

## A prospective study of 500 consecutive laparoscopic cholecystectomies

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*Prospective data of 500 consecutive patients who underwent laparoscopic cholecystectomy over a 39 month-period was analysed. There were 311 females and 189 males. The mean age was 53.8 years. The conversion rate was 5.6% (28 patients) for the whole series and 25% (16 patients) for the 64 patients with acute and subacute cholecystitis. There were 2 deaths (0.4%) one died from fulminant hepatitis and the other from carcinomatosis. The overall complication rate was 6.2%. There were 2 major bile duct injuries (0.4%) which occurred among the first 120 cases. Common bile duct stones were initially managed by endoscopic sphincterotomy followed by laparoscopic cholecystectomy and with a success rate of 75% (15 of 20 patients). The last 8 patients with common bile duct stones successfully underwent a totally laparoscopic cholecystectomy combined with common bile duct exploration. Our results have shown that with increasing experience and careful selection of patients, laparoscopic cholecystectomy can be as safe and effective as open cholecystectomy, and with all the added benefits of minimally invasive surgery.*

**Key word :** *Laparoscopic cholecystectomies*

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ผู้ป่วย 500 รายได้รับการผ่าตัดถุงน้ำดีด้วยวิธีเจาะหน้าท้องและใช้กล้องส่องภายในช่องท้องตั้งแต่ มิถุนายน 2534 ถึง กันยายน 2537 ผู้ป่วยเป็นเพศหญิง 311 รายและเพศชาย 189 รายเฉลี่ย 53.3 ปี ผู้ป่วยส่วนมากมีอาการจุกแน่นหรือปวดท้องจากนิ่วในถุงน้ำดีแต่ 60 รายยังไม่มีอาการเลย ผู้ป่วย 76 รายถูกรับเข้ารักษาในโรงพยาบาลแบบฉุกเฉิน ผลการผ่าตัดพบว่าผู้ป่วยเสียชีวิต 2 ราย (0.4%) จากโรคตับอักเสบรุนแรงหนึ่งราย และจากการกระจายของมะเร็งท่อน้ำดีไปตับและปอดอีกหนึ่งราย มีปัญหาแทรกซ้อนทั้งสิ้น 31 ราย (61.2%) ในจำนวนนี้มีผู้ป่วย 2 ราย (0.4%) ที่ได้รับบาดเจ็บต่อท่อน้ำดีระหว่างผ่าตัดซึ่งต้องผ่าตัดแก้ไขโดยไม่พบปัญหาแทรกซ้อนติดตามมาแต่อย่างใด ระหว่างผ่าตัดจำเป็นต้องเล็กรูวิธีเจาะหน้าท้องและทำผ่าตัดต่อไปแบบเปิดท้องในผู้ป่วย 28 ราย (5.6%) ส่วนมากเนื่องจากมีพังผืดมาก ในผู้ป่วย 64 รายที่มีถุงน้ำดีอักเสบเฉียบพลันผลการผ่าตัดด้วยวิธีเจาะหน้าท้องประสบความสำเร็จ 48 ราย (75%) ในระยะแรกของการศึกษาผู้ป่วยที่มีนิ่วในท่อน้ำดีได้รับการรักษาด้วยการทำ endoscopic sphincterotomy ตามด้วยการผ่าตัดถุงน้ำดีโดยเจาะหน้าท้องซึ่งประสบความสำเร็จ 15 รายจากผู้ป่วย 20 ราย (75%) ในระยะหลังของการศึกษาผู้ป่วย 8 ราย ที่มีนิ่วในท่อน้ำดีได้รับการผ่าตัดถุงน้ำดีร่วมกับเปิดท่อน้ำดีเพื่อตึงนิ่วออกด้วยวิธีเจาะหน้าท้อง โดยประสบความสำเร็จทั้ง 8 ราย แต่พบเศษนิ่วตกค้างอยู่ในท่อ 3 รายซึ่งต้องดึงออกด้วยกล้องส่องหลังผ่าตัด รายงานนี้ยืนยันว่าการผ่าตัดถุงน้ำดีด้วยวิธีเจาะหน้าท้องและใช้กล้องส่องภายในช่องท้องเป็นวิธีที่ได้ผลดีเท่าเทียมกับการผ่าตัดถุงน้ำดีแบบเปิดท้อง แต่ผู้ป่วยได้รับผลประโยชน์มากกว่าเนื่องจากอาการปวดหลังผ่าตัดน้อยกว่าผู้ป่วยพื้นตัว และกลับไปทำงานได้เร็วกว่า และแผลผ่าตัดสวยงามกว่าทั้งนี้ข้อแม้ว่าศัลยแพทย์ต้องมีการเลือกผู้ป่วยก่อนทำผ่าตัดอย่างระมัดระวัง และเปลี่ยนวิธีผ่าตัดเป็นการเปิดท้องถ้าประสบปัญหาระหว่างการผ่าตัดด้วยกล้อง

Laparoscopic cholecystectomy was first performed in 1987 by Mouret and has gained immense popularity over the past 5 years.<sup>(1)</sup> It is now considered the standard treatment for symptomatic gallstones, relegating open cholecystectomy only to cases which are not suitable or feasible by the laparoscopic technique.<sup>(2,3)</sup> The advantages of laparoscopic cholecystectomy over the open procedure, which include less postoperative pain, shorter hospitalization, faster recovery and better cosmetic results, are so obvious that large randomized trials are not necessary and may even be unethical.<sup>(4)</sup> Small randomized trials comparing laparoscopic cholecystectomy to minilap cholecystectomy in which the incision was limited to a length of 5-10 cm. have shown that the laparoscopic procedure was also superior to the open procedure.<sup>(5,6)</sup> Early results of laparoscopic cholecystectomy tended to show a relatively high incidence of bile duct injury of up to 3%<sup>(7)</sup>. This has tempered the enthusiasms of some surgeons and has also led to calls for greater attention to the training in laparoscopic cholecystectomy.<sup>(8)</sup> The role of laparoscopic cholecystectomy in complicated gallstones, such as acute cholecystitis and common bile duct stones, was also not quite clear. In fact some authorities had considered them to be contraindications to laparoscopic cholecystectomy.<sup>(9)</sup> The authors reported the results of the first 120 cases of laparoscopic cholecystectomy in 1992.<sup>(10)</sup> The experience level has now reached 500 cases and we wish to update the series with special emphasis on the selection of patients, the overall results, and complications as well as the role of laparoscopic cholecystectomy in treatment of acute cholecystitis and common bile duct stones.

## Materials and Methods

Prospective data of all patients who underwent laparoscopic cholecystectomy over a 39 month-period was analysed. Initially, only patients with symptomatic gallstones were offered surgery. However, with increasing experience healthy and relatively young patients with asymptomatic gallstones were also operated on. In fact, many asymptomatic patients had requested the operation themselves. The authors' policy for selecting patients for laparoscopic cholecystectomy was quite liberal. The only absolute contraindications were patients with severely compromised cardiopulmonary functions, pregnancy and those who had had multiple upper abdominal operations.

All patients underwent ultrasound examination of the upper abdomen. Oral and intravenous cholangiography were undertaken only in highly selected patients such as those with suspected biliary dyskinesia. Endoscopic retrograde cholangiopancreatography (ERCP) was undertaken in patients with jaundice, a history of pancreatitis and those with dilated bile ducts shown by the ultrasound. Nearly all patients with acute cholecystitis underwent laparoscopic cholecystectomy on the next operating list irrespective of the duration of the symptoms. This had been the authors' policy since the days of open cholecystectomy. Only patients with large empyemas of the gallbladder and dilated bowel loops and who required emergency operations underwent open cholecystectomy without a trial of laparoscopic cholecystectomy.

Patients with common bile duct stones requiring elective or semielective surgery also underwent laparoscopic cholecystectomy. During the first 200 cases of laparoscopic cholecy-

stectomy, common bile duct stones were managed by endoscopic sphincterotomy and, if successful, laparoscopic cholecystectomy was undertaken 1-2 days later. Subsequently, patients with common bile duct stones underwent a totally laparoscopic cholecystectomy and common bile duct exploration via a choledochotomy in which a T-tube was inserted after choledocholithomy, just as in the open procedure.

Preoperatively, all patients received a single dose of broad-spectrum antibiotic. A nasogastric tube was inserted to decompress the stomach. Urinary catheterization was employed selectively in the later part of the series. Pneumoperitoneum was induced using a Veress needle through the subumbilical incision. However, the open technique of carbon dioxide insufflation was used in patients who had had a previous abdominal operation. Details of the operative technique have already been described.<sup>(10)</sup> Intraoperative cholangiogram was undertaken selectively only in patients who had not undergone an ERCP, or if it had been unsuccessful, and in those as a preliminary to laparoscopic choledochotomy.

After successful laparoscopic cholecystectomy an injectable narcotic analgesic was given on demand only on the day of operation, after which an oral analgesic was prescribed. Postoperatively, most patients were given oral liquids on the day of the operation and a soft diet thereafter. Patients who underwent laparoscopic common bile duct exploration had a T-tube cholangiogram on the third or fourth postoperative day and, if normal, the T-tubes were occluded and strapped to the patients' side prior to discharge. Patients returned to the outpatient department 12-14 days after operation for removal of the T-tube.

Attempts were made on the first or second postoperative day to discharge patients who under-

went simple laparoscopic cholecystectomy. Patients were followed up to one month postoperatively, after which they were asked to return if there were any further symptoms.

## Results

From June 1991 to September 1994, 500 laparoscopic cholecystectomies were undertaken by the authors at Chulalongkorn Hospital (264 patients), Bumrungrad Hospital (226 patients) and other private hospitals (10 patients). There were 311 females and 189 males. Patients' age ranged from 13 to 94 years, with a mean of 53.3 years.

The mode of admission was elective or semielective in 424 patients (84.8%). The most common symptoms were dyspepsia and biliary colic although 75 patients were asymptomatic. There were 76 emergency admissions, 57 for acute cholecystitis, 12 for cholangitis and 7 for biliary colic. Table 1 summarises the indications for laparoscopic cholecystectomy. On admission 44 patients (8.8%) had a temperature above 37.5°C and 49 patients (9.8%) were jaundiced. Associated diseases are shown in table 2. One hundred and seven patients (21.4%) had had previous abdominal operations (table 3.)

All patients underwent preoperative ultrasound examination. In addition, oral cholecystography was undertaken in 14 patients, intravenous cholangiography in 4 patients, and ERCP in 44 patients (8.8%). The reasons for preoperative ERCP are shown in table 4. Endoscopic sphincterotomy was successful in extracting common bile duct stones in 16 of 20 patients (80%), and 15 of these 16 patients subsequently underwent successful laparoscopic cholecystectomy 1-2 days later. The other 4 patients underwent open cholecystectomy and common bile duct exploration. In the later part of the series, 8 consecutive patients with common bile duct stones success-

fully underwent laparoscopic cholecystectomy combined with common bile duct exploration.

Intraoperative cholangiography was performed in 39 patients (7.8%), including in 8 patients prior to common bile duct exploration. The remainder were for the delineation of ductal anatomy and the exclusion of bile duct stones in patients who had not undergone ERCP.

The mean operative time for the whole series was 80.3 (30-320) minutes. For patients who successfully underwent simple elective cholecystectomy the mean operative time was 70.5 (30-220) minutes. Other laparoscopic procedures concomitant to cholecystectomy included common bile duct exploration in 8 patients, inguinal hernia repair in 2 patients, appendectomy in 2 patients and posterior truncal vagotomy and anterior seromyotomy in a patient who had a sealed perforation of a duodenal ulcer. Conversion to an open operation was necessary in 28 patients (5.6%), and the reasons for the conversion are shown in table 5. During operation acutely and subacutely inflamed gallbladders were found in 66 patients, of whom 16 (25%) had to be converted to an open procedure. The presence of chronic adhesions obliterating anatomical planes was the reason for conversion in 8 patients.

**Table 1.** Indications for laparoscopic cholecystectomy.

	No. patients
Dyspepsia	202
Biliary colic	147 *
Acute cholecystitis	69
Jaundice	22
Asymptomatic gallstones	60

\*2 patients had biliary dyskinesia.

**Table 2.** Associated diseases in 158 Patients\*

	No. patients
Hypertension	68
Diabetes Mellitus	51
Myocardial ischaemia	12
Cirrhosis	12
Neurological disorders	10
Thalassaemia	6
Renal disorders	5
Thyroid disorders	4
Chronic lung diseases	4
Peptic ulcer	3
Others	6

\*23 patients had more than 1 disorders.

**Table 3.** Previous abdominal operations in 107 patients.

	No. patients
Hysterectomy	30
Caesarian section	28
Tubal ligation	26
Appendectomy	15
Genitourinary operations	4
Gastrointestinal operations	4

**Table 4.** Indications for ERCP in 44 patients.

	No. patients
Jaundice	30
Dilated common bile duct	11
Acute pancreatitis	3

**Table 5.** Reasons for conversion to open cholecystectomy in 28 patients.

	No. patients
Acute/subacute cholecystitis	16
Chronic adhesions	8
Bleeding	2
Transection of common bile duct	1
Carcinoma of distal common bile duct	1

Postoperative complications in 31 patients (6.2%) are shown in table 6. Bile peritonitis was caused by incomplete occlusion of the cystic ducts in 2 patients and leakage from the common bile duct through a needle puncture used for intraoperative cholangiography in one other patient. All 3 patients underwent laparotomies for peritoneal lavage, drainage and correction of the leakage. The 4 biliary fistulas were managed expectantly with spontaneous closure. However one patient required a hepatico-jejunostomy for bile duct stricture 6 months later. This was one of the 2 patients who were considered to have sustained major bile duct injuries. The other case of bile duct injury was caused by accidental transection of the bile duct which was recognised intraoperatively. A hepatico-jejunostomy was undertaken without any complications. These 2 cases of major bile duct injury occurred during the initial series of 120 laparoscopic cholecystectomies, but none occurred subsequently. The incidence of major bile duct injury for the whole series is thus, 0.4%. The 3 cases of retained common bile duct stones or fragments were diagnosed by T-tube cholangiograms after laparoscopic exploration of the common bile duct. The stones were successfully extracted endoscopically via the T-tube tract (1 patient)

and through a sphincterotomy (2 patients). There were 2 hospital deaths, a mortality rate of 0.4%. One patient died from fulminant hepatitis following reoperation to evacuate a subhepatic haematoma. The other death was due to carcinomatosis and pulmonary tumour embolism in a patient who had underwent laparoscopic cholecystectomy for acute cholecystitis caused by an advanced cholangiocarcinoma obstructing the cystic duct.

**Table 6.** Postoperative complications in 31 patients.

	No. patients
Bile peritonitis	3
Biliary fistula	4
Respiratory infection	5
Urinary problems	5
Acute pancreatitis*	2
Cardiovascular problems	3
Abdominal haematoma	3
Wound infection	4
Subhepatic collection	1
Retained common bile duct stones	3

\*Complications after ERCP.

The 472 patients who successfully underwent laparoscopic cholecystectomy required an average of injections of narcotic analgesic postoperatively, and 153 patients did not require any injections. In this subgroup, 392 patients were able to tolerate oral intake on the first postoperative day. The postoperative stay in the hospital varied from 1 to 32 days with a mean of 3.6 days. Patients who successfully underwent laparoscopic cholecystectomy had a mean hospital stay of 3.1 days.

During follow-up, one patient died from metastatic adenocarcinoma of the gallbladder 3 months after the laparoscopic cholecystectomy. One patient who had not undergone ERCP or intraoperative cholangiography returned 14 months after operation with acute cholangitis caused by a common bile duct stone which was subsequently extracted by endoscopic sphincterotomy. Both patients with biliary dyskinesia were cured of their symptoms.

### Discussion

The results of the present series confirmed that laparoscopic cholecystectomy is a safe and effective operation for the majority of patients with gallstones. The mortality rate of 0.4% is comparable to open cholecystectomy.<sup>(11,12)</sup> The complication rate has been halved from 12% in our earlier series to 6.2%. The overall incidence of major bile duct injury was 0.4%, but there were no such injuries after the first 120 cases. Increasing experience, a standardised operative technique, selective use of intraoperative cholangiography and prompt conversion to an open procedure when difficulties were encountered probably contributed to the reduction in bile duct injury to a level comparable to open cholecystectomy. This has also been the experience of most other series.<sup>(13-15)</sup> The conversion rate was also lowered from 10% to 5.6% despite a more liberal policy in selecting patients for laparoscopic cholecystectomy. In fact, cases without acute or subacute inflammation of the gallbladder had a conversion rate of only 2.4%.

The use of intraoperative cholangiography in only 6.2% of cases appeared to be very low. This was due to the fact that intraoperative cholangiography was selectively used in this series complementary to ERCP. Patients with jaundice,

pancreatitis and the majority with dilated common bile ducts had already undergone preoperative ERCP. Thus intraoperative cholangiography was undertaken only to delineate the obscured anatomy of the Calot's triangle in the few patients whom ERCP had been unsuccessful, and to assess the number and size of the common bile duct stones prior to laparoscopic choledocholithotomy. During follow-up in this series, only one patient who had not undergone intraoperative cholangiography returned with symptoms from a common bile duct stone which probably had been missed at the time of operation. Thus our results seem to indicate the selective use of intraoperative cholangiography.

Contraindications for laparoscopic cholecystectomy are becoming fewer as surgical teams became more experienced.<sup>(16,17)</sup> This was also the case in our series. At present, we only consider previous multiple upper abdominal operations, pregnancy, and poor cardiopulmonary status as absolute contraindications. Acute cholecystitis should not be a contraindication unless it is complicated by a large empyema of the gallbladder associated with dilated bowel loops. With this policy, 75% of our patients with acute and subacute cholecystitis successfully underwent laparoscopic cholecystectomy. The success rate in the literature varies from 65-95%, probably as a result of differences in patient selection, experience of the surgical teams and the threshold for conversion.<sup>(18-20)</sup>

The presence of common bile duct stones had initially been considered a contraindication for laparoscopic cholecystectomy. However, this soon changed and bile duct stones began to be managed by endoscopic sphincterotomy followed by laparoscopic cholecystectomy if the former procedure had been successful.<sup>(21,22)</sup> At present, the majority of bile duct stones are probably still

managed in this way. However, experienced surgical teams are now reporting an increasing number of patients with bile duct stones managed by a totally laparoscopic cholecystectomy combined with common bile duct exploration.<sup>(23)</sup> Our initial experience in 8 patients suggests that this combined laparoscopic procedure will probably become the standard treatment for the majority of patients with common bile duct stones. The procedure is similar in all respects to open cholecystectomy and choledocholithotomy, hence surgical principles are not compromised. The problem of retained bile duct stones should be reduced with greater experience and standardisation of operative techniques. Endoscopic stone extraction via a sphincterotomy or the T-tube tract would then serve as a back-up for cases in which laparoscopic choledocholithotomy has been unsuccessful or when there are retained stones.

### Conclusions

The results of 500 consecutive laparoscopic cholecystectomies have confirmed that this procedure should be the standard treatment for gallstone removal. Since our initial report of the first 120 cases, complications and conversion rates to the open procedure have been halved. The majority of patients with acute and subacute cholecystitis could be managed by laparoscopic cholecystectomy with a success rate of 75%. With increasing experience, common bile duct stones are now being managed by a totally laparoscopic cholecystectomy combined with common bile duct exploration.

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