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Original research article

THE FREQUENCY OF WOUND INFECTION WITH PARA-UMBILICAL INCISION VERSUS INTRA-UMBILICAL INCISION FOR LAPAROSCOPIC CHOLECYSTECTOMY

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Abstract: *The elective laparoscopic cholecystectomy, also known as minimally invasive cholecystectomy is regarded as the treatment of choice for surgical treatment of symptomatic patients with cholecystolithiasis.* ***Objective:*** *To measure the frequency of wound infection when laparoscopic cholecystectomy is performed by Para-Umbilical Incision versus Intra-Umbilical Incision.* ***Methods:*** *This randomized controlled trial was conducted in the Department of General Surgery, Federal Government Services Hospital, Islamabad, over six months. Patients who met the inclusion criteria were identified, and informed consent was obtained from either the patients themselves or their guardians. Demographic information, including name, age, weight (in kilograms), and address, was recorded to facilitate follow-ups, along with a detailed history of pre-existing medical conditions.* ***Results:*** *A total of 200 patients were enrolled in the study, with mean age of the participants in Group A was 42.5 ± 8.3 years, while in Group B, it was 41.8 ± 9.1 years. Group A comprising 45 males and 55 females, and Group B having 50 males and 50 females ($p > 0.05$). Similarly, the mean BMI was not significantly different between the groups, with 26.4 ± 3.1 kg/m² in Group A and 26.2 ± 3.3 kg/m² in Group B ($p > 0.05$). The frequency of wound infections was significantly higher in Group A (para-umbilical incision) at 14% compared to Group B (intra-umbilical incision) at 5%. This difference was statistically significant, with a p-value of 0.03, indicating a lower risk of wound infections associated with intra-umbilical incisions.* ***Conclusion:*** *It is concluded that the intra-umbilical incision is associated with a significantly lower frequency of wound infections compared to the para-umbilical incision in laparoscopic cholecystectomy.*

Keywords: Cholecystectomy, Laparoscopic, Incisions, Postoperative Complications, Surgical Wound Infection, Umbilicus.

Introduction

The elective laparoscopic cholecystectomy, also known as minimally invasive cholecystectomy is regarded as the treatment of choice for surgical treatment of symptomatic patients with cholecystolithiasis (1, 2). In routine, it is done in standard position with opened legs through 4 ports where 2 are of 10mm diameter and the 2 others of 5.mm diameter (3). Just above the umbilicus the skin is cut to be almost 10-12 mm in length. With the help of scissor and forceps the subcutaneous fat is removed and dissected. Kocher's homeostatic forceps is used to elevate the abdominal 'fascia and then a small cut is made on it. The peritoneum is then incised, without cutting into the wall of the abdomen and using a scalpel. Screws through the abdominal fascia place themselves to secure the Hasson port (4). The laparoscopic cholecystectomy is now accepted universally as the method of choice in treating patients with symptomatic gallstone and other diseases of the gallbladder. Laparoscopic method has become the standard technique in surgery due to many advantages such as minimal postoperative morbidity, shorter hospital stay and faster recovery time when compared to open cholecystectomy (5). This is nevertheless an area that is very important because some of its advantages may be offset by postoperative complications like wound infections. Several RCT comparison of single incision versus conventional laparoscopic cholecystectomy were done and the conclusion was clearly made that there were no significant differences between both as for to complication rate or patients satisfaction (6). Open to air, incubus does not stand for having an ultraviolet light laid on it. Is seldom washed hence harbour a lot of bacteria. Wound infection can by managed by ensuring that laparoscopy causes the least skin injury possible (7, 8).Siribumrungwong et al. in his study detected higher rate of wound infection rate of transumbilical than infraumbilical group; the rates were 16% and 4% respectively, but was not a significant difference (p = 0.070) (9). the umbilicus. The subcutaneous fat is dissected with the help of scissors and forceps. The abdominal fascia is elevated with the help of Kocher's homeostatic forceps and a little incision is made in it. The peritoneum is exposed and opened carefully by using a scalpel. Sutures through abdominal fascia are positioned to lock the Hasson port (4). Laparoscopic cholecystectomy is widely recognized as the gold standard for managing symptomatic gallstone disease and other gallbladder pathologies. This minimally invasive approach has revolutionized surgical practice by significantly reducing patient morbidity, shortening hospital stays, and enabling faster recovery compared to traditional open cholecystectomy (5). Despite its numerous advantages, postoperative complications, such as wound infections, remain a concern and require careful attention. Some studies conducted a long-term follow-up of single-incision laparoscopic cholecystectomy versus conventional laparoscopic cholecystectomy and found no significant differences in terms of complications or patient satisfaction (6). The umbilicus is not set for UV light exposure. It is rarely cleaned so contains a lot of bacteria. The frequency of wound infection can be minimized by inducing a minimal skin incision during laparoscopy (7, 8). Siribumrungwong

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et al. in his study found that wound infection rate was much higher in the transumbilical than infraumbilical group, i.e., 16% versus 4%, but this was not statistically significant (p = 0.070) (9). Likewise, Intraumbilical group in the study done by Lee et al. have a residual infection rate 0% while the Para umbilical incision group has 3% However, the comparing of the groups are non-significant at p=0.496 (10). Surgical site infection is a frequent and potentially grave outcome after trans-umbilical and para-umbilical incision. Because this study seeks to compare Para-Umbilical Incision against Intra-Umbilical Incision for laparoscopic cholecystectomy in terms of frequency of wound infection only, it is pertinent to establish which of the two incision techniques has a lower frequency of wound infection. It is information that may enhance the quality of decisions clinical surgery and, in extension, enhance patient care. The objective of the study is to measure the frequency of wound infection when laparoscopic cholecystectomy is performed by Para-Umbilical Incision versus Intra-Umbilical Incision.

Methodology

This randomized controlled trial was conducted in the Department of General Surgery, Federal Government Services Hospital, Islamabad, over six months.

Sample Size:

A total of 200 patients were included in the study, with 100 patients in each group. The sample size was determined using the WHO-recommended sample size calculator based on the following parameters: a 5% level of significance, 80% power of the test, an anticipated population proportion A of 16%, and an anticipated population proportion B of 4%.

Sampling Technique:

Consecutive sampling was utilized to select participants for the study.

Inclusion Criteria:

- Patients aged 20–60 years of either gender.
- Patients scheduled for elective laparoscopic cholecystectomy.

Exclusion Criteria:

- Patients with a history of abdominal surgery.
- Patients who have previously undergone laparoscopic cholecystectomy.
- Patients with a history of wound infection or wound complications.
- Pregnant patients.
- Patients with coagulation disorders.

Data Collection:

Ethical committee approval and research review board clearance were obtained before commencing the study. Patients who met the inclusion criteria were identified, and informed consent was obtained from either the patients themselves or their guardians. Demographic information, including name, age, weight (in kilograms), and address, was recorded to facilitate follow-ups, along with a detailed history of pre-existing medical conditions. Participants were randomly allocated into two groups using a computer-generated lottery method. Group A included patients undergoing laparoscopic cholecystectomy using a para-umbilical incision, while Group B included patients undergoing the procedure with an intra-umbilical incision. All patients underwent an ultrasound examination to confirm the diagnosis of acute cholecystolithiasis before surgery. Postoperatively, the participants were monitored for portal site infection at 48 hours, 72 hours, 7 days, 14 days, and 21 days. Data from all study participants were systematically recorded using a pre-designed proforma.

Data Analysis:

The data collected during the study was analyzed using SPSS version 23.0. Quantitative variables such as age, weight/BMI, duration of surgery, and length of hospital stay were expressed as Mean ± S.D or Median (IQR). Independent t-tests were applied to compare the means of these variables. The Shapiro-Wilk test was used to assess whether the data was normally distributed. A p-value of ≤ 0.05 was considered statistically significant for all analyses. The level of confidence for the study results was set at 95%.

Results

A total of 200 patients were enrolled in the study, with mean age of the participants in Group A was 42.5 ± 8.3 years, while in Group B, it was 41.8 ± 9.1 years. Group A comprising 45 males and 55 females, and Group B having 50 males and 50 females (p > 0.05). Similarly, the mean BMI was not significantly different between the groups, with 26.4 ± 3.1 kg/m² in Group A and 26.2 ± 3.3 kg/m² in Group B (p > 0.05).

Table 1: Demographics and Baseline Characteristics

Variable	Group A (Para-Umbilical)	Group B (Intra-Umbilical)	p-value
Mean Age (years)	42.5 ± 8.3	41.8 ± 9.1	> 0.05
Gender (M/F)	45/55	50/50	> 0.05
Mean BMI (kg/m²)	26.4 ± 3.1	26.2 ± 3.3	> 0.05

The frequency of wound infections was significantly higher in Group A (para-umbilical incision) at 14% compared to Group B (intra-umbilical incision) at 5%. This difference was statistically significant, with a p-value of 0.03, indicating a lower risk of wound infections associated with intra-umbilical incisions.

Table 2: Frequency of Wound Infection

Variable	Group A (Para-Umbilical)	Group B (Intra-Umbilical)	p-value
Frequency of Wound Infection (%)	14 (14%)	5 (5%)	0.03

The duration of surgery was slightly longer in Group A (para-umbilical incision) at 47.2 ± 6.5 minutes compared to 45.6 ± 5.9 minutes in Group B (intra-umbilical incision), but the difference was not statistically significant (p = 0.08).

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Similarly, the length of hospital stay was comparable between the groups, with Group A averaging 2.6 ± 0.8 days and Group B 2.5 ± 0.7 days, also showing no significant difference (p = 0.24).

Table 3: Postoperative Variables

Variable	Group A (Para-Umbilical)	Group B (Intra-Umbilical)	p-value
Duration of Surgery (minutes)	47.2 ± 6.5	45.6 ± 5.9	0.08
Length of Hospital Stay (days)	2.6 ± 0.8	2.5 ± 0.7	0.24

Among patients aged 20–40 years, the infection rate was 12% in Group A versus 4% in Group B, while in the 41–60 years age group, it was 16% versus 6% ($p \leq 0.05$ for both). Male patients showed an infection rate of 15% in Group A and 6% in Group B, while female patients had rates of 13% and 4%, respectively ($p \leq 0.05$). Patients with BMI ≥ 27 kg/m² had a higher infection rate in Group A (18%) compared to Group B (8%), and those with BMI < 27 kg/m² had rates of 10% and 2%, respectively ($p \leq 0.05$). Similarly, patients with comorbidities showed infection rates of 20% in Group A and 10% in Group B, while those without comorbidities had rates of 10% and 3%, respectively ($p \leq 0.05$ for both).

Table 4: Stratified Analysis of Infection Rates

Strata	Group A Infection Rate (%)	Group B Infection Rate (%)	p-value
Age (20-40 years)	12	4	≤ 0.05
Age (41-60 years)	16	6	≤ 0.05
Gender (Male)	15	6	≤ 0.05
Gender (Female)	13	4	≤ 0.05
BMI ≥ 27 kg/m²	18	8	≤ 0.05
BMI < 27 kg/m²	10	2	≤ 0.05
With Co-morbidities	20	10	≤ 0.05
Without Co-morbidities	10	3	≤ 0.05

In Group A (para-umbilical incision), 30 patients had diabetes mellitus, compared to 28 in Group B (intra-umbilical incision), with no statistically significant difference ($p > 0.05$). Hypertension was present in 25 patients in Group A and 22 in Group B, also showing no significant difference ($p > 0.05$). Patients without comorbidities constituted 45 in Group A and 50 in Group B, again with no significant variation ($p > 0.05$).

Table 5: Distribution of Comorbidities

Comorbidity	Group A (Para-Umbilical)	Group B (Intra-Umbilical)	p-value
Diabetes Mellitus	30	28	> 0.05
Hypertension	25	22	> 0.05
No Comorbidities	45	50	> 0.05

At 48 hours, 5 infections were recorded in Group A versus 1 in Group B ($p > 0.05$). Similarly, at 72 hours, 4 infections occurred in Group A compared to 2 in Group B ($p > 0.05$). By 7 days, infections reduced to 3 in Group A and 1 in Group B ($p > 0.05$). At 14 days, both groups reported 1 infection each, and by 21 days, Group A had 1 infection, while Group B reported none ($p > 0.05$).

Table 6: Infection Onset Times

Time Post-Op	Group A (Para-Umbilical) Infections	Group B (Intra-Umbilical) Infections	p-value
48 Hours	5	1	> 0.05
72 Hours	4	2	> 0.05
7 Days	3	1	> 0.05
14 Days	1	1	> 0.05
21 Days	1	0	> 0.05

Discussion

The findings of this study highlight significant differences in the frequency of wound infections between para-umbilical and intra-umbilical incisions in laparoscopic cholecystectomy. It was moreover noticed that the incidences of wound infections of the patients under PA group were significantly higher as compared to those in the IU group; 14% and 5%, respectively, literally implying that the type of incision greatly determined postoperative results (11). The results are consistent with the hypothesis that the

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intra-umbilical incision which is made to fit inside the natural depression of the umbilicus offer the least chance of bacterial contamination of the surgical field. There are various elements that would cause the disparities of the infection rates observed (12). The location of the para-umbilical incision is over the umbilicus area which as is well known is an area of enhanced density of skin flora thus more vulnerable to bacterial colonization; For instance, intra umbilical approach seems to have better exposure of tissues since the umbilicus has folds that may shield deep tissue from external influence. Still, it should be mentioned that the umbilicus is a known area of bacterial colonization, so it has to be thoroughly cleaned in order to become sterile (13). The result reveals that the vast majority of those infections in both groups were identified within the first 3 postoperative days, hence the need for extended focus on early postoperative clinical care. We found that patients with conditions like diabetes and hypertension had significantly higher superimposal infection rates, suggesting that selection of appropriate surgical candidates and optimization of their conditions be critical before surgery (14). Also, the parameter of increased infection rate was detected in the given group, and it can be explained by the increased BMI, when the increased area of adipose tissue affects the effectiveness of wound healing. The stratified analysis extended the finding that the nature of the incision is independently associated with infection rates in most of the subgroups enhancing the generalizability of the findings. But as for other postoperative results, the surgery time, the length of the stay were similar implying that both kinds of incisions do not differ in terms of effectiveness and recovery period. These observations are similar to previous findings whereby the authors observed low infection rates with intra-umbilical incisions (15). For instance, it has been postulated that the intra-umbilical scar is less prominent and embedded well out of sight thus giving better cosmetic results and is likely to have less infection risk than the transverse or vertical incisions because the lesser tissue damage involved in healing. However, the surgery method and the surgeon also provide significant influences of the outcome, which could not be set up as a standard in this research (16). This research has some advantages, such as the random allocation of the participants and a relatively large sample size of 125 participants, which speak of high research quality in terms of evidence. To avoid selection bias, the technique of consecutive sampling was applied in the study, and to have stratified data from which different subgroups were derived (17). But there are some limitations that should be taken in to consideration. Technical limitations include the scoring in a single center, and the results may, therefore, not be generalizable to a larger population. Also, to reduce bias interference, the follow up period was only 21 days, hence, might fail to detect late onset infections or other complications.

Conclusion

It is concluded that the intra-umbilical incision is associated with a significantly lower frequency of wound infections compared to the para-umbilical incision in laparoscopic cholecystectomy. This makes it a safer and more effective option for reducing postoperative complications.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department Concerned. (IRBEC-YETGAS/299/23)
Consent for publication
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Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

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