



## OPTIMIZING SPECIMEN EXTRACTION IN LAPAROSCOPIC COLORECTAL CANCER: LONG-TERM OUTCOMES OF THE PFANNENSTIEL VS. TRANSVERSE LEFT LOWER QUADRANT INCISION

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### ABSTRACT

For over a century, the Pfannenstiel incision has remained the most important incision in gynecological cesarean sections. Nevertheless, there is limited data on its application in laparoscopic surgery for the extraction of specimens in the treatment of colorectal cancer. We aimed to analyze and share our experience by comparing the incidence of surgical site infections and incisional hernias in patients who underwent specimen extraction through the Pfannenstiel incision and Transverse Left Lower Quadrant Incision (TLLQI) in laparoscopic colorectal surgery at our hospital over seven years. A retrospective evaluation was conducted on patients who underwent specimen extraction through the Pfannenstiel and TLLQI during elective laparoscopic colorectal cancer surgery. We selected a total of 236 patients who underwent surgery at King Hussein Military Hospital in Amman, Jordan, between September 2015 and June 2022. Surgical site infection and incisional hernia were evaluated. And data from outpatient follow-up were analyzed. The incidence of surgical site infections and incisional hernias was compared using Fisher's exact test. **Results:** Among the 236 patients included, 152 underwent specimen extraction via the Pfannenstiel incision, while 84 patients had a TLLQI. The Pfannenstiel incision group had a significantly lower incidence of incisional hernias (2.4%) compared to the TLLQI group (13%,  $p = 0.0177$ ). Surgical site infections occurred in 4.8% of the Pfannenstiel incision group and 1.2% of the TLLQI group ( $p = 0.367$ ). Importantly, no mortality was documented, indicating overall safety for both approaches. **Conclusion:** When performing laparoscopic surgery for colorectal cancer, the Pfannenstiel incision is an excellent choice for specimen extraction due to its favorable outcomes. Compared to the TLLQI, the Pfannenstiel incision has a significantly lower risk of incisional hernia when used for laparoscopic surgical specimen extraction.

**KEYWORDS:** Pfannenstiel, TLLQI, extraction site, incisional hernia, laparoscopic colorectal surgery, colorectal surgery.

### INTRODUCTION AND BACKGROUND

It is critical to investigate treatment options for colorectal cancer because this disease poses a significant threat to human health. Colorectal cancer is the third most common cancer in the world, with 1.8 million new cases of colorectal cancer and more than 800,000 deaths worldwide in 2018.<sup>[1]</sup> The primary therapy for resectable CRC is surgical removal.<sup>[2]</sup> Open surgery remains the traditional surgical treatment for resectable colorectal cancer. Minimally invasive surgery has also been employed in colorectal cancer surgery due to its

improved outcomes and aesthetics, decreased risk of incisional hernia, and less wound problems,<sup>[3]</sup> in order to extract the specimen, a mini-laparotomy is necessary, increasing the likelihood of postoperative incisional hernia development, which may result in substantial morbidity and mortality.<sup>[4]</sup> Recent literature demonstrating incidence of extraction colectomies site hernia ranging from 4 to 15%.<sup>[5,6]</sup> Patient age, obesity, malnutrition, surgical site infections, chemotherapy, and steroid therapy are common risk factors for the development of incisional hernia<sup>[7,8]</sup> With adoption of

minimally invasive techniques, the specimen extraction site has been recognized as a significant risk factor for incisional hernia<sup>[9,10]</sup> in Laparoscopic colorectal surgery for colorectal cancer, the commonly used incisions for specimen extraction are: infraumbilical midline, periumbilical midline, right and left subcostal, right lower quadrant, left lower quadrant, stoma site, Pfannenstiel and others.<sup>[11]</sup> At present, there is no overall agreement on the preferred site location for specimen extraction in laparoscopic colorectal surgery.<sup>[12,13]</sup> The Pfannenstiel and the left lower quadrant incisions are the most commonly used for the specimen extraction in laparoscopic Sigmoid colectomy and rectal surgery.<sup>[14]</sup>

### Purpose

To analyze and compare the incidence of surgical site infections and incisional hernias in patients undergoing laparoscopic colorectal surgery with specimen extraction through Pfannenstiel and TLLQIs at our hospital over seven years, thereby contributing to the understanding of surgical outcomes associated with these techniques.

### Objective

1. To determine the incidence rates of incisional hernias in patients who underwent specimen extraction via Pfannenstiel incisions compared to those with TLLQIs.
2. To evaluate the incidence of surgical site infections in both groups of patients.
3. To share findings and insights from the analysis to enhance surgical practices and patient care in laparoscopic colorectal surgery.

### MATERIALS AND METHODS

This study received approval from the Ethical Committee for Research at our hospital. It is a retrospective cohort study focusing on sigmoid and rectal cancer patients who underwent elective laparoscopic procedures at our facility between September 2015 and June 2022. The King Hussein Military Hospital, with 720 beds, is the largest hospital within the Jordanian Royal Medical Services. It serves as a surgical training center for colorectal surgery and performing over 100 elective colorectal procedures annually. The data for this study were collected from colorectal computerized archive.

#### The exclusion criteria for this study were as follows

- All colonic resections performed proximal to the sigmoid colon that do not involve the sigmoid colon or any portion of it as other incisions are utilized for specimen extraction.
- Any colectomy or proctectomy that involves perineal resection in rectal surgery, where the specimen is extracted through the perineal incision.
- Cases in which the surgical procedure commenced as laparoscopic and subsequently required conversion to open surgery
- Non-oncologic procedures performed for palliative purposes
- Emergency procedures

- Cases with poor general and nutritional status
- Patients on steroid therapy

Demographics data on patient such as age, gender, comorbidities, and previous abdominal surgery, technical approach, and postoperative morbidity and mortality were collected.

Prior to surgery, comprehensive discussions regarding the surgical procedure and potential complications were held with all patients by a multidisciplinary team, including a colorectal surgeon, colorectal nurse, dietitian, and stoma care nurse. Following these discussions, written consent was secured. One day before the procedure, all patients underwent bowel preparation with oral antibiotics, along with oral and intravenous hydration. Deep vein thrombosis prophylaxis was provided to each patient during their hospital stay, tailored to their individual risk profiles. All surgical interventions were conducted by a consistent surgical team to ensure continuity of care.

At the onset of anesthesia, intravenous antibiotic prophylaxis with ertapenem was administered as a single dose. After that, the patient was positioned in the Lloyd-Davis position, with both arms placed alongside the body, shoulder and arm support device was employed to secure the patient to the operating table, and pressure-relief pads were utilized to minimize the risk of pressure injuries. Pneumoperitoneum was established using carbon dioxide (CO<sub>2</sub>) at an insufflation pressure of 11-13 mmHg. The number of trocars and their insertion sites were adjusted according to the specific procedure. The descending colon was fully mobilized, including the takedown of the splenic flexure. After mobilization, the proximal segment of the bowel was resected with an adequate safety margin using an endoscopic linear stapler (45/60 mm). A Pfannenstiel or TLLQI measuring 5-7 cm was utilized. In the Pfannenstiel incision approach, the transverse and oblique abdominal muscles were meticulously separated using blunt dissection. This allowed for clear visualization and identification of the peritoneum, which was subsequently transversely incised to facilitate the extraction of the specimen. Similarly, in the transverse left lower quadrant incision (TLLQI), a careful technique was employed to bluntly separate both the transverse and oblique abdominal muscles. After ensuring proper exposure, the peritoneum was identified and transversely incised, enabling effective specimen extraction while minimizing trauma to surrounding tissues. In all cases, the bowel was removed through a wound protector (Alexis® - Applied Medical), ensuring optimal protection and minimizing the risk of contamination during the specimen extraction process. If a circular stapler was required, the anvil was positioned in the proximal loop of the bowel, and anastomosis was performed trans-anally with laparoscopic guidance. In cases of ultralow resection, a hand-sewn anastomosis was conducted. After specimen extraction, the peritoneal layer was not sutured; the muscular layer was

approximated with absorbable sutures, and the aponeurotic layer was closed using PDS 1 (Polydioxanone) running sutures. Skin closure was achieved with either absorbable subcuticular sutures or skin staples. Pelvic drains were utilized only for low and ultralow procedures. In cases where the tumor was located in the middle or lower rectum, a protective loop ileostomy was created.

Patients were allowed to start oral fluids on the day of surgery (Day 0) following their full recovery, in accordance with the Enhanced Recovery After Surgery (ERAS) protocol and based on their overall condition. The diet was progressively advanced in the following days according to the ERAS protocol and the patients' tolerance. Once discharge criteria outlined in the ERAS protocol were met, patients were discharged from the hospital.

#### Statistical analysis

Data were analyzed using SPSS IBM Statistics software, with continuous variables expressed as means and standard deviations. These results were subsequently evaluated using a Student's t-test. Categorical variables were assessed with Fisher's exact test. A p-value of less than 0.05 was deemed statistically significant.

#### RESULTS

This study analyzed 236 patients who underwent laparoscopic colorectal procedures from September 2015 to June 2022. Among these patients, 152 underwent specimen extraction via a Pfannenstiel incision, while 84 patients had a TLLQI. To ensure comparability, the left gridiron group was matched 1:1 with the Pfannenstiel incision group based on key demographic factors, including age, gender, comorbidities, and prior abdominal surgeries. All surgical interventions were performed by a uniform surgical team, utilizing a consistent technique throughout the study period.

Tables 1 and 2 detail the patient characteristics prior to and following the 1:1 matching process. Within the Pfannenstiel incision group, 2 patients (2.4%) developed incisional hernias at the specimen extraction site, in stark contrast to 11 patients (13%) in the TLLQI group ( $p = 0.0177$ ). The majority of incisional hernias were identified clinically, with others detected through follow-up CT scans conducted within 24 months after surgery. Most patients diagnosed with an incisional hernia proceeded to elective hernia mesh repair, while a subset received supportive care due to various factors affecting their treatment decisions.

**Table 1: Comparative Analysis of Patient Characteristics in the Pfannenstiel incision and TLLQI Groups Before Implementing 1:1 Matching.**

Characteristic	Pfannenstiel incisions group	TLLQI group	Total cases
Number of patients	152	84	236
Patients Age (mean)	59.9	61.2	60.2
Gender: Male/female	89/63	52/32	141/95
Diabetes mellitus (DM)	16 (10.5%)	8 (9.5%)	24 (10.2%)
Hypertension (HTN)	54 (35.5%)	31 (36.9%)	85 (36%)
Ischemic heart disease (IHD)	14 (9.2%)	7 (8.3%)	21 (8.9%)
Associated Comorbidities	48 (31.5%)	29 (34.5%)	77 (32.6%)
Previous abdominal procedures including minimally invasive	43 (28.2%)	21 (25%)	64 (27.1%)

Moreover, 3 patients (3.5%) in the Pfannenstiel incision group experienced trocar site hernias at locations distinct from the specimen extraction site, compared to 1 patient (1.2%) in the TLLQI group ( $p = 0.620$ ). In terms of postoperative complications, surgical site infections were recorded in 4 patients (4.8%) within the Pfannenstiel incision group versus 1 patient (1.2%) in the TLLQI group ( $p = 0.367$ ). Importantly, no fatalities were documented among the study population, highlighting the overall safety of both surgical approaches.

These findings underscore significant differences in incisional hernia rates between the two surgical techniques, suggesting that the Pfannenstiel incision may be associated with a lower incidence of this complication. However, further investigation is warranted to explore the implications of these results on long-term patient outcomes and the potential need for targeted postoperative management strategies.

**Table 2: Comparative Analysis of Patient Characteristics in the Pfannenstiel incision and TLLQI Groups Following 1:1 Matching.**

Characteristic	Pfannenstiel incisions group	TLLQI group	p value
Number of patients	84	84	1.00
Patients Age (mean)	59.9	61.2	0.094
Gender: Male/female	44/40	44/40	1.00

Diabetes mellitus (DM)	8 (9.5%)	8 (9.5%)	1.00
Hypertension (HTN)	30 (35.7%)	30 (35.7%)	1.00
Ischemic heart disease (IHD)	7 (8.3%)	7 (8.3%)	1.00
Associated Comorbidities	26 (31.0%)	26 (31.0%)	1.00
Previous abdominal procedures including minimally invasive	21 (25.0%)	21 (25.0%)	1.00

## DISCUSSION

In laparoscopic colorectal surgery, the necessity for a small incision to facilitate specimen extraction introduces a critical decision point regarding the optimal incision site. However, the search for an unequivocal optimal site remains elusive, perpetuating ongoing debates among surgical practitioners. This decision is informed by multiple factors, including the extent of

bowel mobilization and the surgeon's experience and preference. The literature reveals a spectrum of approaches for specimen extraction during laparoscopic sigmoid and rectal resection, with options ranging from midline incisions and Pfannenstiel to the left-sided incisions.<sup>[9,15]</sup>

**Table 3: Postoperative Complications in the Pfannenstiel incision and Left gridiron Groups.**

Clinical variable*	Pfannenstiel incisions group n (%)	TLLQI group n (%)	**P Value
Anastomotic leak	2 (2.4%)	1 (1.2%)	1.000
Surgical Site Infection	4 (4.8 %)	1 (1.2%)	0.367
Urinary Tract Infection	5 (5.9%)	4 (4.8%)	1.000
Mechanical intestinal obstruction (surgical intervention)	1 (1.2%)	0 (0%)	1.000
Trocar site Hernia	3 (3.5%)	1 (1.2%)	0.620
Incision Hernia at the Specimen Extraction Site	2 (2.4%)	11 (13%)	0.0177 (significant)
Pneumonia	0 (0%)	1 (1.2%)	1.000
Mechanical Ileus – Conservative Management	3 (3.5%)	2 (2.4%)	1.000
Other complication	10 (11.9%)	9 (10.7%)	1.000

\* Outcomes were recorded if they occurred within 30 days post-operation, with the exception of incisional hernia cases.  
\*\* Fisher's exact test

The site of specimen extraction is a critical factor influencing postoperative complications. Research indicates that midline incisions are associated with a higher incidence of incisional hernias compared to other incision types.<sup>[16]</sup> In colorectal surgery, the reported incidence of hernias at the extraction site varies significantly, ranging from 4% to 15%.<sup>[5,6]</sup> Some surgeons opt for specific incision types due to their anatomical benefits, which can facilitate easier specimen removal. However, while splitting the ventral abdominal muscles may help reduce the risk of incisional hernias, it can also compromise abdominal wall integrity, thereby increasing the likelihood of complications such as seromas and hematomas.<sup>[17]</sup>

The Pfannenstiel incision, frequently employed in gynecological and urological procedures, has been linked to a significantly reduced incidence of wound-related complications.<sup>[3,9]</sup> Its anatomical design facilitates superior exposure to the rectosigmoid colon, making it an optimal choice for left-sided colon resections.<sup>[13,18]</sup> By providing enhanced surgical visibility and access, the Pfannenstiel incision not only improves the precision of the procedure but also potentially mitigates the risk of damage to adjacent structures. This careful approach may

contribute to a decrease in postoperative complications, underscoring the incision's clinical relevance in minimizing patient morbidity while ensuring effective surgical outcomes.

Echoing our results, many others have identified that extraction sites other than the Pfannenstiel incision could be viewed as independent risk factors for incisional hernias.<sup>[3,11,20]</sup> In gynecological surgery, the Pfannenstiel incision has been linked to a decreased incidence of postoperative ileus, lower infection rates, and limited abdominal exposure.<sup>[9]</sup> However, it is also associated with a higher risk of nerve entrapment.<sup>[21]</sup> Despite these benefits, the complications related to the Pfannenstiel incision warrant further investigation to fully understand its advantages and potential drawbacks.

Regarding the surgical site infections (SSIs) recent investigations by Benlice et al. suggest that the left lower transverse incision may confer advantageous outcomes regarding wound infection risk in the context of minimally invasive colorectal surgery compared to Pfannenstiel incisions.<sup>[11]</sup> In our analysis, however, we did not observe a statistically significant difference in surgical wound infection rates based on the extraction

site. The incidence of wound infection was strikingly low in both groups, with 4.8 % in the Pfannenstiel incision group and 1.2% in the TLLQI group ( $p = 0.367$ ).

This study presents certain limitations, notably a small sample size and a retrospective design, both of which can inherently lead to biases that may affect the reliability and generalizability of the findings.

## CONCLUSION

In patients with colorectal cancer, the Pfannenstiel incision utilized for laparoscopic specimen extraction is associated with a significantly lower incidence of incisional hernias compared to the TLLQI, which has been linked to a markedly higher rate of such hernias. Meanwhile, the rates of wound infections showed no significant differences between the two approaches. We advocate for the Pfannenstiel incision as the preferred method for extracting laparoscopic surgical specimens in colorectal cancer patients, and we hope our findings contribute to improved clinical practices.

## REFERENCES

- Baidoun, F., Elshiw, K., Elkeraie, Y., Merjaneh, Z., Khoudari, G., Sarmini, M. T., ... & Saad, A. Colorectal cancer epidemiology: recent trends and impact on outcomes. *Current drug targets*, 2021; 22(9): 998-1009.
- Schuell B, Gruenberger T, Kornek GV, Dworan N, Depisch D, Lang F, Schneeweiss B, Scheithauer W. Side effects during chemotherapy predict tumour response in advanced colorectal cancer. *British journal of cancer*, 2005; 93(7): 744-8.
- Orcutt, S. T., Balentine, C. J., Marshall, C. L., Robinson, C. N., Anaya, D. A., Artinyan, A., ... & Albo, D. Use of a Pfannenstiel incision in minimally invasive colorectal cancer surgery is associated with a lower risk of wound complications. *Techniques in coloproctology*, 2012; 16: 127-132.
- Carlson, M. A., Ludwig, K. A., & Condon, R. E. Ventral hernia and other complications of 1,000 midline incisions. *Southern medical journal*, 1995; 88(4): 450-453.
- Klaristenfeld, D. D., McLemore, E. C., Li, B. H., Abbass, M. A., & Abbas, M. A. Significant reduction in the incidence of small bowel obstruction and ventral hernia after laparoscopic compared to open segmental colorectal resection. *Langenbeck's archives of surgery*, 2015; 400: 505-512.
- Cano-Valderrama, O., Sanz-López, R., Domínguez-Serrano, I., Dziakova, J., Catalán, V., Rojo, M., & Torres, A. J. Extraction-site incisional hernia after laparoscopic colorectal surgery: should we carry out a study about prophylactic mesh closure?. *Surgical Endoscopy*, 2020; 34: 4048-4052.
- Itatsu, K., Yokoyama, Y., Sugawara, G., Kubota, H., Tojima, Y., Kurumiya, Y., & Nagino, M. Incidence of and risk factors for incisional hernia after abdominal surgery. *Journal of British Surgery*, 2014; 101(11): 1439-1447.
- Walming, S., Angenete, E., Block, M., Bock, D., Gessler, B., & Haglind, E. Retrospective review of risk factors for surgical wound dehiscence and incisional hernia. *BMC surgery*, 2017; 17: 1-6.
- DeSouza, A., Domajnko, B., Park, J., Marecik, S., Prasad, L., & Abcarian, H. Incisional hernia, midline versus low transverse incision: what is the ideal incision for specimen extraction and hand-assisted laparoscopy?. *Surgical endoscopy*, 2011; 25: 1031-1036.
- Lee, L., Mappin-Kasirer, B., Sender Liberman, A., Stein, B., Charlebois, P., Vassiliou, M., & Feldman, L. S. High incidence of symptomatic incisional hernia after midline extraction in laparoscopic colon resection. *Surgical endoscopy*, 2012; 26: 3180-3185.
- Benlice, C., Stocchi, L., Costedio, M. M., Gorgun, E., & Kessler, H. Impact of the specific extraction-site location on the risk of incisional hernia after laparoscopic colorectal resection. *Diseases of the Colon & Rectum*, 2016; 59(8): 743-750.
- Laurent, C., Leblanc, F., Bretagnol, F., Capdepon, M., & Rullier, E. Long-term wound advantages of the laparoscopic approach in rectal cancer. *Journal of British Surgery*, 2008; 95(7): 903-908.
- Paruch, J. L. Extraction Site in minimally invasive colorectal surgery. *Clinics in Colon and Rectal Surgery*, 2023; 36(01): 047-051.
- Lim, S. W., Huh, J. W., Kim, Y. J., & Kim, H. R. Vertical transumbilical incision versus left lower transverse incision for specimen retrieval during laparoscopic colorectal surgery. *Techniques in coloproctology*, 2013; 17: 59-65.
- Singh, R., Omiccioli, A., Hegge, S., & McKinley, C. Does the extraction-site location in laparoscopic colorectal surgery have an impact on incisional hernia rates?. *Surgical endoscopy*, 2008; 22: 2596-2600.
- Griffith, K. C., Clark, N. V., Mushinski, A. A., Gu, X., Ajao, M. O., Brown, D. N., ... & Cohen, S. L. Incisional outcomes of umbilical vs suprapubic mini-laparotomy for tissue extraction: a retrospective cohort study. *Journal of Minimally Invasive Gynecology*, 2018; 25(6): 1024-1030.
- Lim, S. W., Huh, J. W., Kim, Y. J., & Kim, H. R. Vertical transumbilical incision versus left lower transverse incision for specimen retrieval during laparoscopic colorectal surgery. *Techniques in coloproctology*, 2013; 17: 59-65.
- Kisielinski, K., Conze, J., Murken, A. H., Lenzen, N. N., Klinge, U., & Schumpelick, V. The Pfannenstiel or so called "bikini cut": still effective more than 100 years after first description. *Hernia*, 2008; 8: 177-181.
- Singh, R., Omiccioli, A., Hegge, S., & McKinley, C. Does the extraction-site location in laparoscopic colorectal surgery have an impact on incisional hernia rates?. *Surgical endoscopy*, 2008; 22: 2596-2600.

20. Khoury, W., Stocchi, L., & Geisler, D. Outcomes after laparoscopic intestinal resection in obese versus non-obese patients. *Journal of British Surgery*, 2011; 98(2): 293-298.
21. Charipova, K., Gress, K., Berger, A. A., Kassem, H., Schwartz, R., Herman, J., & Urits, I. A comprehensive review and update of post-surgical cutaneous nerve entrapment. *Current Pain and Headache Reports*, 2021; 25: 1-8.