RESEARCH PAPER

Comparative Study of Routine Subhepatic Drain versus No Drain in Elective Laparoscopic Cholecystectomy: A Retrospective Analysis

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ABSTRACT

Background: The routine use of subhepatic drains following laparoscopic cholecystectomy remains a topic of debate among surgeons. While traditionally employed to detect bile leaks and prevent fluid collections, recent evidence questions this practice in uncomplicated cases.

Objective: To compare postoperative outcomes between routine subhepatic drain placement versus no drain in patients undergoing elective laparoscopic cholecystectomy for uncomplicated cholelithiasis.

Methods: This retrospective comparative study was conducted at a tertiary care teaching hospital over a three-month period. Patients undergoing elective laparoscopic cholecystectomy for uncomplicated cholelithiasis were divided into two groups: Group A (drain group, n=45) and Group B (no-drain group, n=45). Outcome measures included postoperative pain assessed using Visual Analogue Scale, complications, duration of hospital stay, and time to return to normal activity.

Results: The no-drain group demonstrated significantly lower mean VAS pain scores at 24 hours (3.2±1.1 vs 4.8±1.3, $p<0.001$). Hospital stay was shorter in the no-drain group (1.4±0.5 vs 2.1±0.7 days, $p<0.001$). Complication rates were comparable between groups. Return to normal activity was earlier in the no-drain group (5.2±1.8 vs 7.4±2.1 days, $p<0.001$).

Conclusion: Routine subhepatic drain placement in elective laparoscopic cholecystectomy for uncomplicated cholelithiasis offers no significant benefit and is associated with increased postoperative pain and prolonged hospital stay. Selective drain use based on intraoperative findings is recommended.

Keywords: Laparoscopic cholecystectomy, subhepatic drain, cholelithiasis, postoperative pain, complications

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Introduction

Gallstone disease represents one of the most prevalent gastrointestinal disorders worldwide, affecting approximately 6% of the global population with significant regional variations [1]. Recent epidemiological data indicate that prevalence rates are higher in females compared to males (7.6% vs 5.4%) and demonstrate geographic heterogeneity, with South America showing the highest rates at 11.2% compared to Asia at 5.1% [2]. The condition poses substantial health and economic burden, with over 800,000 cholecystectomies performed annually in the United States alone, representing an expenditure of approximately 6.5 billion dollars [3].

Laparoscopic cholecystectomy has emerged as the gold standard surgical treatment for symptomatic gallstone disease since its introduction in the late 1980s [4]. This minimally invasive approach has largely supplanted open cholecystectomy due to its numerous advantages, including reduced postoperative pain, shorter hospital stays, faster recovery, improved cosmetic outcomes, and enhanced patient satisfaction [5,6]. The procedure offers smaller incisions and significantly less postoperative discomfort compared to the open approach, with lower rates of wound infection and postoperative adhesions [7].

Despite the widespread adoption of laparoscopic cholecystectomy, the practice of routine abdominal drainage following the procedure remains controversial [8]. Historically, surgeons have employed subhepatic drains prophylactically to detect early bile leaks, prevent intra-abdominal fluid collections, and monitor for postoperative bleeding [9]. This practice was carried over from the era of open cholecystectomy without substantial evidence supporting its benefit in the laparoscopic setting [10].

The rationale for drain placement centers on the concern for bile leakage, which may arise from the cystic duct stump, accessory bile ducts (ducts of Luschka), or inadvertent injury to the common bile duct [11]. Bile leak following laparoscopic cholecystectomy occurs in approximately 1.2-4.0% of cases, potentially leading to biloma formation, subphrenic abscess, or generalized peritonitis if unrecognized [12]. Proponents of routine drainage argue that early detection of such complications through drain output monitoring allows for timely intervention and prevents more serious sequelae [13].

However, accumulating evidence challenges the traditional practice of routine drainage. Several randomized controlled trials and meta-analyses have demonstrated that prophylactic drain placement does not reduce the incidence of postoperative complications and may paradoxically increase morbidity [14,15]. Studies have shown that drains are associated with increased postoperative pain, longer hospital stays, higher wound infection rates, and no significant benefit in preventing or detecting bile collections [16]. Furthermore, drains may provide a false sense of security, as they can become blocked or dislodged, failing to detect complications even when present [17].

Despite this evidence, surgical practice varies considerably worldwide. Surveys indicate that surgeons remain divided on this issue, with practices ranging from routine drain use in all cases to complete avoidance of drains [18]. This heterogeneity in practice reflects the ongoing debate and the need for institution-specific data to guide clinical decision-making.

The present study was undertaken to compare the postoperative outcomes of routine subhepatic drain placement versus no drain in patients undergoing elective laparoscopic cholecystectomy for uncomplicated cholelithiasis at our institution. We aimed to evaluate the impact of drain use on postoperative pain, complications, duration of hospital stay, and overall recovery, thereby providing evidence to guide surgical practice in our setting.

Materials and Methods

Study Design and Setting

This retrospective comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital over a three-month period. The study protocol was approved by the Institutional Ethics Committee, and patient confidentiality was maintained throughout the study. Due to the retrospective nature of the study, informed consent was waived.

Study Population

All patients who underwent elective laparoscopic cholecystectomy for gallstone disease during the study period were screened for inclusion. The diagnosis of cholelithiasis was confirmed by ultrasonography in all cases [19].

Inclusion Criteria:

1. Patients aged 18 years and above
2. Diagnosis of uncomplicated symptomatic cholelithiasis
3. Patients undergoing elective laparoscopic cholecystectomy

Exclusion Criteria:

1. Acute cholecystitis (clinical or radiological evidence of acute inflammation)
2. Empyema or gangrenous gallbladder
3. Perforated gallbladder
4. Conversion to open cholecystectomy
5. Associated biliary pathology (choledocholithiasis, biliary pancreatitis)
6. Hepatic pathology or coagulopathy
7. Incomplete medical records

Grouping

Based on the operative notes, patients were categorized into two groups: Group A (Drain group) comprising patients in whom a subhepatic drain was placed at the end of surgery, and Group B (No-drain group) comprising patients in whom no drain was placed. The decision to place a drain was based on the operating surgeon's preference and intraoperative findings.

Surgical Technique

All procedures were performed under general anesthesia using the standard four-port technique [20]. A pneumoperitoneum was created using the closed technique with a Veress needle inserted at the umbilicus, maintaining intra-abdominal pressure at 12-14 mmHg. The standard port placement included a 10-mm umbilical port for the camera, a 10-mm epigastric port for

dissection, and two 5-mm ports in the right hypochondrium and right flank for retraction.

The critical view of safety was achieved in all cases before clipping and dividing the cystic artery and cystic duct [21]. Hemostasis was ensured, and the gallbladder was retrieved through the epigastric port using a specimen retrieval bag. In Group A, a 16-French closed suction drain was placed in the subhepatic space through the lateral 5-mm port site and secured to the skin. The drain was typically removed when the output was less than 50 mL per 24 hours and appeared serous.

Outcome Measures

The primary outcome measure was postoperative pain assessed using the Visual Analogue Scale (VAS), a validated 100-mm linear scale where 0 represents "no pain" and 100 represents "worst imaginable pain" [22,23]. Pain scores were recorded at 6 hours, 24 hours, and 48 hours postoperatively. For analysis, VAS scores were converted to a 0-10 scale.

Secondary outcome measures included:

1. Incidence of postoperative complications (bile leak, intra-abdominal collection, wound infection, bleeding)
2. Duration of hospital stay (calculated from the day of surgery to discharge)
3. Time to return to normal activity (assessed during follow-up at 2 weeks)
4. Analgesic requirements

Statistical Analysis

Data were collected and entered into Microsoft Excel spreadsheet and analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean ± standard deviation, and categorical variables were expressed as frequencies and percentages. Comparison of continuous variables between groups was performed using independent samples t-test, while categorical variables were compared using Chi-square test or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant [24].

Results

Patient Demographics and Baseline Characteristics

A total of 98 patients underwent elective laparoscopic cholecystectomy during the study period. After applying the exclusion criteria, 90 patients were included in the final analysis, with 45 patients in each group. The demographic and baseline characteristics of the study population are presented in Table 1.

Table 1: Demographic and Baseline Characteristics

Parameter	Group A (n=45)	Group B (n=45)	p-value
Age (years), mean±SD	42.3±12.4	44.1±11.8	0.48
Sex (Male:Female)	12:33	14:31	0.64
BMI (kg/m²), mean±SD	26.8±4.2	27.1±3.9	0.72
ASA Grade I/II, n (%)	38/7 (84.4/15.6)	40/5 (88.9/11.1)	0.54
Duration of symptoms (months)	8.2±4.6	7.8±5.1	0.69
Operative time (minutes)	52.4±14.8	46.2±12.3	0.03*

**Statistically significant (p<0.05); SD: Standard Deviation; BMI: Body Mass Index; ASA: American Society of Anesthesiologists*

The two groups were comparable in terms of age, sex distribution, body mass index, ASA grade, and duration of symptoms (p>0.05). The operative time was significantly longer in Group A (52.4±14.8 minutes) compared to Group B (46.2±12.3 minutes, p=0.03), which can be attributed to the additional time required for drain placement.

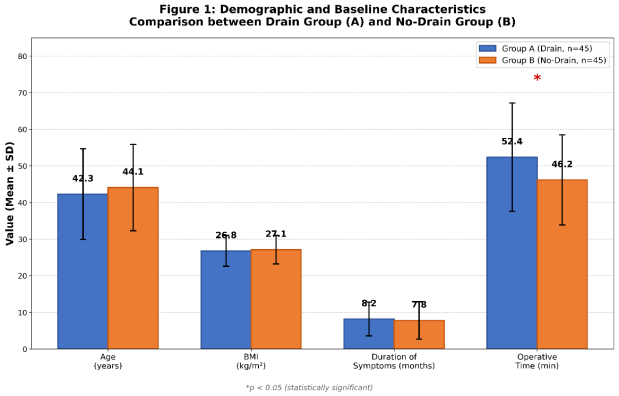

Fig 1: Bar chart comparing demographic parameters between groups

Postoperative Pain Assessment

Postoperative pain scores assessed using VAS at different time points are presented in Table 2. The no-drain group demonstrated significantly lower pain scores at all time points compared to the drain group.

Table 2: Postoperative Pain Scores (VAS 0-10 scale)

Time Point	Group A (mean±SD)	Group B (mean±SD)	p-value
6 hours postoperative	5.6±1.4	4.2±1.2	<0.001*
24 hours postoperative	4.8±1.3	3.2±1.1	<0.001*
48 hours postoperative	3.4±1.1	2.1±0.9	<0.001*

**Statistically significant (p<0.05); VAS: Visual Analogue Scale; SD: Standard Deviation*

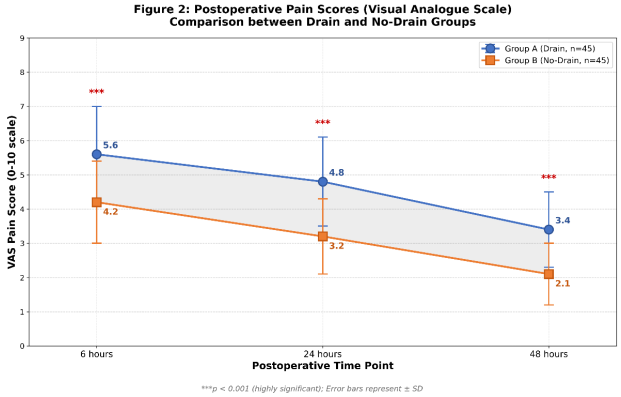

Fig 2: Line graph showing VAS scores at different time points for both groups

Postoperative Complications

The incidence of postoperative complications is summarized in Table 3. The overall complication rate was 11.1% (5/45) in Group A and 6.7% (3/45) in Group B, with no statistically significant difference between the groups (p=0.46).

Table 3: Postoperative Complications

Complication	Group A n (%)	Group B n (%)	p-value
Bile leak	1 (2.2)	0 (0)	1.00
Subhepatic collection	1 (2.2)	1 (2.2)	1.00
Wound infection	2 (4.4)	1 (2.2)	0.56
Postoperative bleeding	1 (2.2)	1 (2.2)	1.00
Nausea/Vomiting	8 (17.8)	6 (13.3)	0.56
Total major complications	5 (11.1)	3 (6.7)	0.46

Fisher's exact test applied; No statistically significant differences observed

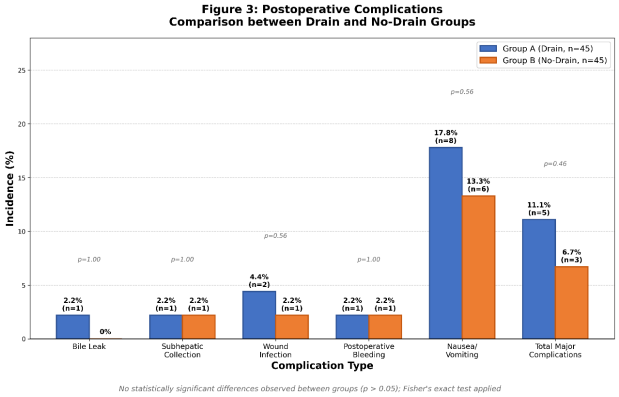

Fig 3: Clustered bar chart comparing complication rates between groups

Hospital Stay and Recovery

The duration of hospital stay and recovery parameters are presented in Table 4. The no-drain group had significantly shorter hospital stay and earlier return to normal activities compared to the drain group.

Table 4: Hospital Stay and Recovery Outcomes

Parameter	Group A (mean±SD)	Group B (mean±SD)	p-value
Hospital stay (days)	2.1±0.7	1.4±0.5	<0.001*
Return to normal activity (days)	7.4±2.1	5.2±1.8	<0.001*
Analgesic doses required (n)	4.8±1.6	3.2±1.2	<0.001*
Time to oral intake (hours)	18.2±4.8	14.6±3.9	<0.001*

**Statistically significant (p<0.05); SD: Standard Deviation*

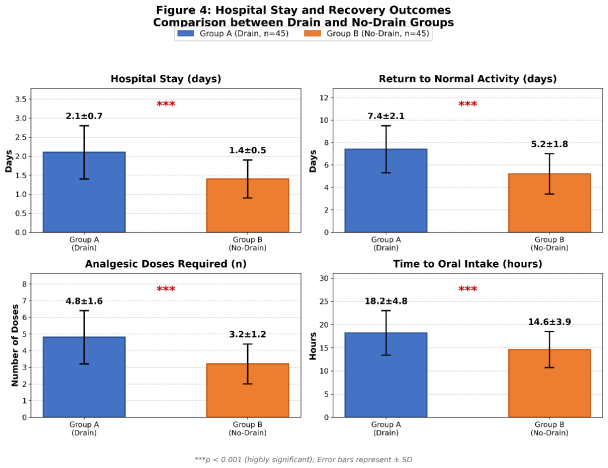

Fig 4: Comparative bar chart showing hospital stay and recovery parameters

Discussion

The present study demonstrates that routine subhepatic drain placement following elective laparoscopic cholecystectomy for uncomplicated cholelithiasis is associated with increased postoperative pain, prolonged hospital stay, and delayed return to normal activity without offering any significant benefit in terms of reducing postoperative complications. These findings align with the growing body of evidence questioning the traditional practice of prophylactic drainage.

The significantly higher postoperative pain scores observed in the drain group (VAS 4.8±1.3 vs 3.2±1.1 at 24 hours) are consistent with findings from multiple randomized controlled trials. Picchio et al. in their meta-analysis of 12 trials involving 1939 patients reported that abdominal pain 24 hours after surgery was significantly more severe in the drain group compared to the no-drain group (standardized mean difference 2.30; 95% CI 1.27-3.34; p<0.0001) [14]. The mechanism of drain-associated pain is multifactorial and includes irritation of the peritoneum and diaphragm by the drain tube, localized inflammatory response at the drain site, and restriction of patient mobility due to drain management [25].

The finding of increased wound infection rate in the drain group, although not statistically significant in our study (4.4% vs 2.2%), reflects the potential for drains to act as a conduit for bacterial contamination. The meta-analysis by Picchio et al. demonstrated a significantly higher wound infection rate in the drain group (OR 2.35; 95% CI 1.22-4.51; p=0.01) [14]. This finding supports the hypothesis that drains may introduce infection rather than prevent it.

Our study showed comparable rates of bile leak and subhepatic collections between the two groups, suggesting that prophylactic drains do not effectively prevent these complications. This observation is supported by the work of Ahmad et al., who noted that drain placement following laparoscopic cholecystectomy did not prevent the development of biliary peritonitis in a minority of patients, presumably because drains may become blocked or be removed prematurely [26]. Furthermore, as highlighted by the World Society of Emergency Surgery guidelines, the absence of bile in a drain does not exclude a bile leak, and conversely, the presence of a drain does not guarantee detection of all complications [27].

The significantly shorter hospital stay observed in the no-drain group (1.4±0.5 vs 2.1±0.7 days) has important implications for healthcare resource utilization and patient satisfaction. Tzovaras et al. in their randomized controlled trial of 565 patients similarly concluded that the routine use of drains in elective laparoscopic cholecystectomy has nothing to offer and is associated with increased pain, while having no impact on the detection or prevention of complications [18]. The systematic review by Gurusamy et al. in the Cochrane database further supports the conclusion that routine drainage offers no benefit in uncomplicated laparoscopic cholecystectomy [10].

Several physiological considerations explain why routine drainage may be unnecessary in uncomplicated cases. Post-cholecystectomy collections in the subhepatic recess are generally small, rapidly reabsorbed, and essentially similar in volume whether a drain is used or not [28]. Studies using postoperative ultrasonography have demonstrated that minor fluid collections occur frequently following laparoscopic cholecystectomy but are clinically insignificant and resolve spontaneously [29]. The peritoneum has a remarkable capacity for absorption, and small collections of serous fluid or blood are typically reabsorbed without sequelae.

It is important to acknowledge the limitations of this study. The retrospective design introduces potential selection bias, as the decision to place a drain was based on surgeon preference and intraoperative findings. Patients with more difficult dissections or intraoperative concerns may have been more likely to receive drains, potentially confounding the results. The relatively small sample size limits the power to detect differences in rare complications such as bile leak. Additionally, the single-

center nature of the study may limit generalizability to other settings.

Despite these limitations, our findings are consistent with the preponderance of evidence suggesting that routine prophylactic drainage is not beneficial in elective laparoscopic cholecystectomy for uncomplicated gallstone disease. However, it is crucial to recognize that selective drain placement may still be warranted in specific circumstances, including difficult dissections, intraoperative bile spillage, inadequate hemostasis, or concern for bile duct injury [30]. In such cases, the drain serves a therapeutic rather than prophylactic purpose.

The implications of these findings for surgical practice are significant. Moving away from routine drainage can reduce operative time, decrease postoperative pain and analgesic requirements, shorten hospital stay, and potentially reduce costs. However, this practice change requires careful patient selection and should be accompanied by vigilant postoperative monitoring to detect early signs of complications.

Conclusion

This study provides evidence that routine subhepatic drain placement following elective laparoscopic cholecystectomy for uncomplicated cholelithiasis offers no significant benefit in preventing postoperative complications. On the contrary, drain placement is associated with increased postoperative pain, prolonged hospital stay, delayed return to normal activity, and higher analgesic requirements. The complication rates were comparable between the drain and no-drain groups, suggesting that prophylactic drainage does not effectively prevent or detect bile leak or fluid collections. Based on these findings, we recommend abandoning the practice of routine prophylactic drainage in elective laparoscopic cholecystectomy for uncomplicated gallstone disease. Drain placement should be reserved for selective cases where there are specific intraoperative concerns such as difficult dissection, bile spillage, inadequate hemostasis, or suspected bile duct injury. This selective approach optimizes patient outcomes while maintaining safety through appropriate clinical judgment.

Future prospective randomized controlled trials with larger sample sizes and long-term follow-up are recommended to further validate these findings and identify specific patient subgroups that may benefit from selective drain placement.

References

1. Lammert F, Gurusamy K, Ko CW, et al. Gallstones. Nat Rev Dis Primers. 2016;2:16024.

2. Wang X, Yu W, Jiang G, et al. Global Epidemiology of Gallstones in the 21st Century: A Systematic Review and Meta-Analysis. Clin Gastroenterol Hepatol. 2024;22(8):1586-1595.

3. Stinton LM, Shaffer EA. Epidemiology of gallbladder disease: cholelithiasis and cancer. Gut Liver. 2012;6(2):172-187.

4. Litwin DE, Cahan MA. Laparoscopic cholecystectomy. Surg Clin North Am. 2008;88(6):1295-1313.

5. Coccolini F, Catena F, Pisano M, et al. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. Int J Surg. 2015;18:196-204.

6. Ahmad F, Sevik H, Dagher I. Evolution of minimally invasive cholecystectomy: a narrative review. BMC Surg. 2024;24:412.

7. Reynolds W Jr. The first laparoscopic cholecystectomy. JSLS. 2001;5(1):89-94.

8. Antoniou S, Koch O, Antoniou G, et al. Routine versus no drain placement after elective laparoscopic cholecystectomy: meta-analysis of randomized controlled trials. Minerva Chir. 2014;69(3):185-194.

9. Kim EY, Lee SH, Lee JS, et al. Is routine drain insertion after laparoscopic cholecystectomy for acute cholecystitis beneficial? A multicenter, prospective randomized controlled trial. J Hepatobiliary Pancreat Sci. 2015;22(8):551-557.

10. Gurusamy KS, Koti R, Davidson BR. Routine abdominal drainage versus no abdominal drainage for uncomplicated laparoscopic cholecystectomy. Cochrane Database Syst Rev. 2013;(9):CD006004.

11. Spanos CP, Syrakos T. Bile leaks from the duct of Luschka (subvesical duct): a review. Langenbecks Arch Surg. 2006;391(5):441-447.

12. Kum CK, Eypasch E, Lefering R, et al. Laparoscopic cholecystectomy for acute cholecystitis: is it really safe? World J Surg. 1996;20(1):43-48.

13. Georgiou C, Demetriou N, Pallaris T, et al. Is the routine use of drainage after elective laparoscopic cholecystectomy justified? A randomized trial. J Laparoendosc Adv Surg Tech A. 2011;21(2):119-123.

14. Picchio M, Lucarelli P, Di Filippo A, et al. Meta-analysis of drainage versus no drainage after laparoscopic cholecystectomy. JSLS. 2014;18(4):e2014.00242.

15. Wong CS, Cousins G, Duddy JC, Walsh SR. Abdominal drainage for laparoscopic cholecystectomy: a systematic review and meta-analysis. Int J Surg. 2016;35:101-108.
16. Picchio M, De Angelis F, Zazza S, et al. Drain after elective laparoscopic cholecystectomy. A randomized multicentre controlled trial. Surg Endosc. 2012;26(10):2817-2822.
17. Ahmad F, Saunders R, Lloyd G, et al. An algorithm for the management of bile leak following laparoscopic cholecystectomy. Ann R Coll Surg Engl. 2007;89(1):51-56.
18. Tzovaras G, Liakou P, Fafoulakis F, et al. Is there a role for drain use in elective laparoscopic cholecystectomy? A controlled randomized trial. Am J Surg. 2009;197(6):759-763.
19. Shea JA, Berlin JA, Escarce JJ, et al. Revised estimates of diagnostic test sensitivity and specificity in suspected biliary tract disease. Arch Intern Med. 1994;154(22):2573-2581.
20. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll Surg. 1995;180(1):101-125.
21. Strasberg SM. Avoidance of biliary injury during laparoscopic cholecystectomy. J Hepatobiliary Pancreat Surg. 2002;9(5):543-547.
22. Jensen MP, Chen C, Brugger AM. Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. J Pain. 2003;4(7):407-414.
23. Myles PS, Myles DB, Galagher W, et al. Measuring acute postoperative pain using the visual analog scale: the minimal clinically important difference and patient acceptable symptom state. Br J Anaesth. 2017;118(3):424-429.
24. Altman DG. Practical statistics for medical research. London: Chapman and Hall; 1991.
25. Lucarelli P, Picchio M, Martellucci J, et al. Drain after laparoscopic cholecystectomy for acute calculous cholecystitis. A pilot randomized study. Indian J Surg. 2015;77(Suppl 2):288-292.
26. Ahmad F, Saunders RN, Lloyd GM, et al. An algorithm for the management of bile leak following laparoscopic cholecystectomy. Ann R Coll Surg Engl. 2007;89(1):51-56.
27. De Simone B, Sartelli M, Coccolini F, et al. 2020 WSES guidelines for the detection and management of bile duct injury during cholecystectomy. World J Emerg Surg. 2021;16(1):30.
28. Thiebe C, Eggert A. Drainage in uncomplicated cholecystectomy: a randomized prospective study. Chirurg. 1997;68(2):154-157.
29. Uchiyama K, Tani M, Kawai M, et al. Clinical significance of drainage tube insertion in laparoscopic cholecystectomy: a prospective randomized controlled trial. J Hepatobiliary Pancreat Surg. 2007;14(6):551-556.
30. Gupta R, Kaman L, Dahiya D, Singh R. Biliary Complications Postlaparoscopic Cholecystectomy: Mechanism, Preventive Measures, and Approach to Management: A Review. ISRN Surg. 2011;2011:349676.