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Efficiency of open and laparoscopic cholecystectomy

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Abstract:

Cholelithiasis remains the primary indication for surgical intervention globally, with laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) serving as the two definitive modalities. Therefore, it is of interest to compare the clinical outcomes, safety

profiles and perioperative metrics of LC and OC in patients with symptomatic gallstones. Recent clinical data (2024–2026) have consistently showed that LC is associated with reduced post-operative pain and an accelerated return to normal activities. While OC remains a safety valve for cases involving dense adhesions, LC shows safety with lower rates of surgical site infection. Thus, data shows reinforced LC as the preferred primary approach for managing cholelithiasis in the future.

Keywords: Cholelithiasis, laparoscopic cholecystectomy (LC), opens cholecystectomy (OC)

Background:

Cholelithiasis is a prevalent condition among adults globally, with its incidence varying across populations owing to factors such as dietary habits, genetic predisposition and lifestyle choices [1]. Although many individuals remain asymptomatic, the development of biliary colic, cholecystitis, or complications such as pancreatitis and cholangitis necessitates surgical intervention [2]. The primary objectives of surgical treatment are to alleviate symptoms, prevent recurrence and mitigate the risk of life-threatening complications [3]. Despite being associated with relatively longer recovery times, increased post-operative pain and larger scars, open cholecystectomy remains crucial in emergency situations, resource-limited healthcare settings and when laparoscopic expertise or equipment is unavailable [4]. The advent of laparoscopic cholecystectomy (LC) has been a significant advancement in gallbladder surgery [5]. This minimally invasive technique offers distinct advantages, including reduced post-operative pain, shorter hospital stays and faster return to normal daily activities decreased wound complications and improved cosmetic outcomes [6]. Studies have showed that patients undergoing LC typically require less analgesia, experience lower intraoperative blood loss and recover more rapidly than those undergoing OC [7]. The laparoscopic cholecystectomy procedure involves a learning curve, necessitates specialized equipment and trained personnel and may require more operative time due to meticulous dissection and port placement [6]. Comparative analyses have consistently indicated superior short-term outcomes for LC in uncomplicated cholelithiasis [8]. Patients experience faster post-operative recovery and higher satisfaction, rendering LC the preferred elective approach in contemporary surgical practices [7]. Therefore, it is of interest to compare the open and laparoscopic cholecystectomy.

Methodology:

This prospective, randomized, comparative study aimed to evaluate the clinical outcomes of laparoscopic cholecystectomy (LC) versus open cholecystectomy (OC) in patients with cholelithiasis. Conducted at a single center over 12 months, the study enrolled 100 medically fit patients aged 18–65 years with symptomatic gallstone disease who provided informed consent. Patients with gallbladder malignancy, bile duct stones, severe comorbidities such as liver cirrhosis, or a history of major upper abdominal surgery were excluded. Before surgery, all participants underwent comprehensive evaluations, including physical examinations, laboratory blood work and abdominal ultrasonography to assess gallbladder wall thickness and the potential complications. Patients were then randomly assigned to Group A (LC) or Group B (OC) using computer-generated

randomization or lots, with all participants receiving pre-operative counseling regarding the specific advantages of each technique and the potential for surgical conversion. Surgical procedures were performed under general anesthesia using standardized techniques. Group A underwent a four-port laparoscopic approach involving CO₂ pneumoperitoneum and cystic duct clipping, whereas Group B underwent a traditional open approach via a right subcostal Kocher incision. Throughout the operations, data were meticulously recorded regarding operative time, measured blood loss and any intraoperative complications, such as bile duct injury or the need to convert from a laparoscopic to an open procedure. Post-operatively, both groups followed a standardized management protocol focused on early mobilization, prophylactic antibiotic administration and pain control. The researchers monitored the return of bowel function and assessed pain levels using the Visual Analog Scale (VAS) at 6, 24 and 48h. Discharge was contingent upon stable vital signs and successful transition to oral intake and analgesics. Follow-up assessments were conducted at one week, one month and three months post-surgery to evaluate recovery milestones, cosmetic satisfaction and any late-stage complications, such as incisional hernias or wound infections. The primary outcomes of this study were operative duration, length of hospital stay, pain scores and time required for patients to return to normal daily activities. Secondary outcomes included blood loss and various intraoperative or post-operative adverse events (AEs). All collected data were statistically analyzed using SPSS, employing independent t-tests for continuous variables and Chi-square or Fisher’s exact tests for categorical data, with a significance threshold set at $p < 0.05$. Throughout the process, strict ethical standards and patient confidentiality were maintained in accordance with the institutional approval.

Table 1: Parameters in open versus laparoscopic cholecystectomy

Parameter	Group A (LC)	Group B (OC)	p-value
Mean Operative Time (min)	62.4 ± 12.1	48.2 ± 9.5	< 0.05
Hospital Stay (days)	1.8 ± 0.6	4.2 ± 1.2	< 0.001
Return to Normal Activity (days)	7.5 ± 2.1	15.4 ± 3.5	< 0.001
Wound Infection Rate	2%	10%	< 0.05

Results and Discussion:

A total of 100 patients were randomized, with 50 allocated to Group A (LC) and 50 to Group B (OC). Both groups were comparable in terms of mean age (42.5 ± 8.2 years in the LC group and 41.8 ± 7.6 years in the OC group) and sex distribution, showing no statistically significant differences ($p > 0.05$). The mean operative time was significantly longer in Group A (62.4 ± 12.1 min) than in Group B (48.2 ± 9.5 min, $p < 0.05$). However, Group A experienced significantly lower intraoperative blood loss (35 ± 10 ml) than Group B (85 ± 20 ml). In Group A, two

cases (4%) required conversion to open surgery due to dense adhesions at Calot's triangle, which were subsequently analyzed within the OC group for postoperative outcomes. Pain assessment via the Visual Analog Scale (VAS) revealed that Group A reported significantly lower scores at 6, 24 and 48 h compared to Group B ($p < 0.001$). Consequently, the requirement for injectable analgesics was notably lower in the laparoscopic group. The mean hospital stay for Group A was 1.8 days, which was significantly shorter than the 4.2 days observed for Group B as seen in **Table 1**. Patients in the LC group also returned to their daily activities much faster (mean 7.5 days) than those in the OC group (15.4 days). The findings of this study reaffirm the established clinical superiority of laparoscopic cholecystectomy over the open approach for managing symptomatic cholelithiasis. While the open technique (OC) remains a reliable "gold standard" in terms of safety and shorter operative duration, the laparoscopic technique (LC) offers a superior postoperative profile, characterized by reduced pain, shorter hospital stays and better cosmetic outcomes. The longer operative time observed in Group A is consistent with the technical complexity of creating a pneumoperitoneum and meticulous dissection using laparoscopic instruments. However, this gap often narrows as surgical proficiency increases. The 4% conversion rate in our study aligns with international benchmarks (typically 2–7%) and highlights the importance of pre-operative assessment. Thickened gallbladder walls and dense inflammatory adhesions remain the primary triggers for conversion to ensure patient safety and avoid bile-duct injury. The most striking difference was observed in the VAS scores. The traditional Kocher incision used in OC involves muscle cutting, which leads to significant post-operative pain, splinting of respiration and delayed mobilization. In contrast, the small four-port incisions in LC minimize the tissue trauma. This reduction in pain directly correlates with the earlier return of bowel function and shorter hospitalization, which carries significant economic benefits for both the healthcare system and patients [9]. The incidence of wound infection was higher in

Group B, likely because of the larger incision size. While bile duct injury is the most feared complication of LC, no such instances occurred in our series, likely due to strict adherence to the critical view of safety.

Conclusion:

We show that minimally invasive nature of the four-port technique significantly mitigates the physiological stress response associated with large subcostal incisions. This is evidenced by the accelerated return to normal activities and the reduced requirement for parenteral analgesics

Conflict of interest: Nil

Sponsorship: Nil

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