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Original Research Article

COMPARISON OF LAPAROSCOPIC AND OPEN APPENDECTOMY IN TERMS OF SURGICAL SITE INFECTION

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Abstract: *Appendectomy is a common surgical procedure, and the choice between laparoscopic and open approaches has clinical significance. Surgical site infection (SSI) is a critical postoperative complication. This study aimed to compare laparoscopic and open appendectomy in terms of SSI rates. A prospective observational study was conducted at multiple centers including Department of General Surgery, MRHSM Hospital Pabbi Nowshera, Jinnah Teaching Hospital Peshawar and Cat C Hospital Tangi Charsadda, DHQ Hospital Daggar Buner, Khyber Pakhtunkhwa Pakistan in the duration from July, 2023 to December, 2023. The research is involving 320 patients aged 14 to 64 years. Data included demographic information, surgical approach, operative time, hospital stay, and SSI severity using the Southampton grading system. Statistical analysis was performed using SPSS. Laparoscopic (Group A, n=110) and open (Group B, n=210) appendectomies were compared. Group A had a shorter hospital stay ($p < 0.05$) and similar operative times. SSI rates favored laparoscopic surgery ($p < 0.05$), with fewer patients developing infections within 10 days post-surgery. Laparoscopic appendectomy demonstrated reduced SSI risk and improved postoperative outcomes. Laparoscopic appendectomy is associated with lower SSI rates, shorter hospital stays, and comparable operative times compared to open appendectomy. These findings support the preference for laparoscopic surgery, especially in low-risk patients, to enhance postoperative outcomes.*

Keywords: Appendectomy, Laparoscopic Surgery, Open Surgery, Surgical Site Infection, Postoperative Outcomes

Introduction

Appendectomy, the surgical removal of the appendix, is one of the most common surgical procedures performed worldwide (Sartelli et al., 2018). Traditionally, open appendectomy has been the standard approach for treating acute appendicitis. However, with advancements in surgical techniques, laparoscopic appendectomy has gained popularity as a minimally invasive alternative (Basunbul et al., 2022; Cai et al., 2013). The choice between laparoscopic and open appendectomy depends on various factors, including the patient's condition, surgeon's expertise, and hospital resources (Robinson et al., 2018).

Laparoscopic appendectomy involves making several small incisions in the abdomen to insert a camera and specialized instruments for appendix removal. In contrast, open appendectomy requires a larger incision in the abdominal wall to directly access and remove the inflamed appendix (McAnena and Willson, 1993).

The selection between laparoscopic and open appendectomy is a critical decision that can impact postoperative outcomes, including the risk of surgical site infection (SSI) (Danwang et al., 2018; Tansawet et al., 2023). Surgical site infection is a common complication following abdominal surgery and can lead to prolonged hospital stays, increased healthcare costs, and patient discomfort.

The rationale behind this study is to compare laparoscopic and open appendectomy in terms of surgical site infection rates. While both procedures have been widely practiced, there is a need to provide evidence-based data that can inform surgical decisions and improve patient care. Understanding the differences in SSI rates between laparoscopic and open appendectomy can help healthcare professionals make informed choices when selecting the surgical approach.

The primary objective of this study is to assess and compare the incidence of surgical site infection between laparoscopic and open appendectomy procedures. By evaluating the infection rates, this study aims to contribute to the body of knowledge surrounding the choice of surgical approach for appendectomy and its impact on patient outcomes.

Methodology

This research employed a prospective observational study design to investigate the outcomes of appendectomies performed at at multiple centers including Department of General Surgery, MRHSM Hospital Pabbi Nowshera, Jinnah Teaching Hospital Peshawar and Cat C Hospital Tangi Charsadda, DHQ Hospital Daggar Buner, Khyber Pakhtunkhwa in the duration from July, 2023 to December, 2023. Patient Selection: A total of 320 patients were enrolled in the study using a systematic sampling approach. Patients were selected from the pool of individuals undergoing appendectomy procedures at the hospital during the specified time frame. The Institutional Review Board

(IRB) of the Hospital granted ethical approval for this study. All participating patients or their legal guardians provided informed consent. Patients aged between 14 and 64 years who underwent either laparoscopic or open appendectomy were included in the study. Complete medical records and follow-up data were also required. Patients who had a history of chronic illnesses that could affect surgical outcomes, had concurrent infections or comorbidities that could confound the results, or were undergoing emergency appendectomy were excluded from the study. For each patient enrolled, the study collected demographic information such as age and gender, type of surgical procedure (laparoscopic or open), duration of operation (in minutes), length of hospital stay (in days), and whether or not they developed a surgical site infection (SSI) and its severity based on the Southampton grading system.

Laparoscopic Appendectomy (Group A): This minimally invasive approach involved making small incisions and using a laparoscope to remove the inflamed appendix (**Figure 1**).

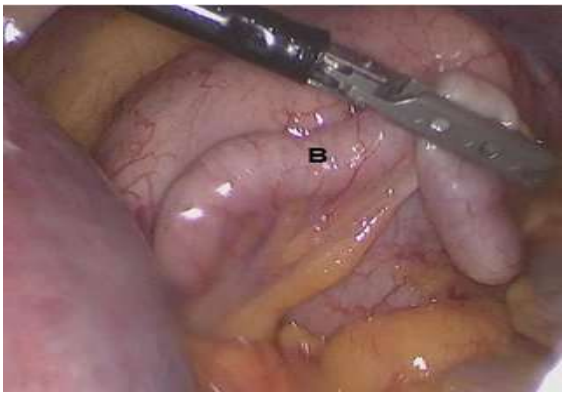

Fig.01 Laparoscopic Appendectomy (Group A)

Open Appendectomy (Group B): This conventional surgical method involved making a larger incision to access and remove the inflamed appendix (**Figure 2**).

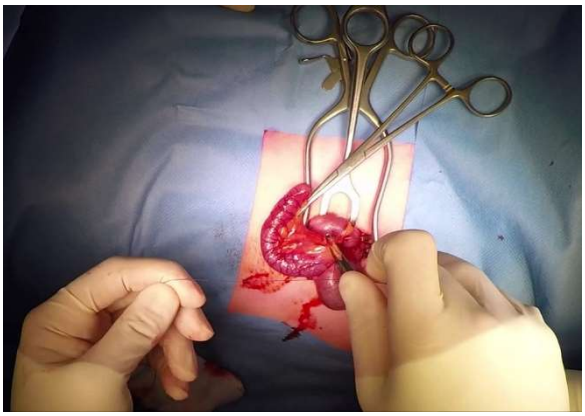

Fig 02 Open Appendectomy (Group B)

The time taken for the surgical procedure, including anesthesia induction, surgery, and wound closure, was recorded for each patient. The duration of the postoperative hospital stay, from the day of surgery until discharge, was documented.

Patients were assessed for the presence of SSI within 10 days post-surgery. The severity of SSI was classified according to the Southampton grading system, ranging from Grade 0 (no infection) to Grade V (most severe).

Statistical analysis was performed using appropriate software (e.g., SPSS). Descriptive statistics such as means, standard deviations, frequencies, and percentages were used to summarize the data. The chi-squared test and t-test were employed to compare categorical and continuous variables, respectively. A p-value of < 0.05 was considered statistically significant.

Results

The demographic characteristics of the patients who underwent either laparoscopic (Group A) or open (Group B) appendectomy are presented in Table (Sartelli et al., 2018). Among the 320 patients included in the study, 110 belonged to Group A, while 210 were part of Group B.

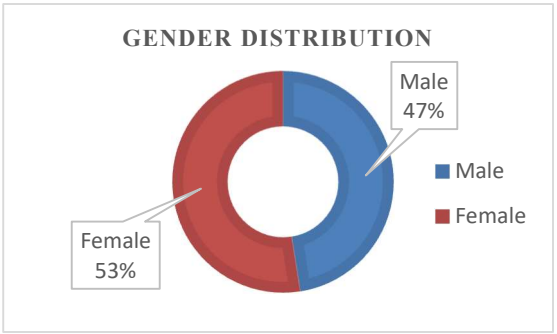

Figure 1: Gender distribution in study population

The age range of patients in both groups varied from 14 to 64 years. The overall mean age of all patients combined was 28.9 years, with a standard deviation (SD) of 13.8. When considering gender differences, males had a mean age of 27.9 years (±13.8 SD), while females had a mean age of 29.8 years (±13.7 SD) (**Table 1**). This table highlights that the study comprised a higher number of patients in Group B (open appendectomy) compared to Group A (laparoscopic appendectomy). The age distribution within both groups ranged from young adults to middle-aged individuals, with an overall mean age that was quite consistent. Additionally, the gender-based analysis of mean ages indicated minor variations between males and females.

Table 2 provides insights into the operative time and hospital stay for patients in Group A (laparoscopic surgery) and Group B (open surgery). In Group A, the mean operative time was 78.5 minutes, with a standard deviation of 22.7, while the mean hospital stay was 2.8 days (±0.9). In contrast, Group B patients experienced a mean operative time of 42.2 minutes (±19.6) and a mean hospital stay of 4.9 days (±2.1). This table reveals a significant difference in operative time between the two groups, with laparoscopic surgery (Group A) requiring a longer duration. On the other hand, patients in Group A had a notably shorter mean hospital stay compared to those in Group B. These findings highlight the efficiency and potentially faster recovery associated with laparoscopic appendectomy.

Table 3 focuses on the rates of Surgical Site Infection (SSI) observed in Group A (laparoscopic surgery) and Group B (open surgery) patients. It includes the percentage of patients falling into various categories of infection severity, as well as the p-value indicating statistical significance. In

Group A, 6.25% of patients had no SSI, 2.5% had Southampton Grade I infection, 2.25% had Grade II infection, 1.0% had Grade III infection, and no patients experienced Grade IV or Grade V infections. In Group B, 11.90% of patients had no SSI, 4.25% had Grade I infection, 6.0% had Grade II infection, 1.15% had Grade III infection, 0.5% had Grade IV infection, and no patients had Grade V infections. The data demonstrates that Group A had a lower overall SSI rate compared to Group B, suggesting a potentially reduced risk of surgical site infections associated with laparoscopic surgery. Additionally, the majority of patients in both groups did not exhibit signs of infection within 10 postoperative days. The p-value indicates a statistically significant difference in SSI rates between the two groups, favoring laparoscopic appendectomy (Group A).

Table 1: Demographic Information of the Patients (n=320)

Variables	Group A	Group B
Patients (n)	110	210
Age Range (years)	15-64	14-63
Overall Mean Age (±SD)	30.1 ± 15.2	27.8 ± 12.4
Mean Age (±SD) - Males	28.6 ± 14.7	27.4 ± 12.9
Mean Age (±SD) - Females	29.7 ± 15.8	28.3 ± 12.1

Table 2: Operative Time and Hospital Stay (n=320)

Variables	Group A	Group B	*p*-Value
Mean Operative Time (±SD)	78.5 ± 22.7 minutes	42.2 ± 19.6 minutes	< 0.05
Mean Hospital Stay (±SD)	2.8 ± 0.9 days	4.9 ± 2.1 days	< 0.05

Table 3: Surgical Site Infection (SSI) Rates (n=320)

Variables	Group A	Group B
No SSI (%)	6.25%	11.90%
Southampton Grade I (%)	2.5%	4.25%
Southampton Grade II (%)	2.25%	6.0%
Southampton Grade III (%)	1.0%	1.15%
Southampton Grade IV (%)	0%	0.5%
Southampton Grade V (%)	0%	0%
P Value	< 0.05	

Discussion

The choice between laparoscopic and open appendectomy has been a subject of debate in the surgical community. This study aimed to compare the outcomes of these two approaches in terms of surgical site infection (SSI), operative time, and hospital stay. The findings provide valuable insights into the considerations surrounding the selection of the surgical technique for appendectomy.

One of the key findings of this study is the significant difference in operative time between laparoscopic and open appendectomy (Hansen et al., 1996). Laparoscopic surgery required a longer mean operative time (78.5 minutes) compared to open surgery (42.2 minutes) (Ayoub et al., 2020). This difference can be attributed to the complexity and technical demands of laparoscopic procedures, including the need for insufflation, trocar placement, and intracorporeal suturing. However, it's important to note that despite the longer operative time, laparoscopic appendectomy offers other advantages, such as reduced postoperative pain and faster recovery (Sauerland et al., 2002).

The study also revealed a notable difference in hospital stay duration between the two groups. Patients who underwent laparoscopic appendectomy had a significantly shorter mean hospital stay (2.8 days) compared to those who had open appendectomy (4.9 days) [Table 2]. This finding aligns with the well-documented benefits of laparoscopic surgery, which include early mobilization and reduced postoperative ileus. The shorter hospital stay not only contributes to cost savings but also enhances patient satisfaction and overall experience (Allegranzi et al., 2016).

Surgical site infection is a significant concern in abdominal surgery, including appendectomy. The study assessed the incidence of SSI in both laparoscopic and open appendectomy groups. The results indicated that laparoscopic appendectomy (Group A) had a lower overall SSI rate (6.25%) compared to open appendectomy (Group B) (11.90%) This finding is consistent with previous studies that have reported a reduced risk of SSI associated with laparoscopic surgery (Zaman et al., 2021).

Further analysis of the SSI rates in both groups revealed that the majority of patients did not develop infections within 10 postoperative days. However, when infections did occur, they were generally of lower severity in the laparoscopic group. The Southampton grading system allowed for a standardized classification of infection severity, and the data showed that Grade IV and Grade V infections were absent in the laparoscopic group, highlighting the safety profile of this approach (Kelly et al., 2014; Rogmark et al., 2013).

The statistically significant difference in SSI rates between the two groups underscores the importance of considering laparoscopic appendectomy as a preferred option, particularly in low-risk patients (Bessoff and Forrester, 2020). The reduced risk of infection contributes to improved

postoperative outcomes and reduces the burden on healthcare resources (Allegranzi et al., 2016; Shander et al., 2011).

This study has some limitations, including its single-center nature and the potential for selection bias. Additionally, the study focused on short-term outcomes, and long-term follow-up data were not included. Future research could explore long-term outcomes, including scar formation and quality of life, to provide a more comprehensive assessment of both surgical approaches (Lipman et al., 2020; Ziolkowski et al., 2019).

Conclusion

In conclusion, this study provides evidence supporting the advantages of laparoscopic appendectomy over open appendectomy. Laparoscopic surgery is associated with shorter hospital stays, reduced risk of surgical site infection, and similar operative times compared to open surgery. These findings underscore the importance of considering laparoscopic appendectomy as a preferred option, particularly in low-risk patients, to improve postoperative outcomes and healthcare resource utilization.

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.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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References

Allegranzi, B., Zayed, B., Bischoff, P., Kubilay, N. Z., de Jonge, S., de Vries, F., Gomes, S. M., Gans, S., Wallert, E. D., and Wu, X. (2016). New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective. *The Lancet Infectious Diseases* **16**, e288-e303.

Ayoub, F., Brar, T. S., Banerjee, D., Abbas, A. M., Wang, Y., Yang, D., and Draganov, P. V. (2020). Laparoscopy-assisted versus enteroscopy-assisted endoscopic retrograde cholangiopancreatography (ERCP) in Roux-en-Y gastric bypass: a meta-analysis. *Endoscopy international open* **8**, E423-E436.

Basunbul, L. I., Alhazmi, L. S. S., Almughamisi, S. A., Aljuaid, N. M., Rizk, H., Moshref, R., and Alhazmi, L. (2022). Recent technical developments in the field of laparoscopic surgery: a literature review. *Cureus* **14**.

Bessoff, K. E., and Forrester, J. D. (2020). Appendicitis in low-resource settings. *Surgical Infections* **21**, 523-532.

Cai, Y.-L., Xiong, X.-Z., Wu, S.-J., Cheng, Y., Lu, J., Zhang, J., Lin, Y.-X., and Cheng, N.-S. (2013). Single-incision laparoscopic appendectomy vs conventional laparoscopic appendectomy: systematic review and meta-analysis. *World Journal of Gastroenterology: WJG* **19**, 5165.

Danwang, C., Mazou, T. N., Tochie, J. N., Nzalie, R. N. T., and Bigna, J. J. (2018). Global prevalence and incidence of surgical site infections after appendectomy: a systematic review and meta-analysis protocol. *BMJ open* **8**.

Hansen, J. B., Smithers, B. M., Schache, D., Wall, D. R., Miller, B. J., and MenZies, B. L. (1996). Laparoscopic versus open appendectomy: prospective randomized trial. *World journal of surgery* **20**, 17-21.

Kelly, K. N., Fleming, F. J., Aquina, C. T., Probst, C. P., Noyes, K., Pegoli, W., and Monson, J. R. (2014). Disease severity, not operative approach, drives organ space infection after pediatric appendectomy. *Annals of Surgery* **260**, 466-473.

Lipman, K., Wang, M., Berthiaume, E., Holloway, J., Da Lio, A., Ting, K., Soo, C., and Zheng, Z. (2020). Evaluating current scar assessment methods. *Annals of plastic surgery* **84**, 222-231.

McAnena, O. J., and Willson, P. D. (1993). Laparoscopic appendicectomy: diagnosis and resection of acute and perforated appendices. *Baillière's clinical gastroenterology* **7**, 851-866.

Robinson, J. R., Carter, N. H., Gibson, C., Brinkman, A. S., Van Arendonk, K., Speck, K. E., Danko, M. E., Jackson, G. P., Lovvorn III, H. N., and Blakely, M. L. (2018). Improving the value of care for appendectomy through an individual surgeon-specific approach. *Journal of pediatric surgery* **53**, 1181-1186.

Rogmark, P., Petersson, U., Bringman, S., Eklund, A., Ezra, E., Sevonius, D., Smedberg, S., Österberg, J., and Montgomery, A. (2013). Short-term outcomes for open and laparoscopic midline incisional hernia repair: a randomized multicenter controlled trial: the ProLOVE (prospective randomized trial on open versus laparoscopic operation of ventral eventrations) trial. LWW.

Sartelli, M., Baiocchi, G. L., Di Saverio, S., Ferrara, F., Labricciosa, F. M., Ansaloni, L., Coccolini, F., Vijayan, D., Abbas, A., and Abongwa, H. K.

(2018). Prospective observational study on acute appendicitis worldwide (POSAW). *World Journal of Emergency Surgery* **13**, 1-10.

Sauerland, S., Lefering, R., and Neugebauer, E. (2002). Laparoscopic versus open surgery for suspected appendicitis. *The Cochrane Database of Systematic Reviews*, CD001546-CD001546.

Shander, A., Fleisher, L. A., Barie, P. S., Bigatello, L. M., Sladen, R. N., and Watson, C. B. (2011). Clinical and economic burden of postoperative pulmonary complications: patient safety summit on definition, risk-reducing interventions, and preventive strategies. *Critical care medicine* **39**, 2163-2172.

Tansawet, A., Siribumrungwong, B., Techapongsatorn, S., Numthavaj, P., Poprom, N., McKay, G. J., Attia, J., and Thakkinstian, A. (2023). Delayed versus primary closure to minimize risk of surgical-site infection for complicated appendicitis: A secondary analysis of a randomized trial using counterfactual prediction modeling. *Infection Control & Hospital Epidemiology*, 1-7.

Zaman, S., Mohamedahmed, A. Y. Y., Srinivasan, A., Stonelake, S., Sillah, A. K., Hajibandeh, S., and Hajibandeh, S. (2021). Single-port laparoscopic appendicectomy versus conventional three-port approach for acute appendicitis: a systematic review, meta-analysis and trial sequential analysis of randomised controlled trials. *The Surgeon* **19**, 365-379.

Ziolkowski, N., Kitto, S. C., Jeong, D., Zuccaro, J., Adams-Webber, T., Miroshnychenko, A., and Fish, J. S. (2019). Psychosocial and quality of life impact of scars in the surgical, traumatic and burn populations: a scoping review protocol. *BMJ open* **9**.