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Prospective Observational Study of Post-Operative Port-Site Pain After Gall Bladder Retrieval from Umbilical vs Epigastric in Laparoscopic Cholecystectomy

ABSTRACT

Background: Laparoscopic cholecystectomy is the standard surgical treatment for benign gallbladder disease. Although minimally invasive, postoperative port-site pain remains a common concern and may influence patient recovery. Gallbladder retrieval is a critical terminal step of the procedure and can be performed through either the umbilical or epigastric port; however, the optimal retrieval site with respect to postoperative pain remains controversial.

Objectives: To compare postoperative port-site pain following gallbladder retrieval through the umbilical versus epigastric port in patients undergoing elective four-port laparoscopic cholecystectomy, and to evaluate secondary outcomes including retrieval time, surgical site infection, and length of hospital stay.

Methods: This prospective observational study was conducted over 18 months at a tertiary care center. Eighty adult patients undergoing elective laparoscopic cholecystectomy were enrolled and divided into two groups based on the port used for gallbladder extraction: umbilical port (n = 40) and epigastric port (n = 40). Postoperative pain was assessed using the visual analogue scale at 1, 6, 12, 24, and 36 hours after surgery. Demographic variables, gallbladder extraction time, surgical site infection, and duration of hospital stay were also recorded and analyzed.

Results: Baseline demographic and operative characteristics were comparable between the two groups. Patients in the umbilical port group demonstrated significantly lower postoperative pain scores at all assessed time intervals compared to the epigastric port group ($p < 0.05$). No statistically significant difference was observed between the groups in gallbladder extraction time, incidence of surgical site infection, or length of hospital stay.

Conclusion: Gallbladder retrieval through the umbilical port is associated with significantly reduced postoperative port-site pain without increasing operative time, infection rates, or hospital stay. The umbilical port may therefore be preferred for gallbladder extraction during elective laparoscopic cholecystectomy to improve postoperative patient comfort.

Key words: Laparoscopic cholecystectomy; gallbladder retrieval; port-site pain; umbilical port; epigastric port; visual analogue scale.

INTRODUCTION

Gallbladder and biliary diseases are among the most common digestive system disorders, with a steadily rising global burden. A large proportion of benign gallbladder conditions such as cholelithiasis and polyps remain asymptomatic, although nearly one-third progress to symptomatic disease requiring surgery.

Laparoscopic cholecystectomy has become the gold standard for the management of gallstone disease due to reduced postoperative pain, lower morbidity, shorter hospital stay, and faster recovery compared with open surgery.

Despite its advantages, postoperative pain—particularly port-site pain—remains the most frequent complaint after laparoscopic cholecystectomy. Pain is influenced by factors such as abdominal wall trauma during port insertion and gallbladder retrieval, pneumoperitoneum, and manipulation of inflamed or distended gallbladders. Gallbladder extraction, the terminal step of the procedure, is therefore considered a key contributor to port-site pain.

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The gallbladder is commonly retrieved through either the umbilical or epigastric port, with selection largely based on surgeon preference. While some studies suggest technical ease with the epigastric port and others report less pain with the umbilical port, evidence remains conflicting. Meta-analyses and guidelines have highlighted heterogeneity among studies and the absence of definitive recommendations. In this context,

the present study aims to compare umbilical and epigastric ports for gallbladder retrieval with respect to postoperative port-site pain.

AIMS AND OBJECTIVES

Aims

To find which technique is better in terms of clinical outcomes (port site pain) when GB is retrieved through umbilical port as compare to epigastric port.

Objectives

Primary Objectives:

1. To find out the clinical outcome in terms of port site pain after GB is retrieval through umbilical port.
2. To find out the clinical outcome in terms of port site pain after GB is retrieval through epigastric port.
3. To compare clinical outcomes of both the technique with each other.

Secondary Objectives:

To compare the time taken to mobilize GB out of bed following LC when GB is extracted through umbilical compared to epigastric port.

REVIEW OF LITERATURE

Postoperative pain remains the most common complaint following laparoscopic cholecystectomy (LC) and is a major factor influencing hospital stay and analgesic requirements. Among the various contributors to pain after LC, gallbladder (GB) retrieval—the terminal step of the procedure—has been identified as an important determinant of port-site pain due to local tissue trauma.

Conventionally, GB extraction is performed either through the epigastric or umbilical port, largely based on surgeon preference, as definitive evidence favoring one site over the other is lacking.

Gallstone disease is highly prevalent worldwide, affecting 10–15% of adults in Western populations and approximately 4% in India, with higher prevalence reported in North India. Although most gallstones remain asymptomatic, nearly 1–3% of patients develop symptoms annually, making LC one of the most commonly performed general surgical procedures. LC has become the gold standard since its introduction by Eric Mühe in 1985 due to reduced postoperative pain, shorter hospital stay, faster recovery, and lower wound-related morbidity compared with open cholecystectomy.

Despite these advantages, port-site complications such as pain, infection, hematoma, and incisional hernia remain clinically relevant. Port-site pain is typically more pronounced than visceral pain during the first 48 hours after surgery and is influenced by abdominal wall trauma during trocar insertion, pneumoperitoneum, gallbladder manipulation, and extraction. Retrieval becomes particularly challenging in cases of inflamed, distended, or stone-packed gallbladders, often requiring decompression, stone evacuation, or fascial extension, which may further exacerbate pain and increase the risk of wound complications.

Several randomized controlled trials (RCTs) and comparative studies have evaluated the optimal port for GB retrieval. Many studies, including those by Siddiqui et al., Jain et al., Hajong et al., Gul-e-Lala et al., and Vashisht et al., demonstrated significantly lower postoperative port-site pain when GB retrieval was performed through the umbilical port compared with the epigastric port. Some of these studies also reported reduced surgical site infection (SSI) rates and improved ease of retrieval with the umbilical port. However, retrieval time was often shorter with the epigastric port due to better ergonomics and the absence of telescope repositioning.

Conversely, a few studies, such as those by Muneeb et al. and Bashir et al., reported either comparable pain scores between the two ports or lower pain with epigastric port retrieval. Umbilical port extraction has also been associated with a higher risk of port-site hernia in some series, likely due to larger fascial defects and inherent weakness of the umbilical ring. Infection risk at the umbilical port has been attributed to local bacterial colonization; however, routine use of specimen retrieval bags (endobags) has been shown to significantly reduce port-site contamination and infection.

Meta-analyses have highlighted significant heterogeneity among available studies, including differences in pain assessment tools, timing of evaluation, analgesic protocols, surgical techniques, and patient selection, making it difficult to draw definitive conclusions. Consequently, the Society of American Gastrointestinal and Endoscopic Surgeons guidelines state that, in the absence of strong evidence, gallbladder extraction may be performed according to surgeon preference.

In summary, existing literature suggests that umbilical port retrieval is often associated with reduced early postoperative port-site pain, while epigastric port retrieval may offer technical ease and shorter extraction time. Given the conflicting evidence and lack of consensus, further comparative studies are warranted to clarify the optimal port for gallbladder retrieval, particularly with respect to postoperative pain and overall clinical outcomes.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted over 18 months (August 2022–January 2024) in the Department of General Surgery at a tertiary care institute in western India.

Study Population

Adult patients (18–75 years) of either gender undergoing elective four-port laparoscopic cholecystectomy (LC) were included. Patients converted to open surgery, with gallbladder malignancy, acute cholecystitis or pancreatitis, empyema/ mucocele gallbladder, chronic analgesic or steroid use, age <18 years, or refusal to consent were excluded.

Ethical Approval

The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Study Groups

Patients were randomly allocated into two groups:

- Umbilical port retrieval group
- Epigastric port retrieval group

Data Collection

Demographic variables (age, gender, BMI), surgical parameters (indication for LC, gallbladder extraction time, hospital stay, surgical site infection), and postoperative pain scores were recorded.

Outcome Assessment

Postoperative pain was assessed using an 11-point Visual Analogue Scale (VAS) at 1, 6, 12, 24, and 36 hours after surgery.

Study Procedure

Eighty-two patients were screened; two were excluded (acute cholecystitis and refusal of consent). Laparoscopic cholecystectomy was performed by an experienced surgeon. Gallbladder retrieval was done via either the umbilical or epigastric port, with or without an endobag. Intraoperative details including retrieval time, spillage, port contamination, fascial extension, and drain placement were documented. Standard postoperative care and analgesia were provided. Data were recorded using a structured case record form.

Sample Size and Sampling

Based on previous literature, with 5% significance and 90% power, the calculated sample size was 74. A total of 80 patients were enrolled (40 per group). Randomization was done using the odd–even method.

Statistical Analysis

Data were analyzed using SPSS version 23.0. Categorical variables were expressed as frequencies and percentages, and continuous variables as mean ± standard deviation. Chi-square test, independent t-test, and repeated-measures ANOVA with Bonferroni post-hoc analysis were applied. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 80 patients undergoing laparoscopic cholecystectomy were included, with 40 patients each in the umbilical port and epigastric port groups.

Baseline characteristics were comparable between groups. Mean age was 43.02 ± 7.97 years in the umbilical port group and 42.78 ± 8.12 years in the epigastric port group ($p = 0.890$). Female patients predominated in both groups (70% vs. 72.5%), with no significant difference in gender distribution ($p = 0.805$). Mean BMI was similar between groups (23.10 ± 2.23 vs. 23.11 ± 2.54 kg/ m²; $p = 0.997$).

The most common indication for surgery was cholelithiasis, accounting for 85% of cases in the umbilical port group and 80% in the epigastric port group, with no significant difference in indications ($p = 0.556$).

The mean time required for gallbladder extraction was comparable between the umbilical and epigastric port groups (3.41 ± 0.61 vs. 3.10 ± 0.90 minutes; $p = 0.075$).

Postoperative pain, assessed using the visual analogue scale (VAS), was significantly lower in the umbilical port group at all evaluated time points: 1 hour ($p < 0.001$), 6 hours ($p < 0.001$), 12 hours ($p = 0.012$), 24 hours ($p = 0.005$), and 36 hours ($p < 0.001$).

No patient in either group developed surgical site infection, and the incidence was comparable ($p = 1.000$). The mean length of hospital stay did not differ significantly between the umbilical and epigastric port groups (2.1 ± 0.30 vs. 2.2 ± 0.40 days; $p = 0.215$).

DISCUSSION

Laparoscopic cholecystectomy is the standard treatment for symptomatic gallstone disease, offering reduced postoperative pain, shorter hospital stay, and lower surgical site infection rates compared with open surgery. Gallbladder retrieval is a critical terminal step of the procedure and may be performed through either the epigastric or umbilical port, with the choice traditionally based on surgeon preference. Current guidelines from Society of American Gastrointestinal and Endoscopic Surgeons state that, in the absence of definitive evidence, gallbladder extraction may be performed through either port.

In the present study, both groups were comparable with respect to age, gender, BMI, and surgical indications, minimizing confounding factors. These findings are consistent with previously published studies, which similarly report demographic homogeneity between umbilical and epigastric port groups.

Gallbladder extraction time did not differ significantly between the two techniques. Although some authors have reported longer extraction times with either port, these variations are likely attributable to differences in patient habitus, port tract anatomy, and surgeon experience. The straight tract of the umbilical port may facilitate easier extraction, whereas the oblique epigastric tract, often traversing the falciform ligament, may occasionally prolong retrieval.

Postoperative pain was consistently and significantly lower in the umbilical port group at all assessed time intervals. This may be explained by the open insertion technique at the umbilicus, which creates a wider fascial opening and reduces traction on the rectus sheath and parietal peritoneum during gallbladder retrieval. In contrast, epigastric port insertion involves blunt splitting of the rectus muscle, increasing the likelihood of tissue trauma, hematoma formation, and nerve irritation, thereby contributing to higher pain scores. These findings are in agreement with multiple previous studies demonstrating reduced port-site pain with umbilical gallbladder extraction.

No surgical site infections were observed in either group, suggesting that with proper aseptic technique and careful gallbladder retrieval, both ports are safe. Similarly, length of hospital stay was comparable, reflecting the minimally invasive nature of laparoscopic cholecystectomy and standardized postoperative care protocols.

Overall, the findings of this study suggest that gallbladder extraction through the umbilical port offers a significant advantage in terms of reduced postoperative pain without increasing operative time, infection risk, or hospital stay. Based on these results, the umbilical port may be considered the preferred site for gallbladder retrieval in elective laparoscopic cholecystectomy.

STUDY LIMITATIONS

1. This study involved a relatively small number of patients admitted in a single center so future studies of a larger sample size are required to confirm the findings.
2. This was a single-center study. Hence, the results cannot be generalised to the community.
3. The association of pain with co-morbidities was not assessed, and fewer outcome variables were used for the analysis. The sample size of the study is considerably small.
4. We have used visual analogue scale for pain which is subjective score for pain. So, it may vary from person to person.
5. Due to short study duration, long-terms complications, including surgical site hernia was not evaluated.

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