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Original Article

Comparative study of ambulatory versus inpatient laparoscopic cholecystectomy in Thailand: Assessing effectiveness and safety with a propensity score matched analysis

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Backgrounds/Aims: Ambulatory laparoscopic cholecystectomy (LC) is increasingly recognized for its advantages over the inpatient approach, which advantages include cost-effectiveness and faster recovery. However, its acceptance is limited by patient concerns regarding safety, and the potential for postoperative complications. The study aims to compare the operative and postoperative outcomes of ambulatory LC versus inpatient LC, specifically addressing patient hesitations related to early discharge.
Methods: In a retrospective analysis, patients who underwent LC were divided into ambulatory or inpatient groups based on American Society of Anesthesiologists (ASA) classification, age, and the availability of postoperative care. Propensity score matching was utilized to ensure comparability between the groups. Data collection focused on demographic information, perioperative data, and postoperative follow-up results to identify the safety of both approaches.
Results: The study included a cohort of 220 patients undergoing LC, of which 48 in each group matched post-propensity score matching. The matched analysis indicated that ambulatory LC patients seem to experience shorter operative times and reduced blood loss, but these differences were not statistically significant (35 minutes vs. 46 minutes, p-value = 0.18; and 8.5 mL vs. 23 mL, p-value = 0.14, respectively). There were no significant differences in complication rates or readmission frequencies, compared to the inpatient cohort.
Conclusions: Ambulatory LC does not compromise safety or efficacy, compared to traditional inpatient procedures. The findings suggest that ambulatory LC could be more widely adopted, with appropriate patient education and selection criteria, to alleviate concerns and increase patient acceptance.

Key Words: Cholecystectomy, laparoscopic; Gallstones; Ambulatory surgical procedures; Gallbladder diseases

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INTRODUCTION

The prevalence of gallstone disease in the adult population is estimated to be 10%–15% [1]. Laparoscopic cholecystectomy (LC) is the preferred treatment for symptomatic cholelithiasis, offering benefits such as reduced postoperative pain, smaller scars, shorter hospital stays, quicker return to normal activities, and fewer complications, compared to open surgery [2]. However, most elective LC patients still experience uncomfortable overnight hospital stays, which has economic implications for hospitals, patients, and their families.

Ambulatory LC, also known as day-case or outpatient LC, is an opportunity for healthcare systems, especially in developing countries, to optimize resource utilization and reduce costs [3]. While in the USA and UK, it has become standard practice over the last two decades [4,5], in Asia and Thailand, its adoption has been limited, due to concerns about postoperative complications [6-8]. In Thailand, the One Day Surgery (ODS) policy, introduced in 2018 and including LC in 2021, is aligned with global efforts to reduce hospital stays and healthcare expenses, addressing issues like hospital congestion and infection risks. This approach has the potential to transform healthcare delivery.

Surgeon concerns about ambulatory LC revolve around the risk of missing postoperative complications. Well-defined criteria for patient selection are essential to ensure success and safety [8]. Selection factors include social considerations, such as patient understanding, consent, the availability of a responsible caregiver, and suitable transportation for postoperative recovery. Medical factors encompass the American Society of Anesthesiologists (ASA) physical status, age, and body mass index (BMI) [9]. Determining precise cutoff values for these parameters remains challenging, due to limited evidence. Interestingly, some studies have shown positive outcomes in patients with high ASA scores, older age, or obesity, suggesting that these factors alone should not exclude patients from ambulatory LC [10].

This study examines the outcomes of ambulatory LC in Thailand, where this approach is relatively new. It focuses on complication rates, patient recovery, and overall procedural effectiveness, compared to traditional admission cases. The goal is to establish a robust framework for patient selection, and address concerns about early discharge and potential complications. By evaluating the advantages and limitations of ambulatory LC in this healthcare setting, the research aims to contribute to improving surgical practices and policies in Thailand and similar environments, potentially changing how minimally invasive surgeries, like ambulatory LC, are perceived and practiced.

MATERIALS AND METHODS

Study design

The study received approval from the institutional review board (EC-65-0037 and EC-67-32), and written informed consent was obtained from all patients. The article adheres to the STROCSS checklist and criteria for reporting [11].

Data collection and participants

This retrospective study, conducted from January 2022 to June 2023 in our general surgery department, focused on elective cholecystectomy patients. Patients having a planned open procedure, or where the gallbladder was removed as part of another procedure, were excluded. Data obtained from medical records included standard demographical data, such as BMI, age, sex, ASA classification, and comorbidities. Outcome measures included hospital stay, conversion rate, admission rate for the ambulatory group, readmission rate, and complications. Complications were recorded using the Clavien–Dindo (CD) classification, which was further defined as minor (CD < III) or major (CD ≥ III) [12].

Prior to the introduction of the ambulatory LC protocol to Thailand, selection of patients for the procedure was made based on the Thai guideline for ODS, with its definition of no overnight stay or discharge after surgery within 24 hours. An ODS protocol was introduced to our center in early 2021 to develop a safe and appropriate selection process [13]. Patients were identified as appropriate for ODS, and underwent preoperative consent and education. Inclusion criteria were patients who were 18–65 years old, with elective case, ASA I or II, and BMI < 35 kg/m^2. Patients with malignant gallbladder disease, simultaneous procedure, or high risk of conversion to open technique were excluded from this study. We provided comprehensive information to patients and their relatives about the ambulatory setting, including the process, risks, and benefits of the procedure. This education was designed to ensure that patients and their families had a clear understanding of what to expect before, during, and after the surgery. We emphasized the importance of postoperative care, pain management, and recognition of potential complications. Informed consent was obtained from all patients after they had the opportunity to ask questions and discuss any concerns with the medical team. This approach aimed to alleviate anxiety, foster trust, and ensure that patients and their relatives were well-prepared for the ambulatory LC experience. Preoperative assessment was made by the anesthesiologist after screening by the surgical consultant, and standard laboratory and radiological tests were obtained and recorded.

We conducted a subgroup analysis to compare outcomes between patients who met the Thai guideline for ODS with ASA I or II, and those with ASA III. The aim was to explore the potential for expanding the criteria for ambulatory LC to include high-risk patients. Patients with ASA classification III were included if they were preoperatively assessed by an anesthesiologist and an internist according to our institute's preoperative guidelines. In our institute, LC patients are typically evaluated and discharged within 24 hours after surgery by the attending surgeon. The general criteria for discharge include stable vital signs, normal breathing with oxygen saturation levels above 90% on room air, reasonable mobility, tolerance of a soft diet, good bowel function, and manageable levels of pain, nausea, and vomiting. Before discharge, patients and their relatives received specific written and verbal instructions for post-surgery care, including information on possible aggravated symptoms related to the patient's underlying diseases. We also conducted follow-up phone calls on days 1 and 3 after discharge to assess the patient's overall condition, and any aggravated symptoms of their underlying diseases.

Operative and postoperative details in ambulatory laparoscopic cholecystectomy

On the day of surgery, ambulatory cases were always scheduled in the morning session, with the first operation starting at 9:00 AM. Patients were re-evaluated by both the anesthetist and the operating surgeon prior to the procedure, with house staff assistance. A prophylactic antibiotic dose was administered approximately 30 minutes before incision, along with graduated stockings. General anesthesia was administered using propofol, cisatracurium, fentanyl, succinylcholine, desflurane, and a 50% oxygen–air mix. During surgery, 1–2 L of crystalloid solution was infused, and LC was performed using a 3- or 4-port technique. Saline wash and possible drainage were applied in complicated cases. Post-surgery, patients received ondansetron intravenously for nausea prophylaxis and bupivacaine injection at port sites. A topical skin adhesive was used for wound closure (Dermabond^{TM}, Ethicon), followed by a pressure dressing.

After surgery, patients were monitored in the postoperative care room for 4–6 hours by nurses. Pain, nausea, and vomiting were managed with nonsteroidal anti-inflammatory drugs (NSAIDs), paracetamol infusion, and metoclopramide, as needed. The operating surgeon assessed each patient for discharge based on criteria like stable vital signs, no nausea or vomiting, ability to eat and drink, normal urination, and mobility. Pain was measured using a visual analog scale, with a score of 7 or higher necessitating an overnight stay. The post anesthetic discharge scoring system (PADSS) was used [14], with a score of 9 or above indicating readiness for discharge. Patients received paracetamol and ibuprofen for 48–72 hours post-discharge, and were given a contact number for post-surgery inquiries. They were instructed to visit the emergency department for persistent issues, and had follow-up at the outpatient clinic for one-week post-surgery. The day after surgery, patients were called to check on pain control, wound status, dietary tolerance, and any concerns. In contrast, patients with a PADSS score less than 9, and those who required conversion to an open procedure, were considered dropouts from ambulatory LC. In these cases, we changed their status to admitted patients, and discharged them only after they met the institute's criteria for discharge.

Statistical analysis

Data for the study was collected from electronic medical records, focusing on patient demographics, operative findings, and perioperative and postoperative details. Statistical analysis involved descriptive statistics for demographic data, and the Mann–Whitney U test and Pearson's chi-squared test for continuous and categorical variables, respectively. Propensity score matching (PSM) was performed using a logistic regression model with the following covariates: sex, age, BMI, ASA classification, preoperative diagnosis, and underlying diseases. Cox's regression analysis was employed to validate outcome analysis with a significant p-value < 0.05. The analysis aimed to identify trends and significant patterns in the data, contributing to the understanding of ambulatory LC outcomes. The statistical analyses were performed using Stata BE 18.0 (Stata Corp., LLC).

RESULTS

Demographic characteristics

The initial cohort for this study comprised 51 patients in the ambulatory group, and 169 in the conventional group. The ambulatory group had a significantly younger mean age (43.66 years), compared to the conventional group (57.11 years, $p < 0.001$). There were more male patients in the conventional group (33%), than in the ambulatory group (33.14%, $p = 0.04$). The two groups had similar BMI. ASA classification showed a higher percentage of ASA I patients in the ambulatory group (58.82%), compared to the conventional group (21.30%, $p < 0.001$). The ambulatory group had more cases of symptomatic gallstone disease (84.31%), compared to the conventional group (55.62%, $p < 0.001$). Chronic cholecystitis and common bile duct stone after endoscopic stone removal were less common in the ambulatory group. The ambulatory group also had lower rates of underlying diseases, such as diabetes mellitus (DM, 7.84%) and hypertension (HT, 15.69%), compared to the conventional group (DM = 23.08%; HT = 39.05%).

Operative details and outcomes

The ambulatory group demonstrated significantly shorter operative times, with a mean of 40.33 minutes, compared to the conventional group, which had a mean operative time of 49.63 minutes ($p = 0.03$). The ambulatory group had less estimated blood loss, compared to the conventional group at 8.11 mL vs. 32.87 mL, but this difference was not statistically significant ($p = 0.09$). No significant differences were observed between the two groups in terms of conversion rate, readmission rate, or short-term postoperative complications, such as wound infection or bile duct injury.

After propensity score matching

After PSM, the ambulatory and conventional care groups consisted of 43 well-balanced patients each. Age distribution became comparable (ambulatory: 45.60 years; conventional: 45.55 years, $p = 0.98$), and sex distribution was nearly identical (ambulatory: 23.26% male; conventional: 25.58% male, $p > 0.999$). ASA classifications were similar to post-PSM. Operative time remained shorter for the ambulatory group, though not statistically significant (ambulatory: 39.34 minutes; conventional: 45.93 minutes, $p = 0.18$). Estimated blood loss was lower in the ambulatory group, but not significantly different (ambulatory: 8.48 mL; conventional: 23.39 mL, $p = 0.14$). Readmission and complication rates were comparably low, with no significant differences in wound infection or bile duct injuries incidence. The patients' demographic data and operative outcomes are described in Table 1 in both before- and after-PSM.

Analysis of the ambulatory laparoscopic cholecystectomy group in postoperative outcomes

Two patients experienced nausea post-surgery, which was effectively managed with ondansetron. Additionally, two patients faced postoperative pain, which was controlled with intravenous parecoxib. All patients were discharged without complications, and none visited the Emergency Department for procedure-related issues before their scheduled follow-up. One female patient did seek care two days post-surgery for severe abdominal pain, but investigations showed no abnormalities, and after an overnight stay, she was discharged. It was later discovered that she had a history of panic disorder. Two diabetic patients developed cellulitis at the umbilical wound, which was successfully treated with oral antibiotics. Of the 51 patients, 50 were satisfied with the ambulatory LC, while one preferred an inpatient setting for a more reassuring environment.

Subgroup analysis

In this study, a comparison was made between the ambulatory group and patients classified as ASA III, to explore the possibility of expanding criteria for ambulatory settings. There were significant demographic differences between the two groups, including age, diagnosis, and underlying diseases. Perioperative data also showed significant differences in operative time (40.33 minutes vs. 55.96 minutes, p-value = 0.002) and estimated blood loss (8.11 mL vs. 47.82 mL, p-value = 0.03). However, there were no significant differences in readmission rates or complications (p-value > 0.05).

In patients with ASA III, there were six patients with BMI > 40 kg/m^2, all diagnosed with symptomatic gallstones, with half of them having underlying diseases. All six patients were able to be discharged as planned, and during the follow-up period, no complications were detected. Table 2 shows subgroup analysis data.

Table 1. Patient demographics data and perioperative outcomes (before and after matching)

	Before PSM			After PSM		
	Ambulatory (n = 51)	Conventional (n = 169)	p-value	Ambulatory (n = 43)	Conventional (n = 43)	p-value
Age (yr)	43.66 ± 11.36	57.11 ± 15.40	< 0.001	45.60 ± 10.72	45.55 ± 12.30	0.98
Male	10 (19.61)	56 (33.14)	0.04	10 (23.26)	11 (25.58)	> 0.999
BMI (kg/m^2)	25.28 ± 3.60	25.71 ± 5.07	0.57	25.27 ± 3.46	25.46 ± 4.05	0.81
ASA						
I	30 (58.82)	36 (21.30)	< 0.001	23 (53.49)	24 (55.81)	> 0.999
II	21 (41.18)	105 (62.13)	0.01	20 (46.51)	19 (44.19)	> 0.999
III	0 (0)	28 (16.57)	0.001	-	-	-
Diagnosis						
Symptomatic gallstone	43 (84.31)	94 (55.62)	< 0.001	36 (83.72)	34 (79.07)	0.782
Chronic cholecystitis	3 (5.88)	39 (23.08)	0.004	3 (6.98)	3 (6.98)	> 0.999
Bile duct stone after stone removal	5 (9.80)	26 (15.38)	0.368	4 (9.30)	4 (9.30)	> 0.999
Gallbladder polyp	0 (0)	6 (3.55)	0.592	-	2 (4.65)	-
Gallstone pancreatitis	0 (0)	4 (2.37)	0.576	-	-	-
Underlying disease						
DM	4 (7.84)	39 (23.08)	0.016	4 (9.30)	4 (9.30)	> 0.999
HT	8 (15.69)	66 (39.05)	0.002	8 (18.60)	5 (11.63)	0.54
Ischemic heart disease	0 (0)	6 (3.55)	0.34	-	-	-
Operative time (min)	40.33 ± 17.24	49.63 ± 28.98	0.03	39.34 ± 17.70	45.93 ± 26.87	0.18
Conversion	0 (0)	9 (5.33)	0.12	0 (0)	3 (6.98)	0.24
EBL (mL)	8.11 ± 9.91	32.87 ± 104.30	0.09	8.48 ± 10.68	23.39 ± 65.01	0.14
Readmission	1 (1.96)	4 (2.37)	> 0.999	1 (2.33)	0 (0)	> 0.999
Complication	2 (3.92)	7 (4.14)	> 0.999	2 (4.65)	1 (2.33)	> 0.999
Wound infection	2 (3.92)	4 (2.37)	0.625	2 (4.65)	0 (0)	0.49
Bile duct injury	0 (0)	3 (1.78)	> 0.999	0 (0)	1 (2.33)	> 0.999

Values are presented as mean ± standard deviation or number (%).
PSM, propensity score matching; BMI, body mass index; ASA, American Society of Anesthesiologists; DM, diabetes mellitus; HT, hypertension; EBL, estimated blood loss.

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Table 2. Patient demographic data and operative outcomes (compared between the ambulatory group and a group of patients with ASA III)

	Ambulatory (n = 51)	ASA III (n = 28)	*p*-value
Age (yr)	43.66 ± 11.36	68.60 ± 14.70	< 0.001
Male	10 (19.61)	15 (53.50)	0.019
BMI (kg/m^2)	25.28 ± 3.60	25.61 ± 5.70	0.75
Diagnosis			
Symptomatic gallstone	43 (84.31)	10 (35.71)	< 0.001
Chronic cholecystitis	3 (5.88)	10 (3.57)	0.001
Bile duct stone after stone removal	5 (9.80)	6 (21.43)	0.18
Gallbladder polyp	0 (0)	1 (3.57)	0.35
Gallstone pancreatitis	0 (0)	1 (0.35)	0.35
Underlying disease			
DM	4 (7.84)	15 (53.57)	< 0.001
HT	8 (15.69)	25 (89.29)	< 0.001
Ischemic heart disease	0 (0)	5 (17.86)	0.004
Operative time (min)	40.33 ± 17.24	55.96 ± 26.45	0.002
Conversion	0 (0)	2 (7.14)	0.12
EBL (mL)	8.11 ± 9.91	47.82 ± 134.91	0.03
Readmission	1 (1.96)	1 (3.57)	> 0.999
Complication			
Wound infection	2 (3.92)	1 (3.57)	> 0.999
Bile duct injury	0 (0)	1 (3.57)	0.35

Values are presented as mean ± standard deviation or number (%).
ASA, American Society of Anesthesiologists; BMI, body mass index; DM, diabetes mellitus; HT, hypertension; EBL, estimated blood loss.

DISCUSSION

Since 1990, the safety and effectiveness of the concept of ambulatory LC in various healthcare settings has been highlighted. This approach facilitates shorter postoperative hospitalization, enabling patients to return to the daily life activities sooner. Additionally, it reduces waiting times for surgery, and optimizes the utilization of healthcare resources [15]. Despite its evident benefits, the adoption of this approach remains limited in Thailand, due to apprehensions among doctors, healthcare providers, patients, and their relatives. Our study aligns with global data that show high patient acceptance and low readmission rates. Key to this success is the appropriate selection of patients, as evidenced by our use of specific criteria, including ASA classification and postoperative care capabilities [16]. Despite initial concerns, our findings indicate that ambulatory LC results in low complication rates. Patient education about postoperative expectations and effective pain management strategies significantly contribute to patient satisfaction, underlining the importance of comprehensive patient care. To the best of our knowledge, we are the first to provide a comparative analysis of ambulatory LC versus inpatient LC in Southeast Asia. Our experience reflects broader trends in ambulatory LC, pointing toward its potential as a safe, efficient surgical option in diverse healthcare environments.

In the context of ambulatory LC, our study underscores the significance of meticulous patient selection to ensure safety and effectiveness. Previous studies reported several risk factors of ambulatory LC failure, such as age > 50 years, ASA III, longer operative time, previous abdominal surgery, or history of acute pancreatitis or cholecystitis. Our study also aligns with previous studies about the selection criteria, and meets the ODS criteria set by the Thai government. Adhering to criteria such as the ASA classification, and the patient's capacity for postoperative self-care, was pivotal to achieving low complication and readmission rates [13]. Additionally, our findings highlight the vital role of comprehensive preoperative education and efficient pain management in enhancing patient satisfaction and the acceptance of ambulatory LC.

In previous research, postoperative nausea has been identified as a significant factor affecting postoperative discharge and hospital stay [17]. However, in our study, we observed that all patients were able to be discharged within 4–6 hours after surgery, without experiencing postoperative nausea and vomiting (PONV). This was confirmed through follow-up phone calls the next day, indicating that our patients were in good condition. We implemented a protocol of administering ondansetron to all patients prior to extubation, along with using paracetamol or NSAIDs instead of opioids for pain management. Additionally, local injections of bupivacaine at port sites may have contributed to the positive outcomes observed in our study. Ondansetron is known for its effectiveness in reducing PONV, compared to a placebo [18]. While previous studies have suggested that combining dexamethasone with an antiemetic is more effective than using antiemetic alone for reducing PONV [19], we chose to administer ondansetron alone for antiemetic purposes in our study. Although there are conflicting findings in previous studies regarding the effectiveness of local anesthetic injections [20,21] and opioid-free anesthesia [22,23] in reducing PONV, our study did not directly compare these approaches. Therefore, further research is warranted to clarify these points, and provide more comprehensive insights.

All patients in the ambulatory group were discharged in the morning of the next day (length of stay < 24 hours after surgery) in our study, which aligns closely with the concept of ambulatory LC according to the Thai guideline for ODS. Interestingly, subgroup analysis revealed that even ASA III patients could safely undergo LC, provided they undergo thorough preoperative evaluation. This insight suggests the potential for expanding the selection criteria, thereby allowing a broader patient population to benefit from this minimally invasive surgical approach. Recent study found that ASA III patients could be considered for ambulatory LC with careful preoperative evaluation [24]. Integrating these insights with broader research can enhance patient outcomes, and extend the benefits of ambulatory LC to a wider patient population.

The exploration of broadening patient selection for ambulatory LC is gaining momentum in medical research. Recent study has started to challenge the conventional criteria, particularly the reliance on age and BMI as primary factors for patient eligibility [15]. These studies propose a more comprehensive selection process, where factors like the ASA classification are considered, alongside the overall health and specific conditions of the patients. This approach could potentially include ASA III patients and older individuals, who were previously deemed less suitable for ambulatory LC. This shift in criteria is aimed at making ambulatory LC more accessible to a wider range of patients, reflecting a more inclusive and patient-centered approach in surgical practice. In our study, the underlying diseases of ASA III patients were limited to poorly controlled DM, HT, and a history of myocardial infarction more than 3 months prior to surgery. While these conditions may not represent the full spectrum of ASA III patients, our findings suggest a potential for expanding ambulatory criteria to include this group of patients. However, further research is needed to evaluate the safety and feasibility of ambulatory LC in a broader range of ASA III patients. The goal is to extend the benefits of this minimally invasive procedure to a broader demographic, without compromising patient safety and outcomes.

Patient education plays a pivotal role in postoperative care, particularly in managing pain and nausea expectations [25]. Aligned with global practices, this comprehensive approach significantly enhances patient satisfaction and acceptance, which is crucial in scenarios where early discharge might cause apprehension. Moreover, ambulatory LC offers broader benefits, such as cost savings, increased hospital bed availability, and educational opportunities for medical students and residents, without compromising patient safety. In Thailand, where awareness of ambulatory LC might be limited, culturally tailored education is vital. Engaging relatives in the care process is essential, as they play a key role in medication management and recognizing complications. This approach alleviates patient and family anxiety, while also highlighting the practical advantages of ambulatory LC, fostering its acceptance as a preferred surgical option. This study emphasizes the importance of culturally sensitive patient education in improving ambulatory LC acceptance, and underscores its potential for safe and effective implementation in diverse healthcare settings, benefiting patients, healthcare providers, and the medical community [26].

The study's notable advantage lies in its contribution to expanding our understanding of the safety and efficacy of ambulatory LC, particularly in rural areas. By shedding light on the potential to broaden patient selection criteria, it offers valuable insights for future research. However, it is crucial to acknowledge certain limitations, including the relatively small sample size and single-center nature of the study, which may restrict the generalizability of the findings to broader healthcare settings. Moreover, the study's focus on short-term outcomes underscores the need for long-term follow-up investigations. Future research could further explore risk factors associated with complications or failure cases, including anesthetic and pain control techniques, to enhance our understanding of the efficacy and safety of ambulatory LC in diverse healthcare contexts.

In conclusion, this study on ambulatory LC in our center demonstrates its safety and effectiveness. The findings suggest that careful patient selection, comprehensive education, and adherence to safety protocols can lead to low complication rates and high patient satisfaction. This approach has the potential to expand patient criteria for ambulatory LC, making it a viable option for a broader demographic.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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