

Evaluation of the Clinical Outcomes in Laparoscopic Cholecystectomy as Ambulatory Surgery: Comparative Analysis in Two Periods 2019–2020 and 2021–2022

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Abstract

Objectives: To compare the results of ambulatory laparoscopic cholecystectomy and traditional laparoscopic cholecystectomy.

Methods: Data were collected patients aged 20-80 years who underwent elective laparoscopic cholecystectomy between January 2019 - December 2022. We divide in 2 group: Group A: 2019-2020, Traditional laparoscopic cholecystectomy and Group B: 2021-2022, Ambulatory laparoscopic cholecystectomy.

Results: Ambulatory laparoscopic cholecystectomy was successful in 96% of patients. The incidence of bile duct injuries was 1% less in group B patients with ambulatory surgery than 3.8% in group A patients

Keywords: Laparoscopic cholecystectomy, Ambulatory surgery, One day surgery, Bile duct injury.

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with traditional surgery, but there was no statistical difference. Cost of admission of patients in group B: ambulatory laparoscopic cholecystectomy was significantly lower than patients in group A: traditional laparoscopic cholecystectomy 14,742 bath (427 USD) and 21,222 bath (615 USD) respectively ($P < 0.001$).

Conclusion: Ambulatory laparoscopic cholecystectomy can effectively reduce the cost per admission and reduce the length of stay in hospital without any difference in major complication in selective case with experienced surgeons.

Introduction

Gallstones are common surgical diseases in the North of Thailand. There are found more in women than men. The common age range is from 30 to 50 years old, with many risk factors such as female gender, obesity, high blood lipid levels, thalassemia and over 40 years of age (1).

There are several levels of symptoms of gallbladder stone disease, categorized as asymptomatic gallstones, symptomatic gallstones, acute calculous cholecystitis, chronic calculous cholecystitis and empyema of the gallbladder (2).

In symptomatic gallbladder disease, patients often have symptoms such as chronic intermittent abdominal pain causing many patients to be misdiagnosed as abdominal pain from stomach disease (dyspepsia). In some cases, they may have referred pain to right scapula. As well, symptoms usually occur after eating a high-fat meal. On the physical examination, tenderness was found under the right ribcage. In some cases, if there is acute inflammation, there will be pain at the right upper quadrant called "Murphy's sign" positive.

Diagnosis can be using abdominal ultrasonography, which has high sensitivity and accuracy. We also use liver function test to confirm gallbladder stones and common bile duct stone.

The gold standard in the management of symptomatic cholelithiasis is the surgical removal of the gallbladder, better known as "cholecystectomy". Carl Langenbuch performed the first successful cholecystectomy at the Lazarus hospital in Berlin on July 15, 1882. Before this, surgical therapy for symptomatic gallstones was limited to cholecystostomy.

Erich Mühe performed the first laparoscopic cholecystectomy on September 12, 1985, in Böblingen, Germany⁴. Day surgery was born in Glasgow thanks to James Nicoll who described 9000 day case

procedures in 1909. He was prompted by the limited availability of beds and the need to reduce the rate of in-hospital infections (5). The term day-surgery as a synonym of ambulatory surgery and same-day surgery.

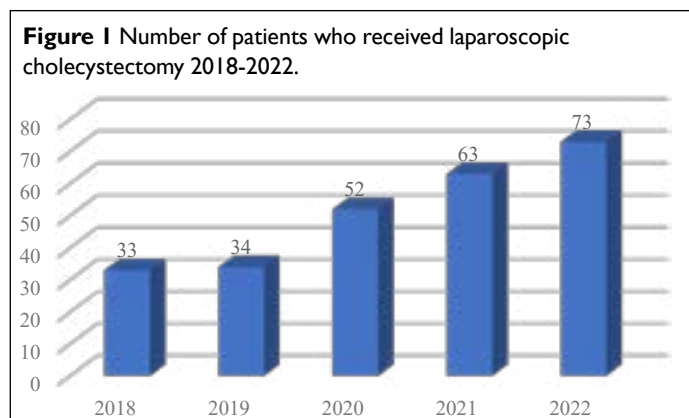
In the present laparoscopic cholecystectomy (LC) is 90% of cholecystectomy and LC is 2nd most common procedure in general surgery (Appendectomy is most common). However the rate complication such as vasculobiliary injury is higher than open cholecystectomy that why surgeon should be aware (6). In 2012 Atsushi Sato et al, evaluated the applicability and safety of ambulatory laparoscopic cholecystectomy and compared day case and overnight stay LC. There was no hospital mortality and no patient was readmitted with serious morbidity after discharge. Day case LC can be performed with a low rate of complications. In overnight stay patients, there are many who could be performed safely as a day case (7).

In Spain 2013, Docobo Durántez et al reported patient in group B 82.5% were day cases. Symptoms such as abdominal pain or nausea and/or vomiting were less frequent in group B. Satisfaction rates were high in both groups but higher in the group B (8).

In Italy 2021, Corona et al reported a total of 150 consecutive patients with ascertained cholelithiasis who underwent laparoscopic cholecystectomy. The results of the study suggest that laparoscopic cholecystectomy in day-surgery can be effectively and safely performed, achieving high rates of patient satisfaction, this might have a positive impact on reducing waiting times, patient turnover and health care costs (9).

Pua Crown Prince Hospital (PCPH) located in Nan Province, in the North of Thailand. It is a community hospital size 120 beds. Our hospital is a referral hospital for patients in the of Nan province covering 6 districts nearby the following Chaloe Phrakiat Hospital, Thung Chang Hospital, Chiang Klang Hospital, Bo Kluea Hospital,

Tha Wang Pha Hospital, and Song Kwae Hospital. Statistics show that there have been laparoscopic cholecystectomies performed since 2018-2022 as following 33 cases, 34 cases, 52 cases, 63 cases and 73 cases, respectively, totalling 255 cases (Figure 1).



Pua Crown Prince Hospital joins the service system for One-Day Surgery (ODS) and Minimally Invasive Surgery (MIS) according to the guidelines of the Department of Medical Services of Thailand in 2020. One-day laparoscopic cholecystectomy starting in 2021.

Therefore, the researcher wanted to study the results of laparoscopic cholecystectomy. In one-day surgery or ambulatory surgery in 2021-2022 compared with traditional laparoscopic cholecystectomy in 2019-2020. In Thailand still has limited research on this subject.

Ambulatory surgery laparoscopic cholecystectomy can be performed in a community hospital. And in line with the development of the health service system, one day surgery (ODS) and minimally invasive surgery (MIS) to be effective, no complications, reduce waiting time, reduce costs and service recipients are satisfied. We have a guideline for Ambulatory surgery laparoscopic cholecystectomy as shown in Figure 2.

Objectives

To compare the results of ambulatory laparoscopic cholecystectomy and traditional laparoscopic cholecystectomy.

Material and Methods

This research is a retrospective cohort study and prospective cohort study historical control

Population: Patients aged 20-80 years with a diagnosis of symptomatic gallstone disease, chronic calculous cholecystitis, and gallbladder polyp who underwent laparoscopic cholecystectomy between January 2019 - December 2022 in department of surgery,

Pua Crown Prince Hospital, Nan Province.

We divided the samples into 2 groups according to the period as show in Figure 3.

Group A: 2019-2020, Traditional laparoscopic cholecystectomy

It was a group of patients who had undergone laparoscopic cholecystectomy. That is, come to the hospital at least 1 day before the day of surgery. undergo surgery and go home 1-2 days after surgery if there are no complications.

Group B: 2021-2022, Ambulatory laparoscopic cholecystectomy

It is a group of patients who have undergone laparoscopic cholecystectomy as a one-day surgery or ambulatory surgery, that is, they come to the hospital in the morning. Same day as the day of surgery and go home no later than 24 hours after surgery.

Two-week and three-month follow-up of patients in both groups and data were collected if there was a repeat hospitalization during the first two weeks.

The criteria for selecting research participants consisted of:

Inclusion Criteria

- 1) Patients aged 20-80 years.
- 2) Diagnosis of symptomatic gallstones, chronic calculous cholecystitis, and gallbladder polyps.
- 3) Undergoing laparoscopic cholecystectomy during January 2019 - December 2022.

Exclusion Criteria

1. Patients with inflammation from bile duct stones (Cholangitis) and endoscopic retrograde cholangiopancreatography (ERCP) was performed.
2. Patients with acute cholecystitis who received transcutaneous bile duct insertion (Percutaneous Cholecystostomy).
3. American Society of Anesthesiologists Classification (ASA) score class ≥ 3 .
4. Body mass index (BMI) > 35 .
5. Patients who underwent open cholecystectomy from the beginning.
6. Laparoscopic cholecystectomy in combination with surgery for other diseases.
7. Unable to participate in ambulatory surgery (2021-2022).

Statistical Analysis

1. Demographic, clinical data and laboratory results will express in percentage, mean and standard deviation, median, frequency and range.
2. The comparison of qualitative data between groups use Chi-square test or

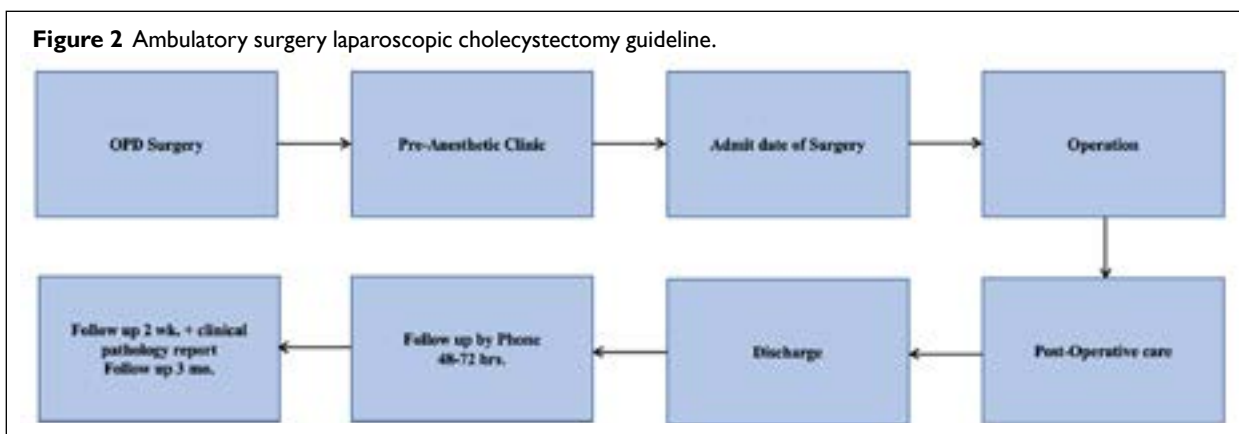
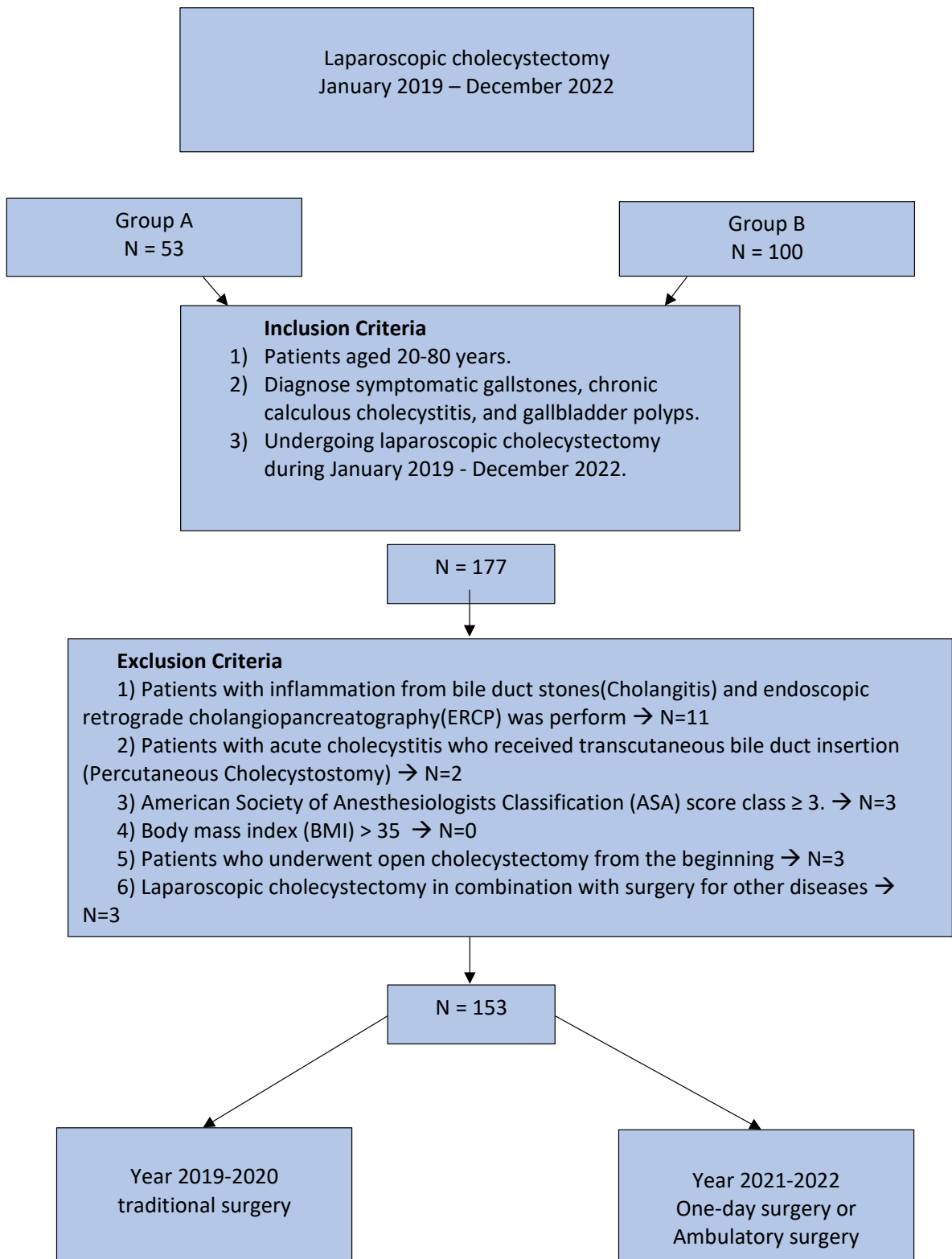


Figure 3.



3. Fisher's exact test.
4. The comparisons of quantitative data between 2 groups use Student's T-test or Wilcoxon rank sum test (Mann-Whitney's U test)
5. The comparisons of quantitative data between groups use ANOVA or Kruskal-Wallis tests.
6. Using the statistical significance at $p \leq 0.05$.
7. Propensity score matching
8. Data analysis using Stata program

Sample size

A method for calculating the sample size of this research using the reference formula. According to the research of Docobo Durántez (8), Day surgery laparoscopic cholecystectomy: comparative analysis in two consecutive periods in a cohort of 1132 patients, 2013. Sample size by calculate is 10,056 patients.

Primary outcome: Major complication

Secondary outcome: Cost of admission, ODS success rate in group B

Results

Patients and clinical characteristic

A total of 153 subjects were included in the study, 53 were group A, 100 were group B, 54 males and 99 females. The mean age in group A patients was 54 years and the mean age in patients Group B was 57 years. Group A included 30 and 23 patients with ASA class I and II, respectively and group B included 40 and 60 patients with ASA class I and II, respectively. There was no significant difference in comorbidities between the two groups. Mean total bilirubin in group A was 0.6 mg/dl and 0.5 mg/dl in group B. There was no statistical difference between the two groups including previous ERCP (Table 1).

Operative outcome

Symptomatic Gallstone was the most common in 47 (88.7%) and 71 (71%) patients in Groups A and B, respectively, and secondly, chronic calculous cholecystitis was found in 4 (7.5%) patients in Groups A and 28 (28%) were group B, respectively, and the third was Gallbladder polyp (Table 2).

Post operative diagnosis chronic calculous cholecystitis most common in group B patients and we found symptomatic gallstone and chronic calculous cholecystitis in the same ratio in group A. The two groups of patients were not statistically different. Estimate blood loss in both groups of patients was 10, there was no statistical difference, including drain placement.

Table 1 Baseline Characteristic.

	Group A N=53	Group B N=100	P-value
Sex, n (%)			
Male	12 (22.6%)	42 (42%)	0.017*
Female	41 (77.4%)	58 (58%)	0.017*
Age (yrs.), Mean \pm SD	54.77 \pm 14.76	57.19 \pm 12.14	0.279
20-40	9 (17%)	11 (11%)	0.296
40-60	26 (49.1%)	45 (45%)	0.632
60-80	18 (34%)	44 (44%)	0.229
BMI (kg/m²), Mean \pm SD	23.41 \pm 5.09	23.3 \pm 3.59	0.878
ASA, n (%)			
I	30 (56.6%)	40 (40%)	0.050
II	23 (43.4%)	60 (60%)	0.050
Underlining disease, n (%)			
None	30 (56.6%)	40 (40%)	0.050
HT	13 (24.5%)	39 (39%)	0.072
DM	6 (11.3%)	12 (12%)	0.901
DLP	5 (9.4%)	22 (22%)	0.052
COPD	2 (3.8%)	0 (0%)	0.051
Thalassemia others	2 (3.8%)	3 (3%)	0.798
Heart disease (AF, IHD)	1 (1.9%)	2 (2%)	0.962
Mean Total bilirubin(mg/dl), median (IQR)	0.6 (0.5, 0.71)	0.5 (0.4, 0.7)	0.132
Mean Direct bilirubin(mg/dl), median (IQR)	0.1 (0.1, 0.1)	0.1 (0.1, 0.2)	0.270
Previous ERCP, n (%)	2 (3.8%)	10 (10%)	0.173

Independent t test and Mann-Whitney U or Chi-square test.

Table 2 Operative information.

	Group A n=53	Group B n=100	P-value
Pre-operative diagnosis, n (%)			
Symptomatic Gallstone	47 (88.7%)	71 (71%)	0.013*
Chronic calculous cholecystitis	4 (7.5%)	28 (28%)	0.003*
Gallbladder polyp	2 (3.8%)	1 (1%)	0.239
Post operative diagnosis, n (%)			
Symptomatic Gallstone	25 (47.2%)	34 (34%)	0.111
Acute op top Chronic cholecystitis	0 (0%)	1 (1%)	0.465
Subacute calculous cholecystitis	0 (0%)	2 (2%)	0.300
Chronic calculous cholecystitis	25 (47.2%)	61 (61%)	0.101
Gallbladder polyp	2 (3.8%)	2 (2%)	0.513
Empyema gallbladder	1 (1.9%)	0 (0%)	0.168
Estimate blood loss (ml)			
Median (IQR)	10 (5, 20)	10 (5, 20)	0.335
Drain placement, n (%)			
	6 (11.3%)	8 (8%)	0.498
Number of port, n (%)			
3 port	51 (96.2%)	94 (94%)	0.556
4 port	2 (3.8%)	6 (6%)	0.556
Average Operative time (min), median (IQR)			
	60 (50, 80)	55 (43, 88)	0.234

Mann-Whitney U or Chi-square test.

In a laparoscopic cholecystectomy, a three-port operation is generally used in our center. If there is severe adhesion around the gallbladder or very swollen cholecystitis, difficult to grasp and resulting in difficult surgery, a fourth port may be added under the ribcage to help pull out the gallbladder better. In both groups, 96.2% and 94% of three-port laparoscopic cholecystectomy were performed. There was no statistical difference between the two groups.

Operative time in group B was shorter, 55 minutes and 60 minutes in group A, depending on the surgical experience of each surgeon, but there was no statistical difference.

Post operative and follow up outcomes

In group B patients, the length of hospital stay that did not exceed 24 hours was as high as 96%, with statistical significance. and length of hospital stay >24-48 hours and >48 hours in group A were 58.5% and 41.5%, respectively, with statistical significance (Table 3).

Table 3 Post Operative information.

	Group A n=53	Group B n=100	P-value
Discharge time (hours), n (%)			
< 24	0 (0%)	96 (96%)	<0.001*
>24-48	31 (58.5%)	2 (2%)	<0.001*
>48	22 (41.5%)	2 (2%)	<0.001*
Success rate of one day surgery, n (%)			
	-	96 (96%)	N/A
Cause of drop out one day surgery, n (%)			
Abdominal pain / Discomfort	-	1 (1%)	N/A
Hemoperitoneum	-	1 (1%)	N/A
Open conversion	2 (3.8%)	2 (2%)	0.513
Major complication, n (%)			
Bile duct injury	2 (3.8%)	1 (1%)	0.239
Vascular injury	0 (0%)	0 (0%)	N/A
Mortality rate, n%			
	0 (0%)	0 (0%)	N/A
Cost of admission(bath), median (IQR)			
	21,222 (17,312 - 25,860)	14,742 (13,730 - 16,385.5)	<0.001*

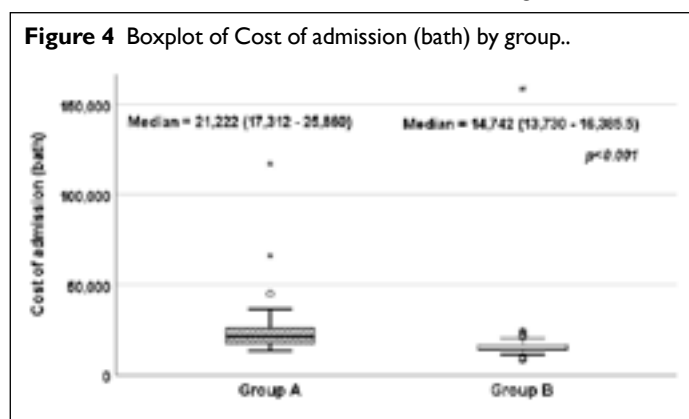
Mann-Whitney U or Chi-square test.

Ambulatory laparoscopic cholecystectomy was successful in 96% of patients in group B. There was 1 patient with abdominal discomfort and 1 Hemoperitoneum (due to the patient not being able to remove the drain), thus ambulatory surgery was unsuccessful.

The open conversion rate was 3.8% and 2% in group A and B patients, respectively, both groups were not statistically significant.

The incidence of major complication, Bile duct injury, was 3.8% and 1% in group A and B, respectively, with no statistical difference between the two groups. In patients with bile duct injury, endoscopic retrograde cholangiopancreatography was performed including Roux-en-y Hepaticojejunostomy to resolve complications that occur without finding the mortality rate at all.

Cost per hospital stay is the resource that the hospital must waste to treat each patient. It was found that group B had a lower average cost per hospital stay of 14,742 baht (427 USD) with statistical significance (P-value < 0.001*). Group A had an average higher cost per hospital stay, which was 21,222 baht (615 USD) as shown in Figure 4.



Pathological information and Surveillance outcomes

For pathological reports, chronic cholecystitis was the most common, 83% in group A and 86% in group B, respectively, and malignant of gallbladder was 1.9% in group A and 1% in group B. Both patients were referred. Go to a hospital with potential for treatment along with the next chemotherapy (Table 4).

At the 2-week follow-up, most of the patients were asymptomatic. Abdominal discomfort was 2% in group B and 3.8% in group A, respectively, which was not statistically significant. At the 3-month follow-up, most patients were asymptomatic too. For symptomatic patients receive symptomatic treatment in conjunction with dietary recommendations. From the data collection, there was no recurrence of hospitalization during the first 2 weeks of surgery in both groups. considered a satisfactory result.

Discussion

Pua Crown Prince hospital is a 120-bed community hospital in Nan province, in the north of Thailand. We have started laparoscopic cholecystectomy since 2018. Statistics show that laparoscopic cholecystectomy increasing every year (Figure 1).

In the past our hospital perform laparoscopic cholecystectomy was a traditional surgery, resulting in a long hospital stay. Including the Covid-19 disease situation that has become more severe. This gave rise to the idea of performing ambulatory laparoscopic cholecystectomy in our hospital in 2021. Although by the principle of one day surgery or ambulatory surgery especially abroad, patients are usually discharge in the evening after surgery. But our patients are in remote areas. There

Table 4 Pathological information and Surveillance.

	Group A n=53	Group B n=100	P-value
Pathological report, n (%)			
Acute on top chronic cholecystitis	5 (9.4%)	10 (10%)	0.911
Cholesterolosis (strawberry gallbladder)	3 (5.7%)	1 (1%)	0.086
Chronic cholecystitis	44 (83%)	86 (86%)	0.624
Empyema gallbladder	0 (0%)	1 (1%)	0.465
Intracholecystic papillary neoplasm (ICPN)	0 (0%)	1 (1%)	0.465
Malignant of gallbladder	1 (1.9%)	1 (1%)	0.646
Re admission in 2 weeks, n (%)	0 (0%)	0 (0%)	N/A
Cost of Re-admission in 2 weeks(bath), median (IQR)	-	-	-
Cause of re-admission, n (%)			
Biliary leakage	-	-	-
Hemoperitoneum	-	-	-
Clinical After 2 weeks, n (%)			
Asymptomatic	51 (96.2%)	95 (95%)	0.730
Abdominal discomfort	2 (3.8%)	2 (2%)	0.513
Abdominal Ecchymosis	0 (0%)	1 (1%)	0.465
Diarrhea	0 (0%)	1 (1%)	0.465
Subhepatic collection	0 (0%)	0 (0%)	N/A
Surgical site infection	0 (0%)	1 (1%)	0.465
Clinical After 3 mo., n (%)			
Asymptomatic	49 (92.5%)	97 (97%)	0.200
Abdominal discomfort	4 (7.5%)	3 (3%)	0.200

Chi-square test.

are difficult to transport and of low socioeconomic status. We adapted it to the hospital context using the admission at date of surgery and stay overnight principle that means the patient was hospitalized the morning of the day of surgery and discharge the patient on post operative day 1, no later than 24 hours from the time of surgery. Thus dividing the research participants into two groups as mentioned above.

Laparoscopic cholecystectomy performed by an experienced general surgeon and understand vasculobiliary variation of hepatobiliary tract 11. When inserting the camera port, we will identify surgical landmarks anatomy such as Rouviere's sulcus or R4U line that runs from Rouviere's sulcus to segment 4b to umbilical fissure (Figure 5).

Figure 5 R4U line from Rouviere's sulcus - segment 4b - umbilical fissure.

Once the camera is inserted into the abdomen, the difficulty of surgery can be assessed by looking at the inflammation of the gallbladder. We usually perform a three-port laparoscopic cholecystectomy, but in severe cholecystitis, a four-port laparoscopic cholecystectomy is added. We perform laparoscopic cholecystectomy by use the way of Critical View of Safety (CVS) proposed by Steven Strasberg 1995 12 (Figure 6) and know way to bail out procedures such as open conversion and subtotal cholecystectomy (Figure 7).

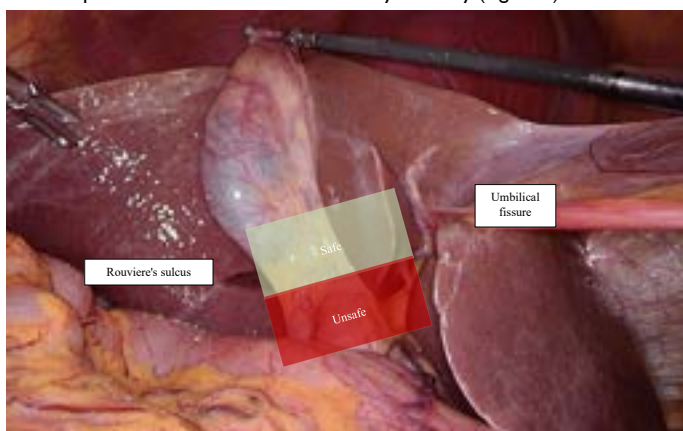


Figure 6 Laparoscopic cholecystectomy according to the guidelines Critical view of safety (CVS).

Based on the research data, it was found that baseline characteristic most of the data on the two groups of patients were not statistically different except for gender, where female patients were more predominantly.

In terms of operational outcome, it was found that in the group of Chronic calculous cholecystitis More in group B, indicating conservative treatment in patients with acute calculous cholecystitis for subsequent elective laparoscopic cholecystectomy. We found no statistical differences in estimate blood loss, drain placement, number of port, and average operative time. Patient in group B had a shorter average operative time, which may indicate increased surgeon experience.

In post operative outcome, we found that in group B the success rate of one day surgery was 96%. From the research of Docobo Durántez



Figure 7 Laparoscopic subtotal cholecystectomy via Endo loop in subacute calculous cholecystitis.

et al, 82.5% were day cases in laparoscopic cholecystectomy (8). In our study, cause of drop out one day surgery was abdominal discomfort 1% and hemoperitoneum 1%. Both patients received supportive treatment and able to go home in less than 48 hours.

Major complication is the subject that we pay the most attention to as a primary outcome. According to the statistics of Health District 1, the upper northern region of 8 provinces, the incidence of bile duct injury was 1.1%. The incidence of bile duct injuries was 1% less in group B patients with ambulatory surgery than 3.8% in group A patients with traditional surgery, but there was no statistical difference. The ambulatory surgery group in this study also incurred fewer bile duct injuries than most northern populations. Incidence of major complications after LC in large series are between 1-5% (13). However, this research is a single center experience with a small sample size, data collection is required or do research as a multicenter in the future.

Cost of admission is the secondary outcome that we pay attention. Because Thailand is a developing country. We have a limited public health budget to provide effective public health services. According to this study, the cost of admission of patients in group B: ambulatory laparoscopic cholecystectomy was significantly lower than patients in group A: traditional laparoscopic cholecystectomy 14,742 bath (427 USD) and 21,222 bath (615 USD) respectively ($p < 0.001$). Because it helps to reduce the length of stay in the hospital, reduce costs, reduce medical treatment, reduce hospital crowding and the empty beds can be open to patients with other diseases. We did not find any patients Re admission in 2 weeks. At postoperative follow-up, >95% of patients in Group B were asymptomatic and there was no difference between the two groups.

However, even today we do overnight stay surgery, but in the near future we have a plan to adjust to true day case.

Conclusion

Ambulatory laparoscopic cholecystectomy can effectively reduce the cost per admission and reduce the length of stay in hospital without any difference in major complication. Selection of patients appropriately and considering patient safety as the primary consideration including surgery by experienced surgeons to help prevent complications that can occur.

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References

1. Alsaleh FM, Smith FJ, Keady S, Taylor KMG. (2010), Insulin pumps: from Panpimanmas S, Manmee C. Risk factors for gallstone disease in a Thai population. *Journal of Epidemiology* 2009;19(3):116–21.
2. Kanchanalarp S. Biliary tract stones. *R Thai Army Medical Journal* 2011;64: 39–45.
3. Jarnagin WR, Belghiti J, Blumgart LH (2012). *Blumgart's surgery of the liver, biliary tract, and pancreas* (5th ed.). Philadelphia: Elsevier Saunders. p. 6. ISBN 978-1-4557-4606-4.
4. Reynolds, Walker Jr. "The First Laparoscopic Cholecystectomy". *Journal of the Society of Laparoendoscopic Surgeons*. 2001;5(1):89–94.
5. Willetts IE. James H Nicoll: pioneer paediatric surgeon. *Annals of the Royal College of the Surgeons of England* 1997;79:164–7.
6. Pucher PH, Brunt LM, Davies N, et al. Outcome trends and safety measures after 30 years of laparoscopic cholecystectomy: a systematic review and pooled data analysis. *Surgical Endoscopy* 2018;32:2175–83.
7. Atsushi Sato, Yukio Terashita, Yoichiro Mori et al. Ambulatory laparoscopic cholecystectomy: An audit of day case vs overnight surgery at a community hospital in Japan. *World Journal of Gastrointestinal Surgery* 2012;4(12):296–300
8. Docobo Durántez F, Arance García M, Navas Cuéllar A, et al. Day surgery laparoscopic cholecystectomy: comparative analysis in two consecutive periods in a cohort of 1132 patients. *Ambulatory Surgery* 2013;19.4:121–6.
9. Corona PF, Garcia S, Estrada R, et al. Day Surgery Laparoscopic Cholecystectomy: Evaluation of the Clinical Outcomes and Patient Satisfaction in a Guatemalan Day Surgery Centre. *Ambulatory Surgery* 2021;27.1:11–4.
10. Keuleman Y, Eshuis J, de Haes H, de Wit LT, Gouma D. Laparoscopic cholecystectomy: day-care versus clinical observation. *Annals of Surgery* 1998; 228(6):734–40.
11. Leslie H. Blumgart, Lawrence H. Schwartz, and Ronald P. DeMatteo. Blumgarts *Surgery of the Liver, Biliary Tract and Pancreas: Surgery of the liver and biliary tract*, ed 6, Philadelphia Elsevier Saunders. 2017, p. 43–48.
12. Strasberg SM, et al: An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *Journal of the American College of Surgeons* 1995;180:101–25.
13. Soper NJ, Dunnegan DL: Laparoscopic cholecystectomy: experience of a single surgeon. *World Journal of Surgery* 1993;17:16–20.