



A prospective study of ambulatory laparoscopic cholecystectomy

Training economic, and patient benefits

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Abstract

Background: Even though ambulatory laparoscopic cholecystectomy (ALC) is safe and cost effective, this approach has yet to gain acceptance in the United Kingdom. We report our 5-year experience of ALC with emphasis on its appropriateness for higher surgical training.

Methods: Between July 1997 and July 2002, patients with symptomatic cholelithiasis who met with appropriate criteria underwent ALC. Surgery was performed either by a consultant surgeon or a higher surgical trainee (HST) under direct supervision in our dedicated day surgery unit. Data were recorded prospectively and patients were interviewed postoperatively by an independent researcher.

Results: There were 269 patients (231 female and 38 male) with a median age of 46 years (range 17–76). Conversion to open cholecystectomy was necessary in three cases (1%). Of the patients, 79% (213) were discharged within 8 hours of surgery; 95% (256) were discharged on the same day. Thirteen patients (5%) required overnight admission as inpatients. An HST performed 166 (62%) of the procedures. There was a statistically significant difference in operating time between consultants (41 min) and trainees (47 min, $P = 0.001$) but no significant difference in clinical outcome or patient satisfaction. The mean procedural cost to the hospital was £768 for ALC compared with £1430 for an inpatient operation. Of patients, 87% expressed satisfaction with the day case operation.

Conclusion: Our results for ALC compare favorably with published series. In addition, we have demonstrated that the operation can be performed safely by HST under direct supervision without compromising operating lists or safety.

Key words: Ambulatory surgery — Laparoscopic cholecystectomy — Outcome, training

Laparoscopic cholecystectomy (LC) has become the standard treatment for symptomatic cholelithiasis and the prevention of related complications [21]. The clinical benefits are well established [2, 10], and more recently improvements in instrumentation, anesthesia, and peri-operative care have made it possible to perform LC without the necessity for an overnight stay [1, 9, 16, 17, 19, 23].

Ambulatory LC (ALC) has become routine practice in the United States with several large series published [16, 23]. These confirm not only the safety of this approach but also a reduction in procedural cost and high levels of patient satisfaction. In the United Kingdom, there is currently a drive to increase the proportion of day case operations to 75% of all elective procedures [7]. However, ALC has been slow to develop in this country despite the results achieved elsewhere.

Higher surgical training is currently undergoing significant reappraisal as a result of the implementation of the New Deal on junior doctors' hours, Calmanisation, and the European Working Time Directive [3, 5, 6, 8]. These initiatives have reduced the duration and intensity of registrar training program and as a consequence have raised concerns about the operative exposure of higher surgical trainees (HST) [6]. The aim of this study was to evaluate the outcome of ALC in our hands and to establish whether the day surgical unit could provide a safe training environment for what is considered an index procedure for higher surgical training.

Materials and methods

Patients and methods

All of the patients underwent surgery in our purpose-built day case unit at Hull Royal Infirmary. The unit is open from 07:00 until 21:00 and is separate from the main hospital building. It is run by dedicated medical, nursing, and administrative staff. ALC was offered to patients with symptomatic gallstone disease who met our established criteria: American Society of Anesthesiology (ASA) grade I or II, body mass

Table 1. Comparison of outcome of ambulatory laparoscopic cholecystectomy with grade of operating surgeon

	Consultant (<i>n</i> = 103)	HST (<i>n</i> = 166)	<i>p</i> value
Operating time (min)	41 (16)*	47 (15)*	0.001 [†]
Recovery nausea score	0 (0–10)**	0 (0–10)**	0.510 [‡]
Recovery pain score	4 (0–10)**	5 (0–10)**	0.567 [‡]
Number admitted	17	26	0.850 [§]
Satisfied patients	91	142	0.510 [§]

HST, Higher Surgical Trainee

Values are mean (s.d.)* or median (range).** *t*-test, [†] Mann-Whitney *U* test, [‡] or chi square[§] was used to analyze the data

index < 32 kg/m². Patients who lived alone or more than 50 miles from the hospital, or who refused an ambulatory procedure were offered a conventional elective LC in the main hospital with an overnight stay. Those with a history of jaundice, deranged liver function tests, or evidence of a common bile duct stone were subjected to preoperative cholangiography and, if necessary, stone extraction prior to surgery. Patients who presented as an emergency with complications of gallstones were dealt with on their index admission and therefore excluded.

Surgery was performed by one of the three consultant general surgeons with a subspecialist interest in minimally invasive surgery or by a supervised HST. The trainees had been appointed to the unit as part of their surgical rotation and typically had at least 3 years of registrar experience. All of the ALCs were performed on a morning list to allow time for recovery prior to closure of the unit in the evening.

The average cost of the procedure was obtained from the financial department of the hospital for the subset of day case, and inpatient elective and nonelective laparoscopic cholecystectomy without the use of cholangiography. This does not include the cost of further admission for the complications in both the groups. The hospital cost was calculated for the procedure (admission, operating room, laboratory, pharmacy) and estimated cost for average length of stay in the hospital.

Operative technique

A pneumoperitoneum was achieved using either veress needle insufflation or an open cannulation technique. Two 5-mm and two 10-mm ports were introduced after local anesthetic infiltration with 0.5% bupivacaine. Surgery was performed under general anesthesia with endotracheal intubation. Induction was achieved with propofol (2 mg/kg), fentanyl (1–5 µg/kg), morphine (10 mg), metoclopramide (10 mg), and atracurium (0.5 mg/kg).

Anesthesia was maintained with intermittent positive pressure ventilation, 33% oxygen, 60% nitrous oxide, and 1–3% sevoflurane, which were adjusted according to individual requirements.

Postoperative analgesic and antiemetic medication was titrated with pain and nausea scores as recorded on a Linkert visual-analogue scale. Prescribed analgesia included paracetamol (mild pain), diclofenac or ketorolac (moderate pain), and morphine, tramadol, or codeine phosphate (severe pain). Antiemetic drugs included parenteral metoclopramide, cyclizine, and ondansetron. All patients were assessed by the anesthetist and the surgeon postoperatively and discharged home by the nursing staff when they were free from pain or nausea, able to take light diet, had successfully voided urine, and were ambulatory. They were instructed on how to contact the day surgery unit and given a supply of oral analgesia. Those who failed to meet with the discharge criteria were admitted to the inpatient surgical ward. All of the patients were voluntarily subjected to a telephone interview by an independent observer on days 1, 2, 7 and weekly postoperatively until fully recovered. Persistent symptoms, patient satisfaction, and return to normal activity were assessed. Formal outpatient review was performed at 2 weeks following surgery. If there were no adverse sequelae, patients were discharged from the surgical service at this time.

Data collection and statistical analysis

Data were collected prospectively and analysis was performed using the Statistical Package for the Social Sciences software for Windows

version 11.5 (Chicago, IL, USA). Parametric and nonparametric data sets were compared using two-tailed *t*-test and Mann-Whitney *U* tests, respectively. The chi-square test was used to analyze categorical data. A *p* value of < 0.05 was considered statistically significant.

Results

Between July 1997 and July 2002, a total of 1025 patients underwent elective LC at Hull Royal Infirmary. Of these, 269 (26%) were performed in the day surgery unit. During the study, the proportion of LC performed as day cases increased from 18% in 1997 to 53% in 2002. The patients were predominantly female (86%). The median age was 46 years (range 17–76). The majority of patients were ASA I (88%) and the remainder were ASA II. Surgery was performed by a supervised HST in 166 patients (62%).

The duration of surgery (including induction) ranged from 30 to 112 min. No patient underwent intraoperative cholangiography. The overall mean (s.d.) operating time was 45 (16) min. Mean (s.d.) operating times for consultants were significantly less than those for registrars, 41 (16) versus 47 (15) min, *p* = 0.001. There were no significant differences for postoperative pain or nausea scores or number of hospital admissions between grades of operating surgeon (Table 1). The overall mean (s.d.) duration of stay on the day surgery unit was 496 (62) min. There was no significant difference in total time spent in the day unit and the grade of surgeon.

Discharge within 8 hours of surgery occurred in 213 cases (79%) and in the same day in 256 (95%) patients. Temporary transfer to the main hospital surgical ward was required for 43 patients (16%) but overnight admission was required for only 13 (5%). The most common reasons for delayed discharge were nausea and vomiting in 20 patients (7%) and minor intraoperative bleeding in 12 patients (4%) which had required placement of an intraperitoneal drain at the time of surgery. Conversion to open cholecystectomy was necessary in three patients (1%). The reasons for conversion were hemorrhage, common bile duct injury, and unusual anatomy. The bile duct injury occurred in a patient with a thin mobile common bile duct that was damaged prior to accurate identification. The procedure was converted to a laparotomy and a *t*-tube placed in the choledochotomy. The patient made an uneventful recovery and endured no adverse sequelae.

Readmission following discharge was necessary in five patients (2%): Three were readmitted with pain and vomiting within 48 hours of discharge. One patient

Table 2. Characteristics of patients admitted after ambulatory laparoscopic cholecystectomy

	Discharged (<i>n</i> = 226)	Admitted (<i>n</i> = 43)	<i>p</i> value
Age (yr)	46 (17–76)*	45 (18–71)*	0.840 [†]
Male: female ratio	31:195	9:36	0.650 [‡]
ASA II	26	6	0.640 [‡]
HST operating	140	26	0.850 [‡]
Operating time (min)	43 (12)**	58 (25)**	< 0.001 [§]
Recovery room pain score > 5	64	27	< 0.001 [‡]
Recovery room nausea score > 5	19	18	< 0.001 [‡]
Vomited in recovery	33	19	< 0.001 [‡]
Satisfied patients	211	22	< 0.001 [‡]

Values are median (range)* or mean (s.d.)**. ** Mann-Whitney *U*-test, [†] chi square,[‡] or *t*-test[§] was used to analyze the data

Table 3. Average length of stay and hospital cost for laparoscopic cholecystectomy

	Day case	Inpatients (elective)	Inpatients (nonelective)
Total cost (£)	768	1430	1879
Mean length of stay	0	1.7	4.2

presented on day 3 with an intraabdominal bile collection, which was drained percutaneously. A further patient presented on day 3 with pain and jaundice due to a retained common bile duct stone that was extracted endoscopically. The overall incidence of significant morbidity was 1% (three patients).

There was no significant difference in age, sex, ASA score, or grade of operating surgeon between patients who were admitted and those who were discharged (Table 2). The mean (s.d.) operating time was significantly longer for patients who required admission [58 (25) min vs 43 (12) min, $p < 0.001$]. Admission was more likely for those patients with higher postoperative pain and nausea scores or those who vomited in recovery (Table 2).

The mean procedural cost to the hospital was £768 for ALC compared with £1430 for an inpatient elective operation (Table 3). At 2 weeks follow-up, 233 patients (87%) were satisfied with their day surgery experience. There was a significant difference in satisfaction scores between those who were discharged on the same day compared with those who were admitted (93% vs 51%, $p < 0.01$). There was no significant difference between grade of operating surgeon and patient satisfaction (86% for HST vs 88% for consultants, $p = 0.510$).

Discussion

With increasing experience and improvements in anesthetic and surgical techniques, surgeons are gaining confidence in the performance of ALC, especially in the United States. However, there have been only a few reports of ALC from the United Kingdom, where the technique has been slow to develop [12, 18]. We have been performing ALC since 1997 and our data represent one of the largest prospective series in the United Kingdom. During the current study, only 26% of LC were performed as day case procedures. This relatively small proportion reflects the case mix, our surgical unit

philosophy with respect to acute presentations of biliary disease (these patients undergo surgery during the index admission) and patient selection for day surgery (ASA I and II cases). However, there was a trend toward an annual increase in the proportion of ALC, and by 2002, 53% of cholecystectomies were performed as day cases. The proportion of ALC increased with experience and this is consistent with published data [14, 20]. We expect to modify our day case selection criteria to include some ASA III patients as others have done to further expand the service [16].

Our clinical outcomes were similar to published series where there is a high proportion of same-day discharges (up to 97%), low admission (< 6%) and readmission rate (up to 5%), low levels of morbidity (< 3%), no mortality, and high patient satisfaction with the procedure [16–19]. Where there is a delay in discharge, overall patient satisfaction is reduced. Discharge delay is associated with high postoperative pain and nausea scores. Other authors have reported similar findings [13]. There were no preoperative predictors of admission identified.

We found that total operating time was significantly longer for supervised HST when compared with consultants. Increased operating time was a risk factor for admission as previously reported [13]. However, there was no significant difference between the grade of operating surgeon and outcome in terms of postoperative pain and nausea scores, hospital admission, and patient satisfaction. This suggests that it is duration of surgery rather than grade of operating surgeon that is associated with a more adverse outcome. This finding may be attributable to the high degree of consultant supervision involved and early intervention in difficult cases.

There is some evidence concerning the learning curve for LC. In the current study, the trainees had at least 3 years of registrar experience (with at least 50 supervised elective LC procedures). It has been reported that the frequency of complications, duration of hospital stay,

and operating time for LC are reduced beyond the first 25 cases [11]. After 35 cases the operating time may significantly decrease for some surgeons but not others, reflecting variability in the ability to acquire skills [4]. There is a reported 40% reduction in operation time for LC after 200 operations [22]; however, the constraints imposed on surgical training by the junior doctors' new deal on working hours and the recently implemented European Working Time Directive may lead to a substantial increase in the number of HSTs and a reduction in exposure to elective and emergency cases, thus potentially limiting training opportunities [6]. This may make such numbers difficult to achieve.

The economic implications of ALC are considerable with a potential reduction in the cost of the operation by 11–25% per patient reported in some series [19, 23]. However in our unit the mean procedural cost of LC for 2002–03 was £768 for day case versus £1430 (46% difference) for the corresponding inpatient operation, making the financial benefits to the National Health Service very substantial. In addition the ambulatory approach enables inpatient beds to be available for other elective and emergency cases.

It is reassuring to confirm that one of the most important index training operations can be safely performed by HSTs under direct supervision in the expanding environment of ambulatory surgery. The widespread adoption of ALC may help to address some of the emerging concerns regarding higher general surgical training as well as having significant clinical and economic benefits.

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