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Research Article

A COMPARATIVE STUDY ON PORT SITE INFECTIONS WITH AND WITHOUT USE OF AUTOCLAVED PLASTIC ENDOBAG DURING LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Background: Port site infection (PSI) remains an important postoperative complication of laparoscopic cholecystectomy (LC). Gallbladder perforation and stone spillage during retrieval contribute to contamination of the extraction port.

Objective: To compare the incidence of port site infection in patients undergoing laparoscopic cholecystectomy with and without use of autoclaved plastic endobag for gallbladder retrieval.

Methods: This prospective comparative study was conducted from December 2023 to November 2024 including 30 patients undergoing elective laparoscopic cholecystectomy. Patients were divided into Group I (with endobag, n=15) and Group II (without endobag, n=15). Postoperative wound assessment was performed on POD 3, 5, 7, 14 and during follow-up. Statistical analysis was done using Chi-square test. $p<0.05$ was considered significant.

Results: Port site infection occurred in 3 patients (20%) in Group I and 10 patients (66.6%) in Group II ($\chi^2 = 6.65$, df = 1; p = 0.01).Majority of infections occurred on POD 3. All infections were superficial surgical site infections. Patients in the endobag group had shorter hospital stay (p=0.01).

Conclusion: Use of autoclaved plastic endobag significantly reduces port site infection and represents a simple, cost-effective preventive strategy in laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Port site infection, Endobag, Gallbladder retrieval, Surgical site infection

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic cholelithiasis owing to reduced postoperative pain, shorter hospital stay, rapid recovery, and improved cosmetic outcome compared to open surgery[1]. Despite its minimally invasive advantages, LC is not devoid of

complications. Among these, port site infection (PSI) remains a clinically relevant issue that increases postoperative morbidity and healthcare cost[2].

Port site infection presents with peri-incisional erythema, induration, wound discharge, tenderness, and occasionally fever[3]. Although the incidence of PSI is lower than wound infection after open surgery, Indian studies have reported rates ranging from 3% to 12%, depending on intraoperative contamination and retrieval technique.

Gallbladder perforation during laparoscopic dissection is reported in 10–40% of cases, while stone spillage occurs in approximately 6–30% of procedures. Contamination may occur during dissection from the liver bed or during specimen extraction through the epigastric port. Spilled bile and infected gallstones increase the risk of wound infection and rarely intra-abdominal abscess formation.

Specimen retrieval technique plays a crucial role in preventing port contamination. Direct extraction without protective barriers allows contact between infected bile and the port wound. Retrieval bags (endobags) have been shown to reduce contamination and infection rates[7]. However, routine use of commercially available endobags increases procedural cost and may not be feasible in resource-constrained settings.

Indian literature has described use of indigenous alternatives such as sterile surgical gloves, drain bags, condom bags, and autoclaved plastic bags as cost-effective substitutes[6]. Studies have demonstrated statistically significant reduction in PSI with the use of protective retrieval systems.

Given the ongoing debate regarding routine endobag use in uncomplicated cases and the importance of cost-effective strategies in developing countries, this study was undertaken to compare port site infections in laparoscopic cholecystectomy performed with and without autoclaved plastic endobag.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of General Surgery from December 2023 to November 2024.

Ethical approval was obtained from the Institutional Ethics Committee of Sri Venkateshwaraa Medical College Hospital & Research Centre. Written informed consent was obtained from all participants.

A total of 30 patients undergoing elective laparoscopic cholecystectomy were included.

Sample Size

Based on previous Indian studies demonstrating a difference of approximately 40% in PSI incidence between endobag and non-endobag groups, with 80% power and 5% alpha error, minimum required sample size was 14 per group. Hence, 15 patients were included in each group.Patients were randomized to Group I (endobag) or Group II (no endobag) using a computer-generated random sequence (1:1 allocation). Allocation concealment was ensured with sequentially numbered, opaque, sealed envelopes opened in the operating room immediately prior to specimen retrieval.

Group Allocation

Group I: Gallbladder retrieval using autoclaved plastic endobag (n=15)

Group II: Direct extraction without endobag (n=15)

Inclusion Criteria

- Age 35–55 years
- Symptomatic cholelithiasis
- Fit for laparoscopic surgery
- Informed written consent

Exclusion Criteria

- Gangrenous cholecystitis
- Gallbladder empyema
- Gallbladder rupture
- Gallbladder carcinoma
- Conversion to open surgery
- Severe comorbidities

Standard four-port laparoscopic cholecystectomy was performed in all cases.

In Group I, gallbladder was retrieved using sterile autoclaved plastic bag introduced through epigastric portto prevent bile and stone spillage during extraction.

Figure 1. Preparation and Intraoperative Use of Autoclaved Plastic Endobag for Gallbladder Retrieval During Laparoscopic Cholecystectomy

Figure 1 illustrates the preparation and intraoperative application of a sterile autoclaved plastic endobag for gallbladder retrieval.

The upper panels demonstrate assembly of the indigenous plastic retrieval bag with thread control mechanism and specimen containment after gallbladder placement.

The lower panels show intra-abdominal deployment of the bag, insertion of the gallbladder specimen into the bag, and protected extraction through the epigastric port.

This technique prevents direct contact between bile-contaminated gallbladder and the port wound, thereby reducing port site contamination and subsequent surgical site infection.

Postoperative wound assessment was done on POD 3, 5, 7, 14, and during follow-up at 1 and 3 months.

Statistical analysis was performed using SPSS software. Chi-square test was applied

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RESULTS

Patient Profile

A total of 30 patients undergoing elective laparoscopic cholecystectomy were included in the study. Patients were equally divided into:

- Group I – Gallbladder retrieval using autoclaved plastic endobag (n=15)
- Group II – Direct gallbladder extraction without endobag (n=15)

The primary objective was to compare the incidence of port site infection between the two groups. Secondary objectives included evaluation of postoperative day of presentation, hospital stay, and type of infection.

Table 1. Distribution of Study Participants According to Demographic Profile

Variable	Group I (With Endobag) n=15	Group II (Without Endobag) n=15	Total (n=30)
Male	4 (26.7%)	5 (33.3%)	9 (30%)
Female	11 (73.3%)	10 (66.7%)	21 (70%)
Mean Age (years) ± SD	44.2 ± 6.1	45.3 ± 5.8	44.7 ± 6.0

The study population showed female predominance (70%), consistent with the epidemiology of gallstone disease. Baseline demographic characteristics were comparable between the two groups, ensuring homogeneity for comparison of outcomes.

Table 2. Incidence of Port Site Infection Between Study Groups

Port Site Infection	Group I (With Endobag)	Group II (Without Endobag)	p-value
Present	3 (20%)	10 (66.6%)	0.01
Absent	12 (80%)	5 (33.3%)	

Port site infection occurred in 3 patients (20%) in Group I and 10 patients (66.6%) in Group II ($\chi^2 = 6.65$, df = 1; p = 0.01).

Table 3. Distribution of Port Site Infection According to Postoperative Day

Postoperative Day	Group I (With Endobag)	Group II (Without Endobag)
POD 3	2 (13.3%)	7 (46.6%)
POD 5	1 (6.7%)	3 (20%)
POD ≥7	0	0

Most infections occurred on POD 3, particularly in the non-endobag group, indicating early wound contamination likely due to intraoperative bile spillage .

Table 4. Comparison of Postoperative Hospital Stay

Hospital Stay	Group I	Group II	p-value
≤3 Days	12 (80%)	5 (33.3%)	0.01
≥5 Days	3 (20%)	10 (66.6%)	

Comparison of hospital stay showed that 12/15 (80%) patients in the endobag group were discharged within 3 days compared to 5/15 (33.3%) in the non-endobag group ($\chi^2 = 6.65$, df = 1; p = 0.01).

Figure 2. Comparison of Incidence of Port Site Infection Between Patients With and Without Endobag Use

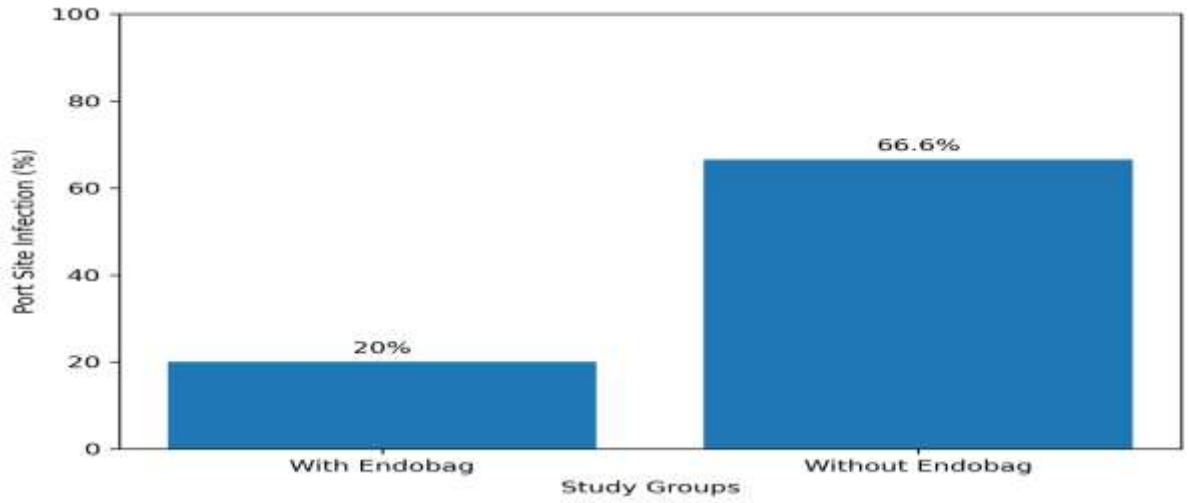

Figure 2 demonstrates the incidence of port site infection in patients undergoing laparoscopic cholecystectomy with autoclaved plastic endobag (20%) compared to direct extraction without endobag (66.6%). The difference was statistically significant ($\chi^2 = 6.65$, df = 1; p = 0.01), indicating that use of protective retrieval bag significantly reduces postoperative port site infection.

Figure 3. Postoperative Day-wise Distribution of Port Site Infection in Study Groups

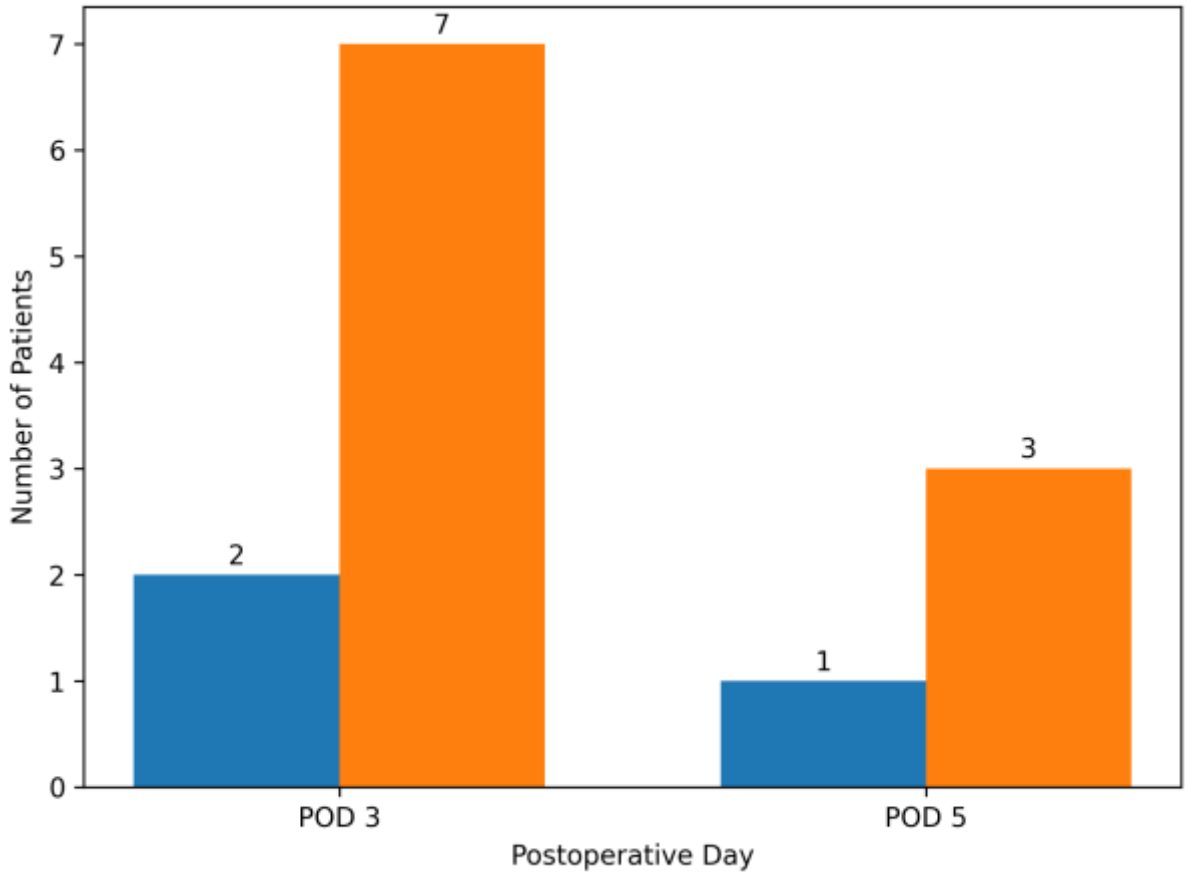

Figure 3 illustrates the distribution of port site infections according to postoperative day. The majority of infections occurred on POD 3, particularly in the non-endobag group (7 patients), compared to the endobag group (2 patients). Fewer infections were observed on POD 5. This pattern suggests early wound contamination likely related to intraoperative bile spillage during specimen retrieval.

Figure 4. Comparison of Hospital Stay Duration Between Study Groups

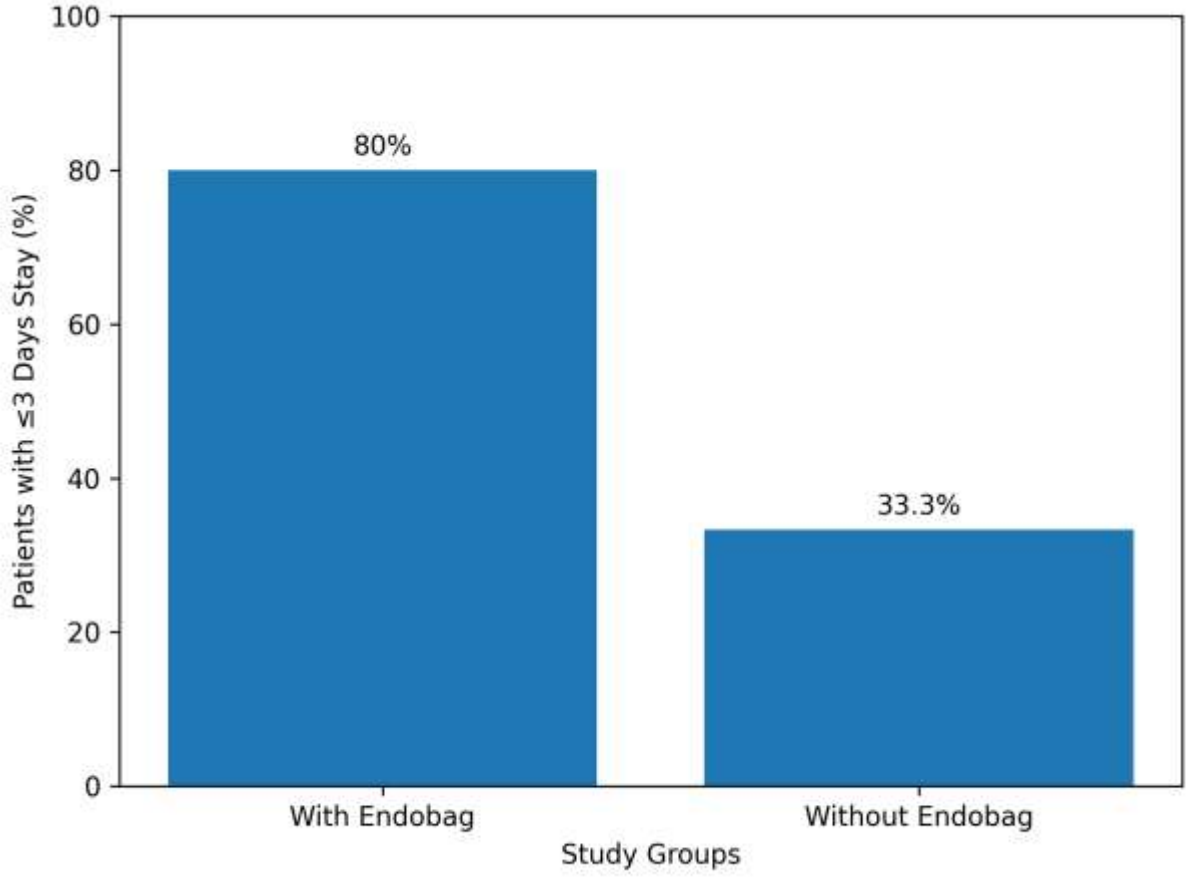

Figure 4 compares the proportion of patients discharged within 3 days between the two groups. A higher percentage of patients in the endobag group (80%) had shorter hospital stay compared to the non-endobag group (33.3%). This supports the secondary outcome that protected specimen retrieval is

associated with faster postoperative recovery.

DISCUSSION

The present prospective comparative study was undertaken to evaluate whether the use of an autoclaved plastic endobag during laparoscopic cholecystectomy reduces the incidence of port site infection (PSI). The primary objective was to compare PSI rates between patients undergoing protected gallbladder retrieval and those undergoing direct extraction. Secondary objectives included assessment of timing of infection and duration of hospital stay.

Incidence of Port Site Infection

Our study demonstrated a statistically significant reduction in port site infection in patients where autoclaved plastic endobag was used (20%) compared to direct extraction without endobag (66.6%) (Table 2, Figure 2; p = 0.01). This represents more than a three-fold increase in infection risk when protective retrieval was not employed.

These findings are consistent with the results reported by Vergadia et al, who observed a significantly lower PSI rate in patients undergoing gallbladder retrieval using an indigenous endobag compared to direct extraction. Similarly, Narayanswamy and Prajwal demonstrated that protective retrieval techniques significantly reduce wound contamination and postoperative infection rates in laparoscopic cholecystectomy.

The mechanism underlying this difference is biologically plausible. Gallbladder perforation and bile spillage during laparoscopic dissection are common intraoperative events. Even in cases where gross perforation is not evident, micro-perforations may occur. Direct extraction allows contact between contaminated bile and port wound tissue, facilitating bacterial inoculation. Protective containment prevents this direct exposure.

Bharath et al, in a recent Indian tertiary care study, also reported significant reduction in PSI with use of retrieval bags, emphasizing that specimen retrieval technique is an independent determinant of wound outcome. Our findings strengthen this evidence and support routine use of protective retrieval even in elective cases.

Timing of Infection

Analysis of postoperative day distribution (Table 3, Figure 3) revealed that the majority of infections occurred on POD 3, particularly in the non-endobag group (7 patients). This early presentation strongly suggests intraoperative contamination rather than delayed wound breakdown or systemic factors.

Upadhyay et al[11] similarly reported that most port site infections following laparoscopic cholecystectomy manifest within the first 72 hours, correlating with intraoperative spillage events. Our findings align with this temporal pattern and further reinforce the role of specimen retrieval technique in early wound infection.

Notably, no infections were observed beyond POD 5 in either group. This indicates that when contamination occurs, it manifests early and can be mitigated by mechanical prevention strategies such as endobag use.

Hospital Stay

Patients undergoing protected retrieval demonstrated significantly shorter hospital stay (Table 4, Figure 4; p = 0.01). Eighty percent of patients in the endobag group were discharged within 3 days compared to only 33.3% in the non-endobag group.

Although PSI in our study was superficial in nature, its presence necessitated prolonged antibiotic therapy, wound dressing, and delayed discharge. Sharma et al[12] observed similar trends, reporting extended hospitalization in patients developing port site infection following direct gallbladder extraction.

Reduction in hospital stay has important implications in resource-limited settings. Decreased inpatient duration translates to reduced antibiotic consumption, lower dressing material cost, and improved bed turnover. Rao et al[13] emphasized that adoption of cost-effective preventive strategies in laparoscopic surgery significantly reduces overall institutional burden.

Nature of Infection

All infections recorded in the present study were superficial surgical site infections. No deep space infection, intra-abdominal abscess, bile duct injury, or mortality was observed. This is comparable to findings reported by Ghosh et al, who noted that most PSIs following laparoscopic cholecystectomy are superficial and manageable with conservative therapy. However, even superficial infections increase morbidity and patient dissatisfaction. Given the rising global concern of antimicrobial resistance, preventing SSI through mechanical barrier techniques assumes greater importance than relying on antibiotic management.

CONCLUSION

The present study demonstrates that the use of an autoclaved plastic endobag during laparoscopic cholecystectomy significantly reduces port site infection compared to direct gallbladder extraction. Protected retrieval was associated with lower early postoperative wound contamination and shorter hospital stay. Autoclaved plastic endobag is a simple, inexpensive, and effective preventive strategy and may be recommended routinely, even in elective uncomplicated cases.

LIMITATIONS

This study is limited by its small sample size, single-center design, and short follow-up duration, which may restrict generalizability of the findings. Absence of detailed microbiological and formal cost-analysis data are additional limitations. Larger multicentric randomized studies are required to validate these results.

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