Routine On-Table Cholangiography During Laparoscopic Cholecystectomy Is Well Worthwhile

A Shah, J Gilmour, C Bransom, R Jones, R Blackett

Citation

Abstract
Background: The role of on-table cholangiography (OTC) during laparoscopic cholecystectomy (LC) is debatable. This study evaluates the importance of OTC during a LC and how it helps to identify potentially significant problems.

Methods: All patients with LC had an OTC over a 3 year period. Abnormal cholangiograms were identified and outcomes studied. Patient records were followed up for 1 year after their operation.

Results: A successful OTC was performed in 440/469 patients who had a LC. An abnormal cholangiogram was noted in 53 patients. Two potential common bile duct (CBD) injuries were avoided. Thirty cholangiograms showed presence of previously undetected CBD stones. Six patients had multiple CBD stones. ERCP was performed in 19 patients.

Conclusion: On table cholangiography was performed in 94% of LCs. Significant abnormality was found in 32 patients that required conversion or other intervention. This study supports the routine use of on-table cholangiogram to prevent bile duct injuries and detect unsuspected common bile duct stones.

INTRODUCTION
Laparoscopic cholecystectomy (LC) has now been accepted as the procedure of choice in the treatment of gall stones. Prior to the introduction of the laparoscopic technique, contrast imaging of the biliary system was carried out by most surgeons during an open cholecystectomy. The reason for performing this was to confirm correct identification of the biliary anatomy and to identify the presence of ductal calculi where appropriate, so that these could be removed during the same procedure.

Since the introduction of the laparoscopic operation, a debate has arisen as to whether intra-operative imaging of the biliary tract is still necessary. The proponents of routine intraoperative cholangiogram (OTC) feel that it is important in the prevention of bile duct injuries whilst the opponents of this feel that it may actually increase the risk of bile duct injuries. Common bile duct (CBD) stones are seen in almost 15% of patients with symptomatic gallstones, thus emphasizing the importance of identifying them either prior to or during surgery. Routine pre-operative ultrasound scan may identify ductal calculi in a large proportion of those patients who have them before surgery. In addition, if the liver function tests were deranged then investigation by Magnetic Resonance Cholangio-Pancreatography (MRCP) or Computerised Tomography scan (CT) or Endoscopic Retrograde Cholangio-Pancreaticography (ERCP) would hopefully detect the majority of ductal calculi prior to surgery.

Therefore, in light of these changes in the practice of biliary surgery there is still a keen debate about the need of intra-operative imaging during laparoscopic cholecystectomy either by on-table cholangiography or laparoscopic ultrasound. This study attempts to evaluate the role of routine on-table cholangiography to identify potential
situations where the bile duct could be damaged because of incorrect interpretation of the biliary anatomy and to also detect ductal calculi so that appropriate treatment can be carried out.

**METHODOLOGY**

A retrospective study included 469 consecutive patients who had undergone a LC within a three-year period between January 2001 and January 2004. The patients were identified from a theatre computer database. All patients who had undergone LC either as elective or as an emergency procedure were included in this study. All patients had normal liver function tests prior to the operation and none had suspected common bile duct stones.

The patients were under the care of four consultant surgeons who routinely performed an on-table cholangiogram after a thorough dissection of Calot's triangle.

Operation notes from the computer database were reviewed from all operations. Information as to whether an on-table cholangiogram was performed, its results, and reasons for not performing or failing to perform the cholangiogram were noted. Case notes of those patients with abnormal cholangiograms were examined and information on postoperative investigation and intervention documented.

Follow-up blood and radiological investigations carried out on patients with a normal OTC were cross-checked from the computer pathology and radiology database for a period of 1 year and any abnormalities were noted. If any abnormality was noted during this period, the case notes of those patients were reviewed.

**RESULTS**

An OTC was planned for all 469 patients that underwent a LC. The OTC was technically successful in 440 patients (94%).

Twenty nine patients (6%) did not have an OTC, 22 patients because of technical operative factors and for non-surgical reasons in 7 patients (Table 1). None of these patients developed any biliary symptoms after their operation.

<table>
<thead>
<tr>
<th>Reason for Unsuccessful OTC</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage of contrast</td>
<td>5</td>
</tr>
<tr>
<td>Inability to cannulate the cystic duct</td>
<td>17</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
</tr>
<tr>
<td>- Absence of radiographer</td>
<td>2</td>
</tr>
<tr>
<td>- Broken X-ray machine</td>
<td>3</td>
</tr>
<tr>
<td>- Incorrect positioning of the patient on operating table</td>
<td>2</td>
</tr>
</tbody>
</table>

In 440 cholangiograms performed, 53 patients (12%) had an abnormal OTC. (Table 2). In 2 patients the common bile duct (CBD) was cannulated in error having been misinterpreted as the cystic duct. In these 2 patients the operation was converted to an open procedure. Six cholangiograms showed previously unsuspected multiple CBD stones. In these patients the procedure was converted to an open cholecystectomy with bile duct exploration.

In 19 patients the procedure was converted to an open cholecystectomy with bile duct exploration.

Nineteen cholangiograms showed a definitive presence of either a single or two CBD stones. OTC raised the suspicion of a CBD stone in 5 patients. Postoperative ERCP during the same admission was planned on 19 patients and the other 5 patients with suspicious stones underwent a MRCP.

Eighteen patients had an ERCP with stone removal within 4 days of their operation. One patient died before his scheduled ERCP from acute pancreatitis. His OTC had shown an unsuspected CBD stone which was confirmed on CT scan after surgery. The delay between his LC and planned ERCP was 4 days as the operation was done on the last working day of the week and the patient developed severe pancreatitis within 48 hours and was transferred to the intensive care unit (ICU) where he died after 7 days. During his stay in the ICU, he was not well enough to have...
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an ERCP. All 5 MRCPs were normal.
Minor abnormalities (21 patients) noted on OTC included air bubbles (9 patients) and presence of an accessory duct or anomalous insertion of the cystic duct (12 patients).

Of those 387 patients with a normal OTC, 8 patients presented postoperatively with a CBD stone between 2 weeks and 4 months after surgery. Five presented with abdominal pain and 3 with obstructive jaundice. All 8 patients had a successful ERCP with sphincterotomy and CBD stone removal.

In summary, 94% of the patients who underwent LC had a successful OTC. Almost 12% had some form of abnormality. A potentially major CBD injury was diagnosed in 2 patients and we had a mortality secondary to a complication of a CBD stone, which was not detected prior to LC.

DISCUSSION

It was possible to successfully carry out an on-table cholangiogram in 94% of patients. Literature indicates a failure rate of 3-17% \cite{1,2,3,4,5} OTT is simple and easy to perform adding 10-20 minutes to the operating time. Where available, laparoscopic ultrasound has a lower failure rate and is slightly quicker to perform.

The reason for performing an OTC is to confirm correct identification of the biliary anatomy and identify any anomalies in order to prevent bile duct injury (BDI) \cite{6,7,8,9,10,11,12,13}. BDI is reported twice as frequently seen with LC as compared to open cholecystectomy \cite{10,11,12,13}. In this series the CBD was cannulated in error in 2 patients despite meticulous dissection of Calot's triangle. The cholangiogram identified this error and allowed prompt correction after conversion to open approach. A review of 12 prospective studies \cite{14}, comparing LUS to OTC showed that OTC was much better in detecting ductal anomalies and preventing CBD injuries.

Our series reports a sensitivity of 79% and a specificity of 97% for detecting CBD stones which is comparable to other studies. The sensitivity and specificity of OTC in detecting CBD stones is 64-80% and 97-100%, respectively \cite{12,13,14,15,16}. LUS has a sensitivity and specificity of 80-100% and 98-100%, respectively for diagnosing CBD stones \cite{12,13,14,15,16}. The accuracies of LUS and OTC are comparable, with only slightly better positive predictive value and accuracy for LUS that, however, is not statistically significant \cite{14}.

From a technical point of view, LUS is a more difficult procedure to perform and interpret the images accurately \cite{14,15,17}. Few surgeons are familiar with the equipment and the results strongly depend on the operator's expertise. This is only achieved with experience whereas OTC can be performed and interpreted with very little training.

For this reason we suggest that an OTC should be routinely used and only replaced by LUS in those centres with appropriate equipment and expertise.

There is a controversy regarding the routine or selective use of OTC. The debate concerns the role of OTC in prevention of bile duct injury.

BDI during the course of laparoscopic surgery is reported to be 2-3 times more frequent than during open cholecystectomy \cite{10,11,12,13}. In a meta-analysis of literature on the use of routine OTC, Ludwig K. et al. have noted that using routine OTC, the incidence of CBD injury was 1 in 476 cases (0.21%) and 87% were diagnosed at the time of cholecystectomy. In contrast, with selective use of OTC the incidence of BDI was 1 in 233 cases (0.43%) and only 45% were diagnosed at operation \cite{12}.

An important aspect of management of these patients is that BDI is much better dealt with at the primary operation if identified than when treated after a delay in diagnosis.

In a cost analysis study, Flum et al. \cite{22,23} showed that routine OTC was associated with a cost/life-year saving of approximately $13,000. The cost that is avoided per CBD injury is approximately $87,143. These costs do not include the litigation and the compensation claims that are awarded as a result of CBD injury. The same authors have mentioned that CBD injury is the sixth most expensive malpractice claim with jury awards of around $500,000 and out-of-court settlements of $250,000.

This also excludes the psychological and social outcomes in patients with CBD injury. Rossi et al. \cite{24} reported a range of lost workdays from 90 to 217, with 3.4 admissions and average duration of hospitalisation of 28.6 days.

We feel that the data provided by this study supports the routine use of on-table cholangiogram during laparoscopic cholecystectomy as a means of preventing and early recognition of bile duct injury: besides diagnosing previously undetected common bile duct stones.
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References

Author Information
Ankur J. Shah, MRCS
Department of Surgery, Nevill Hall Hospital

Jeff Gilmour, MRCS
Department of Surgery, Nevill Hall Hospital

Clive Bransom, FRCS
Department of Surgery, Nevill Hall Hospital

Roderic Jones, FRCS
Department of Surgery, Nevill Hall Hospital

Richard L. Blackett, FRCS
Department of Surgery, Nevill Hall Hospital