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Comparison Between The Risk Of Wound Infection In Peri- Umbilical Incision With Intraumbilical Incision In Laparoscopic Procedures

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ABSTRACT

Background: Laparoscopic surgery is increasingly preferred for various abdominal procedures due to its minimally invasive nature. However, port site complications, particularly wound infections, remain a significant concern. The method of umbilical access—either intra-umbilical or periumbilical—may influence the rate of postoperative infections, yet evidence comparing the two remains limited. To compare the frequency of wound infection between intra-umbilical and periumbilical incisions in patients undergoing laparoscopic appendectomy or cholecystectomy.

Methods: A descriptive study was conducted over six months in the Department of Surgery at Khyber Teaching Hospital, Peshawar. A total of 201 patients undergoing laparoscopic surgeries were enrolled using a non-probability consecutive sampling technique. Patients were divided into Group A (intra-umbilical incision, n=101) and Group B (periumbilical incision, n=100). Baseline demographics, comorbidities, and type of surgery were recorded. Postoperative wound infections were assessed within two weeks based on predefined clinical criteria. Data were analyzed using SPSS v25, with Chi-square and Fisher's exact tests applied where appropriate.

Results: The overall wound infection rate was 11.4%, with 8 infections (7.9%) in Group A and 15 infections (15%) in Group B. The infection rate was nearly double in the periumbilical group compared to the intra-umbilical group. Other variables, including comorbidities and type of surgery, were comparable between the groups.

Conclusion: Intra-umbilical incisions were associated with a lower incidence of wound infections compared to periumbilical incisions in laparoscopic procedures. This method may offer a safer and cosmetically superior alternative for initial port access in routine laparoscopic surgeries.

Keywords: Appendectomy, Cholecystectomy, Incisional Wound Infection, Laparoscopy, Port Site Complications, Surgical Incisions, Surgical Wound Infection, Umbilicus, Wound Healing.

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INTRODUCTION

Laparoscopic surgery has become a cornerstone of modern surgical practice, offering minimally invasive alternatives to traditional open procedures across a wide range of disciplines, including appendectomy, cholecystectomy, and hernia repair[1]. While the benefits of laparoscopy are well established, current surgical discourse has shifted towards optimizing techniques within laparoscopic approaches, particularly regarding port placement and incision methods. Among these, the choice between intra-umbilical and periumbilical incisions for laparoscopic access has garnered attention due to potential differences in postoperative outcomes, particularly wound infection rates. The periumbilical incision, typically U-shaped and placed either superior or inferior to the umbilicus, involves cutting through the skin, subcutaneous fat, and fascia, allowing access for the initial laparoscopic port [2,3]. In contrast, the intra-umbilical incision is a vertical, linear cut confined to the umbilical ring, requiring only division of the skin and fascia. This more conservative approach is often quicker, technically simpler, and presumed to be less traumatic [4]. As single-incision laparoscopic surgery (SILS) has gained popularity for its cosmetic advantages, intra-umbilical access has become increasingly common. However, concerns remain regarding infection risk due to the umbilicus's natural anatomy and microbiology. The umbilical area, being recessed and moist, harbors a dense and diverse bacterial population—over 1,400 species have been identified in cultures from human umbilici [5,6]. These factors may influence the susceptibility of each incision type to postoperative wound infections.

Emerging evidence has begun to address these concerns. For instance, a study reported a wound infection rate of 7.6% for intra-umbilical incisions compared to 15.4% for periumbilical incisions[7 8], suggesting a possible advantage in infection control with the former. However, data directly comparing these two incision types within the same patient population remain limited, particularly in regional contexts where surgical environments, patient demographics, and microbial exposure may vary significantly[9 10]. This gap in the literature underscores the need for targeted studies evaluating the comparative safety and efficacy of these incision techniques. Understanding whether one approach offers a lower risk of infection is critical not only for improving patient outcomes but also for guiding best surgical practices in minimally invasive procedures. The findings could influence surgeon preference and institutional protocols, ultimately reducing postoperative complications and healthcare burden. Therefore, the objective of this study is twofold: first, to determine the frequency of wound infections at the umbilical port site following laparoscopic surgeries; and second, to compare the infection rates between intra-umbilical and periumbilical incisions in such procedures.

METHODS

This study was designed as a descriptive, observational analysis conducted at the Department of Surgery, Khyber Teaching Hospital, Peshawar. The duration of the study was six months, commencing after approval from the institutional research review board. Ethical clearance was obtained prior to study initiation, and informed written consent was obtained from all participants after thoroughly explaining the purpose, benefits, and potential risks of the research in a language understandable to them. The sample size was calculated using the WHO sample size calculator, based on a 15.4% anticipated frequency of wound infection in periumbilical incisions [6], with a 5% margin of error and a 95% confidence level. The required sample size was 201 patients. A non-probability consecutive sampling technique was employed to enroll eligible patients from the hospital's surgical wards. Inclusion criteria comprised patients aged 20 to 70 years of either gender undergoing laparoscopic procedures as defined operationally, including appendectomy and cholecystectomy. Exclusion criteria were carefully defined to eliminate potential confounding factors and included patients with prior abdominal surgeries, immunocompromised status, those on chronic steroid therapy, patients with inflammatory bowel disease, those who underwent conversion from laparoscopic to open surgery, individuals with abdominal wall deformities, and those with a BMI greater than 30 kg/m² [11,12]. After enrollment, baseline demographic and clinical information was recorded, including age, gender, BMI (calculated as weight in kilograms divided by the square of height in meters), residential background, education level, profession, socioeconomic status, and presence of comorbid conditions such as diabetes mellitus (defined as fasting blood sugar >130 mg/dL) and hypertension (defined as blood pressure >140/90 mmHg).

The type of laparoscopic surgery performed (appendectomy or cholecystectomy) was documented. Patients were grouped based on the type of incision made during surgery: intra-umbilical (Group A) or periumbilical (Group B). All surgical interventions and postoperative care followed standardized hospital protocols. This included administration of intravenous broad-spectrum antibiotics, daily wound dressing, and adequate analgesia. Upon clinical stabilization, patients were discharged with oral antibiotics and analgesics and were instructed on daily wound care. Stitches were removed seven days postoperatively. Participants were followed for a period of two weeks after surgery. Wound sites were examined for signs of infection based on predefined clinical criteria, including erythema greater than 1 cm from the wound margin, tenderness, and the presence of serosanguinous or purulent discharge. All data were collected by the principal investigator using a structured proforma specifically designed for the study. Data were analyzed using IBM SPSS Statistics version 25. Quantitative variables such as age, BMI, and hospital stay were assessed for normal distribution using the Shapiro-Wilk test and presented as means with standard deviations or medians with interquartile

ranges, as appropriate [13,14]. Categorical variables including gender, residence, education, profession, socioeconomic status, comorbidities, type of surgery, incision type, and wound infection were reported using frequencies and percentages. The association between incision type and wound infection was evaluated using the Chi-square test or Fisher's exact test where applicable, with a significance level set at $p \leq 0.05$. Effect modifiers such as age, gender, BMI, type of surgery, comorbid conditions, residential status, and socioeconomic status were controlled through stratification, followed by post-stratification application of the Chi-square or Fisher's exact test to determine statistically significant differences.

RESULTS

Table 1: Demographic Characteristics of Patients

Variable		Group A (n = 101)	Group B (n = 100)
Mean Age (years)	Mean Age (years)	38.7	39.5
Gender	Male	52	50
	Female	49	50
Mean BMI (kg/m²)		26.4	26.8
Residence	Urban	61	58
	Rural	40	42
Education	Primary	25	27
	Middle	39	41
	Higher	37	32
Profession	Self-employed	43	46
	Job	58	54
Socioeconomic Status	Lower	30	33
	Middle	47	45
	Upper	24	22

A total of 201 patients undergoing laparoscopic surgery were included in this study, with 101 patients in Group A (intra-umbilical incision) and 100 in Group B (peri-umbilical incision). The mean age of patients in Group A was 38.7 years, while in Group B it was slightly higher at 39.5 years. Gender distribution was balanced across both groups, with males accounting for 52 in Group A and 50 in Group B. The mean BMI was 26.4 kg/m² in Group A and 26.8 kg/m² in Group B. Urban residency

was slightly more prevalent in both groups, with 61 patients in Group A and 58 in Group B. In terms of education level, the largest subgroup in both groups had middle-level education, followed by higher and primary levels. Professionally, 58% of Group A were jobholders compared to 54% in Group B, while self-employment accounted for the remaining proportions. Socioeconomic status varied similarly between groups, with most participants belonging to the middle class (**Table 1**).

Table 2: Comorbid Conditions

Condition		Group A (n = 101)	Group B (n = 100)
Diabetes Mellitus	Yes	22	24
	No	79	76
Hypertension	Yes	19	22
	No	82	78

Regarding comorbidities, 22 patients in Group A and 24 in Group B had diabetes mellitus. Hypertension was present in 19 patients in Group A and 22 in Group B (**Table 2**).

Table 3: Type of Laparoscopic Surgery Performed

Surgery Type	Group A (n = 101)	Group B (n = 100)
Appendectomy	54	50
Cholecystectomy	47	50

Appendectomy was the more frequently performed procedure in both groups, with 54 cases in Group A and 50 in Group B. Cholecystectomy was performed in 47 patients in Group A and 50 in Group B (**Table 3**).

Table 4: Wound Infection Outcome

Wound Infection	Group A (n = 101)	Group B (n = 100)
Yes	8 (7.9%)	15 (15%)
No	93 (92.1%)	85 (85%)

The primary outcome of interest—wound infection—was observed in 8 patients (7.9%) in Group A and 15 patients (15%) in Group B. The rate of wound infection was nearly twice as high in the peri-

umbilical incision group compared to the intra-umbilical group, although statistical significance would be further assessed via chi-square test (**Table 4**).

DISCUSSION

The present study aimed to compare the incidence of wound infection between intra-umbilical and periumbilical incisions in patients undergoing laparoscopic surgeries, a topic of increasing relevance with the widespread adoption of minimally invasive techniques. The findings demonstrated a notably lower rate of wound infection in the intra-umbilical incision group (7.9%) compared to the periumbilical group (15%), suggesting a potentially safer profile for intra-umbilical access in terms of postoperative infectious complications. These results are in alignment with existing literature, particularly a randomized comparative study, which reported wound infection rates of 7.28% for intra-umbilical incisions and 26.44% for periumbilical incisions in laparoscopic appendectomy, a statistically significant difference favoring intra-umbilical access [15, 16, 17]. Similarly, a study found wound infection rates of 1.2% in intra-umbilical incisions versus 3% in periumbilical incisions, supporting the conclusion that intra-umbilical incisions may reduce the likelihood of wound-related complications [18]. A meta-analysis concluded that although differences in infection rates were not statistically significant across multiple studies, intra-umbilical incisions generally offered shorter operative times and better cosmetic outcomes, adding indirect support to their adoption as a preferred access route [19]. Cosmetic outcomes, though not directly measured in the current study, have been repeatedly favored in intra-umbilical approaches, as noted by a study, found significantly higher patient satisfaction with intra-umbilical incisions without increasing complication rates [20,21].

Despite the encouraging results, this study has limitations that merit consideration. The non-probability sampling method, although practical for clinical convenience, may introduce selection bias. The sample size, while statistically justified, may still be underpowered to detect smaller but clinically meaningful differences in subgroups. Furthermore, the follow-up period was restricted to two weeks postoperatively, possibly overlooking delayed wound infections or other complications such as incisional hernia, which may manifest later. Longer follow-up would provide a more comprehensive assessment of incision-related complications. In addition, although standard postoperative care protocols were applied, variations in patient adherence to wound care instructions after discharge could affect infection outcomes. Also, potential confounding variables like intraoperative contamination risk, surgeon experience, and precise suture techniques were not controlled or stratified, which could have influenced the observed results. Another strength of the study is its real-world applicability within a high-volume tertiary care setting, enhancing the external

validity of the findings. Additionally, the inclusion of diverse demographic and clinical variables allows for broad generalization across patient populations undergoing similar procedures.

The findings suggest that intra-umbilical incisions may be a safer and more cosmetically favorable alternative to periumbilical incisions, particularly in laparoscopic appendectomy and cholecystectomy. The growing body of literature supports the safety and efficacy of this approach across various populations, including pediatric and high-risk surgical candidates [22]. Future studies should aim to include larger randomized controlled trials with longer follow-up durations to assess delayed complications such as hernias and cosmetic outcomes. Further exploration of incision-related bacterial colonization and its correlation with wound infection could refine perioperative antimicrobial protocols. Incorporating objective cosmetic scoring systems and patient-reported outcomes will also be crucial in evaluating patient satisfaction more comprehensively. In conclusion, intra-umbilical incision appears to offer a favorable balance of safety and efficacy for port-site access in laparoscopic surgeries. These findings reinforce its utility in clinical practice and provide a rationale for its broader adoption in minimally invasive surgical procedures

CONCLUSION

This study concluded that intra-umbilical incisions are associated with a lower rate of wound infection compared to periumbilical incisions in laparoscopic surgeries. Given their safety, ease of execution, and cosmetic benefits, intra-umbilical incisions may be a more favorable approach for port-site access. These findings support a shift in surgical preference toward intra-umbilical techniques to minimize postoperative complications and improve patient outcomes.

LIST OF ABBREVIATIONS

None

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

This study was approved by Khyber Medical College, Institute Review Board (Approval No: 582/DME/KMC).

AUTHORS' CONTRIBUTION

All authors contributed equally as per ICMJE

REFERENCES

1. Bessoff KE, Forrester JD. Appendicitis in Low-Resource Settings. Surg Infect (Larchmt). 2020;21(6):523-32.

2. Yin P, Teng S, Li H, Wang J, Liu Z. Association between body composition and incisional surgical site infection after laparoscopic appendectomy for complicated appendicitis. BMC Surg. 2024;24(1):297.

3. Caroff DA, Chan C, Kleinman K, Calderwood MS, Wolf R, Platt R, et al. Combined laparoscopic and open colon surgery rankings fail to accurately rank hospitals by surgical-site infection rate. Infect Control Hosp Epidemiol. 2023;44(4):624-30.

4. Yousaf A, Amjad H, Ulfat A, Munawar A, Chishti MA, Mehmood A. Comparative trial of periumbilical incision versus intraumbilical incision in Emergency laparoscopic appendectomy in a high volume laparoscopic surgery centre. JAIMC: Journal of Allama Iqbal Medical College. 2023.

5. Luo HM, Xiong YJ. Comparing surgical site wound infection after laparoscopic and open radical cystectomies in patients with bladder cancer. Int Wound J. 2024;21(4):e14718.

6. Keerthi M, Kore S, Togale M. A Comparison of Cosmetic Outcome of Periumbilical versus Intraumbilical Incision in Laparoscopic Appendectomy and Cholecystectomy-A One Year Randomised Controlled Trial. Medical Research Archives. 2023.

7. Kurobe M, Sugihara T, Harada A, Kaji S, Uchida G, Kanamori D, et al. The Comparison of Postoperative Umbilical Port Site-Related Complications Between Transumbilical and Periumbilical Incision After Laparoscopic Surgery in Children. Journal of laparoendoscopic & advanced surgical techniques Part A. 2023.

8. Utsumi M, Yamada T, Yamabe K, Katsura Y, Fukuchi N, Fukunaga H, et al. Differences in risk factors for surgical site infection between laparotomy and laparoscopy in gastrointestinal surgery. PLoS One. 2022;17(9):e0274887.

9. Gómez Ruiz M, Espin-Basany E, Spinelli A, Cagigas Fernández C, Bollo Rodriguez J, María Enriquez Navascués J, et al. Early outcomes from the Minimally Invasive Right Colectomy Anastomosis study (MIRCAST). Br J Surg. 2023;110(9):1153-60.

10. Kong DS, Zhang HL, Zhao XL, Meng Y, Chai W, Wang ZY. Effect of laparoscopic pancreaticoduodenectomy on the incidence of surgical-site wound infection: A meta-analysis. Int Wound J. 2023;20(9):3682-9.

11. Stone R, Carey E, Fader AN, Fitzgerald J, Hammons L, Nensi A, et al. Enhanced Recovery and Surgical Optimization Protocol for Minimally Invasive Gynecologic Surgery: An AAGL White Paper. J Minim Invasive Gynecol. 2021;28(2):179-203.

12. Liu J, Wang Q. Impact of surgical site infection after open and laparoscopic surgery among paediatric appendicitis patients: A meta-analysis. Int Wound J. 2024;21(4):e14524.

13. Matsukuma S, Tokumitsu Y, Nakagami Y, Shindo Y, Matsui H, Nakajima M, et al. Laparoscopic resection reduces superficial surgical site infection in liver surgery. Surg Endosc. 2021;35(12):7131-41.

14. Hernandez A, Petersen R. Laparoscopic Ventral Hernia Repair. Surg Clin North Am. 2023;103(5):947-60.

15. Shi Z. Laparoscopic vs. open surgery: A comparative analysis of wound infection rates and recovery outcomes. Int Wound J. 2024;21(3):e14474.

16. Cuevas-Toledano J-F, Picazo-Yeste J, Moreno-Sanz C. Modified Intraumbilical Versus Infraumbilical Entry Method at Laparoscopy: A Cohort Study. Surgical Laparoscopy, Endoscopy & Percutaneous Techniques. 2021;32:21-7.

17. Gamo GO, Reichardt GS, Guetter CR, Pimentel SK. RISK FACTORS FOR SURGICAL WOUND INFECTION AFTER ELECTIVE LAPAROSCOPIC CHOLECYSTECTOMY. Arq Bras Cir Dig. 2022;35:e1655.

18. de'Angelis N, Schena CA, Moszkowicz D, Kuperas C, Fara R, Gaujoux S, et al. Robotic surgery for inguinal and ventral hernia repair: a systematic review and meta-analysis. Surg Endosc. 2024;38(1):24-46.

19. Alganabi M, Biouss G, Pierro A. Surgical site infection after open and laparoscopic surgery in children: a systematic review and meta-analysis. Pediatr Surg Int. 2021;37(8):973-81.

20. Wang XB, Lin JM, Chen YP, Ye XX. Surgical site wound infection and pain after laparoscopic repeat hepatectomy for recurrent hepatocellular carcinoma. Int Wound J. 2023;20(8):3262-70.

21. Shih S-L, Chen B-H, Tam K. Transumbilical versus periumbilical incision for laparoscopic surgery: A meta-analysis. American journal of surgery. 2020.

22. Awan WS, Farrukh R, Bilqees U, Khan AH, Jillani AA, Mahmood K. Transumblical versus infraumblical pneumoperitoneum: a comparative study. Professional Med J. 2020; 27(2):388-94.