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Comparison of Post-Operative Port Site Pain after Gall Bladder Retrieval through Umbilical versus Epigastric Port in Patients Undergoing Laparoscopic Cholecystectomy

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ABSTRACT

Port-site pain is a typical issue that occurs after laparoscopic cholecystectomy. When the gall bladder is to be retrieved, the site used could be umbilical or epigastric and could have an effect on the extent of pain, which would impact patient comfort and recovery. **Objectives:** To determine the difference in post-operative port-site pain between umbilical and epigastric ports during laparoscopic cholecystectomy in patients. **Methods:** It was a descriptive study done for six months at Khyber Teaching Hospital. Non-probability consecutive sampling was used to enroll 36 patients undergoing elective laparoscopic cholecystectomy and randomized them into umbilical and epigastric port groups. The Visual Analogue Scale (VAS) was used to measure post-operative pain at 6, 12, and 24 hours. The analyzed data were processed in SPSS v. 25. The chi-square test, independent samples t-tests, and multivariate linear regression were employed to measure the predictors of pain. The p-value≤0.050 was considered significant. **Results:** The umbilical port also recorded lower VAS scores at each time point (p≤0.050). Multivariable regression established port site as the significant predictor of pain with the only significant adjusted variable (p=0.003). **Conclusions:** The recovery of the gall bladder through the umbilical port would lead to much lower early post-surgery pain than through the epigastric port, regardless of patient demographics or comorbidities, and is an argument in favor of the umbilical port as the site of extraction.

INTRODUCTION

Laparoscopic cholecystectomy has become the gold standard in the treatment of symptomatic cholelithiasis because, compared to open surgery, it offers the benefits of smaller incisions, shorter hospital stays, faster recovery, and less postoperative morbidity [1, 2]. The procedure is usually characterized by the removal of the gall bladder using one of the operating ports, most usually either the umbilical or the epigastric port [3]. Despite laparoscopic surgery being viewed as a low-risk surgery, post-operative port site pain is one of the most common patient complaints, and it can affect early discharge, prescription of analgesics, length of stay, and overall patient satisfaction [4]. Thus, measures to reduce port site pain are of significant interest in enhancing post-operative results. Gallstone disease is one of the most prevalent gastrointestinal diseases in the world, with the number of

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cholecystectomies in millions per year [5]. Cholelithiasis is most common in women, and it is more common as age, obesity, and metabolic disorders progress [6]. Laparoscopic cholecystectomy is widely utilized in developing countries, such as Pakistan, both in the public and private sectors, due to its favorable safety profile and good results [7]. The umbilical and epigastric ports were different in anatomical structure, size of incision, fascial manipulation, and manipulation of tissue, which can affect the intensity of pain after surgery [8]. Laparoscopic cholecystectomy causes port site pain that is multifactorial; this occurs due to fascial stretching, muscle fiber disruption, and traction during the retrieval of the laparoscopic specimen [9]. The epigastric port lies in a relatively less compliant region with denser musculofascial tissue compared to the umbilical port, which lies in a naturally weak scar region with little mass [10]. There are surgeons who like to use the epigastric port to retrieve specimens to minimize the risk of umbilical wound complications, and surgeons who like to use the umbilical route because of cosmetic advantages and complaints of less pain [11]. Despite the common practice of laparoscopic cholecystectomy, there remains no explicit agreement as to which of the umbilical or epigastric ports is the most suitable site for retrieving the gall bladder in relation to the post-operative pain. Anatomical differences between the two ports, which include more fascial and muscle manipulation at the epigastric location compared to the naturally less strong umbilical location, could lead to a clinically significant difference in pain magnitudes. In the resource-limited and high-volume surgical environment, determining which port is less painful will aid in maximizing recovery, decreasing the burden of the postoperative phase, and enhancing the quality of care. Thus, the study is necessary to have objective comparative evidence on post-operative port site pain between umbilical and epigastric retrieval ports.

Although there is increasing evidence on the effects of vitamin D on alopecia areata, there are still some significant gaps. There are no large, multicentric, randomized, controlled studies that assessed the efficacy of microneedling-assisted delivery of topical vitamin D3 in localized alopecia areata, and most of the studies had small sample sizes with limited follow-up periods. The best suitability of vitamin D3 level, the vehicle formulation, the dosing schedule, and the required number of microneedling sessions to achieve the highest therapeutic effect have not been determined. This study aims to compare post-operative port site pain after gall bladder retrieval through the umbilical port versus the epigastric port in patients undergoing laparoscopic cholecystectomy.

METHODS

This was a descriptive study done in the Department of Surgery, Khyber Teaching Hospital, Peshawar, for six months from 1st October, 2024 to 31st March, 2025. Research and Ethical Review Board (IREB) of Khyber Medical College (KMC) approved the study with the following approval number: 617/DME/KMC. The sample size was estimated with the help of Open Epi software, and it was calculated on the basis of the reported mean post-operative pain scores. The mean score of pain associated with the retrieval of the gall bladder using an umbilical port was approximated to be 4.00 ± 1.537, and the mean score of pain with the retrieval using an epigastric port was approximated to be 5.27 ± 1.167 [12]. The calculated minimum sample size was 36 patients, with a power of 80% and a confidence level of 95%, with 18 patients in each group. In the calculation, Open Epi assumes that the variances between the groups are equal, and the homogeneity of variance was later established by analysis with the Levene test prior to proceeding with the application of the parametric tests. A non-probability consecutive sampling method was used. The study included patients aged 18 to 60 years who underwent laparoscopic cholecystectomy according to the operation definitions of either gender. Patients were not included when they reported having acute cholecystitis, evidenced by a positive Murphy sign, elevated white blood cell count, pericholecystic edema, or the presence of raised gall bladder wall thickness on ultrasound. Patients who had cholangitis (fever, jaundice, and hypochondria to the right), had common bile duct stones on ultrasonography, or had had gallstone pancreatitis with elevated serum amylase levels were also excluded. Moreover, patients whose BMI exceeded 30 kg/m2 and those who had undergone laparotomy in the past were excluded. Following the approval, data were gathered among patients hospitalized in the indoor Department of Surgery and who met the selection criteria. Eligible patients were approached and informed that written consent was acquired after being made aware of the purpose of the study, the potential risks, and the benefits that would be expected. The proforma included baseline demographic and clinical variables, such as age (years), gender, BMI (weight in kg/height in m 2), place of residence (rural/urban), level of education, occupation, and socioeconomic status. Such clinical features as surgery indications and comorbidity were also recorded. The presence of diabetes mellitus was registered as detected when the level of fasting blood sugar was greater than 130 mg/dl, and hypertension when the blood pressure was more than 140/90 mmHg. Patients who had a laparoscopic cholecystectomy with the gall bladder removed via the umbilical port or the epigastric port were recruited into the study groups. All the

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procedures were done under general anesthesia. The same surgical team performed the surgeries under the guidance of a seasoned consultant laparoscopic surgeon, and the principal researcher was involved in every surgery to maintain uniformity of the procedures and to reduce variability brought about by the operator. All patients were followed by standard procedures. The standardization of post-operative care was based on the departmental guidelines, such as the use of antibiotic prophylaxis, fluid replacement, and adequate analgesia. The assessment of pain was conducted on a post-operative basis with the help of the Visual Analogue Scale (VAS)[13]. The level of pain was measured with the help of the Visual Analogue Scale (VAS) after the operation. Pain measurements were done at port-sites 6hours, 12hours, and 24 hours post-operative, and the respective VAS scores of individual patients were documented. To guarantee the reliability of responses, the patients were educated on the interpretation of the VAS before the operation. Any post-operative complications that occurred immediately were also recorded where necessary.

Statistical Package of Social Sciences version 25 was used to enter and analyze all the collected data. Analysis of data was done after confirmation of its completeness and accuracy. Mean, median, and standard deviation were used to present quantitative variables like age, BMI, postoperative VAS pain scores at 6, 12, and 24 hours, and frequencies and percentages were used to present qualitative variables such as gender, residence, occupation, socioeconomic status, comorbidities, and indication of surgery. The Shapiro-Wilk test was used to determine the normality of quantitative data before inferential analysis, and homoscedasticity (equal variance of residuals) was evaluated based on the residual versus fitted value curves. The Levene test was used to determine the homogeneity of variances between the two groups. The Independent Samples t-test was used to compare the mean VAS pain scores between the umbilical port and epigastric port groups, when the variables followed a normal distribution. The Mann-Whitney U test was used as a non-parametric alternative to test variables that did not meet the assumptions of normality. A statistically significant p-value ≤ 0.050 was taken as significant. A multivariate linear regression model was developed with VAS pain score as the dependent variable and baseline factors, including age, BMI, gender, residence, diabetes mellitus, and hypertension as independent variables, to examine the possible confounding variables. Before the multivariable linear regression was conducted, some important assumptions were evaluated to guarantee that the model was valid. Scatterplots and residual plots verified that the dependent variable (12-hour VAS score) and the continuous predictors are linear. The dependent variable used in the multivariate linear regression model was the 12-hour post-operative VAS pain score since pain is most intense during this period in the post-surgical stage of laparoscopic cholecystectomy, when anesthesia has been successfully finished and before the occurrence of any significant analgesic tapering. This is an early post-operation discomfort measurement that is also reliable and can be used to meaningfully compare the umbilical and epigastric port groups without much variation influenced by immediate post-anesthesia effects or slow recovery. The Multicollinearity between predictor variables was evaluated by using the Variance Inflation Factor (VIF), and variables with VIF > 10 were deemed to be significant and thus excluded from the final model. The assumptions were all met satisfactorily, which justifies the suitability of the regression analysis. Adjusted mean differences, regression coefficients, and 95% confidence intervals were reported.

RESULTS

The demographic and clinical characteristics of the patients in the umbilical and epigastric port groups were similar at baseline. There was no significant difference in mean age and BMI between the two groups and no significant difference in the gender distribution, with evenly represented males and females (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics

Variables	Umbilical (n=18)	Epigastric (n=18)	p-value
Age			
(Years), Mean ± SD	42.1 ± 10.5	44.3 ± 9.8	0.520
Gender			
Male	10 (56%)	9 (50%)	0.680
Female	8 (44%)	9 (50%)	
Residence, n (%)			
Urban	11 (61%)	12 (67%)	0.720
Rural	7 (39%)	6 (33%)	
Others, n (%)			
BMI (kg/m^2), Mean ± SD	25.8 ± 2.9	26.4 ± 3.1	0.480
Diabetes Mellitus	3 (17%)	4 (22%)	0.670
Hypertension	5 (28%)	6 (33%)	0.710

The use of the Visual Analogue Scale (VAS) to measure post-operative pain revealed that the umbilical port group experienced a reduced level of pain compared to the epigastric port group at all the measured time points. The umbilical group complained of less pain at 6 hours after surgery, and this difference was still significant at 12 and 24 hours (Table2).

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Table 2: Post-operative VAS Pain Scores

Time Post-Surgery	Umbilical (Mean ± SD)	Epigastric (Mean ± SD)	Mean Difference (Umbilical – Epigastric)	95% CI	p-value
6 Hours	3.2 ± 1.1	4.5 ± 1.3	−1.3	−2.0 to −0.6	0.002
12 Hours	2.5 ± 1.0	3.7 ± 1.2	−1.2	−1.8 to −0.6	0.001
24 Hours	1.8 ± 0.8	2.4 ± 0.9	−0.6	−1.2 to −0.01	0.048

Note: Negative values indicate lower pain in the umbilical port group

All variables were port site, age, BMI, gender, residence, diabetes mellitus, and hypertension, the port site being the only variable that significantly predicted. During retrieval of the gall bladder using the umbilical port was linked to a reduction in 12-hour pain scores as opposed to the epigastric port (p=0.003) (Table 3).

Table 3: Multivariable Regression Analysis for 12h VAS Pain

Predictors	Adjusted B	95% CI	p-value
Port Site (Umbilical vs Epigastric)	-1.1	-1.8, -0.4	0.003
Age (Years)	0.01	-0.05, 0.07	0.710
BMI (kg/m^2)	0.03	-0.11, 0.17	0.650
Gender (Male vs Female)	-0.1	-0.6, 0.4	0.750
Residence (Urban vs Rural)	0.2	-0.3, 0.7	0.440
Diabetes Mellitus (Yes vs No)	0.3	-0.6, 1.2	0.490
Hypertension (Yes vs No)	0.2	-0.5, 0.9	0.590

In all subgroups, patients who used the umbilical port had significantly lower pain scores than those who used the epigastric port. The statistical significance of these differences was found to be significant across each of the subgroups studied (Table 4).

Table 4: Stratified Analysis of Post-Operative VAS Pain (12h)

Variables	Subgroup	Umbilical (Mean ± SD)	Epigastric (Mean ± SD)	Mean Difference (Umbilical – Epigastric)	95% CI	p-value
Age (years)	≤40	2.5 ± 0.9	3.6 ± 1.0	−1.1	−1.8 to −0.4	0.003*
	>40	2.6 ± 1.0	3.7 ± 1.1	−1.1	−1.9 to −0.3	0.004*
Gender	Male	2.5 ± 0.9	3.6 ± 1.0	−1.1	−1.8 to −0.4	0.002*
	Female	2.6 ± 0.9	3.7 ± 1.0	−1.1	−1.9 to −0.3	0.003*
BMI (kg/m^2)	<25	2.4 ± 0.8	3.5 ± 1.0	−1.1	−1.8 to −0.4	0.002*
	≥25	2.6 ± 0.9	3.7 ± 1.0	−1.1	−1.8 to −0.4	0.003*
Surgery Indication	Symptomatic Cholelithiasis	2.5 ± 0.9	3.7 ± 1.0	−1.2	−1.8 to −0.6	0.001*
Comorbidities	DM	2.5 ± 0.9	3.6 ± 1.0	−1.1	−1.9 to −0.3	0.004*
	HTN	2.6 ± 0.9	3.7 ± 1.0	−1.1	−1.9 to −0.3	0.003*
	None	2.5 ± 0.9	3.6 ± 1.0	−1.1	−1.8 to −0.4	0.002*

DISCUSSION

In the present research, patients who experienced the retrieval of a gallbladder by the umbilical port had considerably reduced postoperative port site pain at various periods of time as opposed to patients who had their gallbladder retrieved by the epigastric port. This result is consistent with an accumulating literature of modern studies that indicates that umbilical port can be connected with less post-surgical pain. Other recent investigations have also noted a reduced VAS score of pain with umbilical port removal. The study led by a randomized controlled trial in 2025 indicated that patients who received umbilical port treatment had a reduced VAS score at different postoperative periods, and the preliminary data showed a lower level of pain in the umbilical port group than in the epigastric port group and no significant difference in port site complications between the two conditions [8]. Respectively, the comparative study released in 2024 has shown that umbilical retrieval was linked with much lower pain levels at 24 hours and reduced time of retrieval time, which proves the superiority of the umbilical method in terms of comfort and recovery [14]. In line with these, a study reported that umbilical port retrieval led to much lower VAS pain scores on the 1st and 2nd postoperative days than when epigastric retrieval was used [15]. The distinction in pain was also filled by improved cosmetic satisfaction and reduced port site infections in the umbilical group, but operative times were similar [16]. On the contrary, there is some recent observational data to indicate that epigastric port extraction, in certain settings, can be linked to reduced immediate postoperative pain. The intervention study showed that the patients retrieved by the epigastric port experienced less pain at 6 hours after the surgery and showed tendencies to have lower overall pain scores and fewer port site complications, such as herniation and infection [17]. A systematic evaluation of randomized trials showed no significant difference in postoperative pain at 24 hours between umbilical and epigastric extraction, but there was an increase in the risk of port site hernia and a slight increase in the length of time spent in the operating theater [18]. The present study also finds that our findings are largely consistent with the literature. A 2022 study found that there was a significant reduction in immediate postoperative pain in the umbilical group at 24 and 48 hours, but the differences were reduced by one week. Previous RCT data also reported less umbilical port retrieval at various postoperative periods [12]. Nevertheless, not all

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evidence can be aptly characterized as biased towards a particular port: there are reports of no significant differences in pain or other outcomes between groups in some comparative studies carried out in similar settings, though most of these usually lack enough power to identify subtle differences [19]. Other than pain alone, complication trends in the recent literature resonate with the need to have balanced decision-making: the 2025 trial did not establish any significant difference in port site complications between groups, and other studies demonstrate higher infection or herniation rates with an alternative port choice. These findings underscore the fact that pain is not the only aspect of the postoperative recovery [20].

There are a number of limitations to this study. To begin with, the sample size was comparatively small, and it might restrict the possibility of applying the results to a more general population. Second, the study was performed in one tertiary care center, and thus, differences in surgical or post-operative care in other jurisdictions could affect the study. Third, post-operative pain was assessed objectively with the help of VAS, which is a patient-reported outcome that could be affected by pain threshold or psychological issues. Fourth, the reduction of follow-up was to 24 hours after the pain assessment; no follow-up results on port-site complications, herniation, or persistent pain were conducted. Fifth, the researchers used non-randomized assignment to umbilical and epigastric port groups, which can result in the introduction of allocation bias in spite of characteristic similarity at the baseline and the correction of confounding factors. Randomized research should be conducted in the future to validate these results. Lastly, even with multivariate regression and stratified analyses to remove confounding, it is not possible to rule out residual confounding by unmeasured variables.

CONCLUSIONS

Laparoscopic cholecystectomy is associated with a clear reduction in the occurrence of early post-operative port-site pain when the gall bladder is retrieved via the umbilical port than when it is retrieved via the epigastric port, regardless of patient age, sex, BMI, surgical indication, and comorbidities. Umbilical approach may thus be a better method to provide better patient comfort during the immediate post-operative period without risking complications. These results justify the consideration of the umbilical port as the most optimal location of gall bladder extraction, and the considerable importance of conducting larger multicenter studies to confirm and expand these findings.

Authors' Contribution

Conceptualization: KN
Methodology: KN, MMI, AYK, MUK, MS
Formal analysis: KN, MMK, MUK, MS
Writing and Drafting: MMI, MMK, AYK, MUK
Review and Editing: KN, MMI, MMK, AYK, MUK, MS, HAK

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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