecystectomy (LCC); its place in modern-day clinical practice has become, if anything, less clear. Support can be identified for a spectrum of clinical practices, such as nonutilization of IOC (used in < 5% of CCs), selective use (in patients assessed as being at higher risk for duct stones, generally 20%–30% of cases) and routine (IOC customarily attempted). This review, of a series of CCs performed since the introduction of LCC but done without IOC, was done to identify problems arising from this strategy, if any such exist.

Methods

Information on 1081 consecutive CCs was assembled prospectively. Twenty-six patients were excluded who underwent CC as part of major laparotomies; but among these, there were no deaths or complications re-

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lated to CC. The remaining 1055 procedures were performed from 1991 through 2002: 1003 laparoscopic, 24 converted (a conversion rate of 2.3%) and 28 open. Median age was 47 (range 13–85 yr); 263 were male (M:F ratio 1:3). None were asymptomatic: all but 3 (99.7%) had cholelithiasis; 796 (75.5%) presented with chronic symptoms alone; and the remaining 259 had complicated disease, including acute cholecystitis (12.1%), overt CDL (8.3%) and gallstone pancreatitis (7.4%). Base examinations were liver biochemistry and abdominal ultrasound. Median operating time was 69 minutes (range 20–210 min). Patients were suspected of having CDL on the basis of abnormal liver function tests (elevated serum bilirubin), abnormal ultrasound examination (extrahepatic bile duct dilatation, common bile duct [CBD] stones) or clinical presentation (jaundice, cholangitis). No formal attempt was made to stratify their risk of CDL; risk was therefore managed on a case-by-case basis. Those suspected or proven to have CBD stones were investigated further by endoscopic retrograde cholangiopancreatography (ERCP) and treated if necessary by endoscopic sphincterotomy (ES). This was done preoperatively unless CDL was missed. Resolved gallstone pancreatitis was not by itself considered an indication for ERCP.

Results

For 1055 patients, the early reoperation rate was 0.1% and readmission rate, 4.1%. ERCP alone or with ES was performed in 103 patients (70 preoperatively, 38 postoperatively, 5 both), a rate of 9.8%. ERCP results were positive in 65 cases (60.2%), with 41 negative and 2 failed. Open common bile duct exploration (CBDE) was performed in 5 instances. Ten nonendoscopic cholangiograms were performed (5 T-tube, 4 percutaneous and 1 IOC). Overall, duct stones were proven pre- or postoperatively in 66 patients and strongly suspected of having passed in 109 more, for a rate of CDL occurrence between 6.3% and 16.6%.

In the cases studied, 102 adverse outcomes were identified in 89 patients, for a combined morbidity and mortality rate of 8.4%. All 3 deaths (mortality rate 0.3%) occurred in individuals over 70 years of age with major comorbidities; none were directly related to technical complications of CC (Table 1).

Outcomes in 2 groups were examined with particular interest. The first was 10 patients with bile leaks, collections or duct injuries. Two patients had minor CBD linear traction tears, treated by intraoperative suture and drainage. In 7, the source of leak was the cystic stump; 3 were treated with intraoperative drains, but 3 others required endoscopic stenting and 1 needed laparotomy and drainage. Missed CDL was associated with 3 of these 7 leaks, but whether it played any role in causation remains unclear. The last patient, who underwent laparotomy and drainage, was observed to have a small biloma, but the source of leak was not identified. All were followed to resolution with liver biochemistry and nuclear scanning tests; none had ductal reconstructions.

The second group was 33 patients with CDL who required management postoperatively, which we considered missed cases because of our preference for treating suspected or proven CBD stones preoperatively. In 4 cases, failure to clear large stones preoperatively led to primary open surgery, and in all 4 of these further T-tube manipulations (mechanical lithotripsy, basket extractions) were required postoperatively to obtain total CBD clearance. Of the remaining 29, 21 presented with biliary pain and 8 with mild pancreatitis. Nine of these 29 had already been managed preoperatively for suspected or proven CDL, and represented treatment failures or recurrent CDL. In 14 patients in this group, spontaneous passage was assumed because symptoms had resolved or ERCP results were negative; in the other 15 ES was required to clear the CBD. Two patients required a second operation, the first for cystic duct leak after ES, and the second, a choledochojejunostomy, for primary duct stones 7 years after CC. No duct stones were knowingly left or observed in any patient.

Discussion

Surgeons have recognized for years that management of associated CDL at the time of CC can be a potential source of difficulties. Historically, CBDE provided not only the best assurance of duct clearance but also the best hope that reoperations for retained stones could be avoided: the clinical indications for CBDE were well established by 1958.[1] IOC was described in 1931,[2] and in North

Table 1

Morbidity of 102 complications in 89 patients (with 3 deaths)

Complication	*n*
Missed choledocholithiasis	33
Wound infection, deep	15
Minor bile leaks or duct injuries (includes 1 early reoperation)	10
Late port-site hernia	10
Atelectasis or pneumonia (1 patient died)	5
Pancreatitis related to ERCP	4
Intra-abdominal hematoma or abscess	4
Conversion for intraoperative hemorrhage	4
Urinary retention or urosepsis	3
Venous thromboembolic disease	2
Recognized bowel injury	2
Prolonged ileus	2
Myocardial infarction	2
PTC complications: hepatic hematoma or false aneurysm	2
Late ventral hernia	1
Missed gallbladder cancer	1
Liver failure: cirrhosis (patient died)	1
Mesenteric ischemia (patient refused laparotomy, and died)	1

ERCP = endoscopic retrograde cholangiopancreatography; PTC = percutaneous transluminal coronary

American practice appears to have become established for the detection of duct stones by about 1960,[3] when many of the preceding indications for CBDE became instead indications for IOC. By 1980, a secondary role for IOC had been postulated in the prevention or early recognition of bile duct injuries occurring at the time of CC.[4,5] Recommendation of routine IOC to prevent such injuries has continued into the laparoscopic era,[6] though this practice remains unproven and debated.

Since the introduction of IOC, many other changes have taken place in the management of cholelithiasis and CDL, and the traditional role of IOC may require reassessment in the context of newer, sometimes competing practices. Ultrasonography has become *the* standard means of investigation of the biliary tract.[7] We now understand more about the possibilities for spontaneous migration of gallstones, especially small ones and in gallstone pancreatitis.[8,9] Percutaneous T-tube extraction allowed nonoperative treatment of some cases of stones retained after CC.[10] The introduction of ERCP and ES[11,12] permitted duct depiction and clearance without surgery in a wide variety of clinical situations. LCC has replaced the open operation. Laparoscopic CBDE has been described,[13] though not adopted widely. The introduction of magnetic resonance cholangiography in the 1990s[14] has provided CBD imaging comparable to that of ERCP and promises to reduce invasive cholangiograms by as much as half.[15]

CC remains one of the most common surgical procedures performed. For this reason even minor variations in technique can have major importance if they affect outcome measurements like cost, operative time or patient safety. Given the ongoing controversy about when and how often to perform IOC, it is likely that no tremendous differences in results accompany present practice variations, and that a surgeon's choice will continue to be based on what he or she was taught, individual beliefs and local resources.

It is difficult to determine a true contemporary standard of care — and in fact, such a standard may not exist. Geographic variation is apparent; for instance, in France IOC is said to be mandatory, and its omission to represent almost malpractice.[16]

Even before the introduction of LCC, some surgeons clearly did not utilize IOC.[17] With LCC, support has been published for non-use,[18,19] selective use[20,21] and routine use of IOC.[22,23] All advocates of any of these positions believe that their methods are satisfactory for managing associated CDL and for preventing or recognizing iatrogenic bile-duct injuries. There appear to be only 5 small randomized trials in the literature comparing routine IOC in CC with no or selective use; these did not find major differences in outcomes and generally support a selective approach.[24–28]

Complications associated with IOC are uncommon, though concerns have been raised about its use in small ducts,[29] and performance certainly leads to a modest lengthening of operating time. To date, the strongest indication supporting the idea that IOC might prevent duct injuries is probably reviews of several state-wide hospital discharge databases.[30,31] Conversely, that caution is required in inferring rates of bile duct injury from such administrative databases has been clearly documented for Canada.[32]

In assessing the relative merits of nonutilization, selective and routine use of IOC, it appears necessary to agree on some criteria defining success, addressing both issues of prevention of bile duct injury and management of associated CDL. The first of these seems straightforward: any major duct injury requiring reconstruction or reoperation has to represent a cause for concern, and an excess over 0.1% or so should sound alarms.

The second issue is more complicated and less objective. With the widespread availability of ERCP and ES, historical concerns about reoperative CBDE are no longer as relevant. With any strategy relying on ERCP/ES for management of duct stones, costs, usage rates and complications are all important.

For preoperative assessment, the unattainable ideal would be to identify and resolve all cases of associated duct stones, with no negative studies and no ERCP/ES morbidity. It seems more realistic perhaps to assess postoperative failures of detection and to be aware of their consequences. What was the rate of missed CDL, and how serious were the resulting illnesses? Were the stones manageable with ERCP/ES, or was laparotomy necessary?

Finally, it seems necessary to know how acceptable the treatment is to the patient and to the health care system, to determine if more pleasant, safer or more economical alternatives would be better. It is with this that much of the objectivity is lost, and preferences and opinions seem to prevail.

The present series is contemporary, involves mainly LCC and was carried out without IOC. Results of this strategy are believed to be satisfactory. No major bile-duct injuries were encountered. Most cases of duct stones were identified and resolved before surgery. Overall utilization of ERCP and ES was about 10%; more than half of these represented positive studies. The rate of missed CDL was low (about 3%) and, in the main, the morbidity encountered was acceptable: no intensive care unit admissions, no deaths and no reoperations. There were no obvious problems with patient acceptance of treatment.

The major shortcoming of this review is that it is a retrospective analysis involving cases treated with a single management strategy: CC without concomitant IOC. It cannot definitively answer the question of whether nonutilization, selective use

or routine use of IOC is a truly superior strategy. To answer that, a large randomized controlled trial would be needed. As well, the results presented herein may have no relevance in other health-care systems where more junior or less supervised trainees carry out many of the CCs. Also, in this series access to good diagnostic and therapeutic endoscopy has been an essential part of management. Taking all these factors into account, and with the current absence of higher levels of evidence, it seems fair to conclude that in the described setting, cholecystectomy can be safely performed using a technique based totally on anatomic demonstration, and that satisfactory results in the management of concomitant choledocholithiasis can be obtained in the manner outlined.

Competing interests: None declared.

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