

## Use of Transumbilical Incision as an Organ Removal Site in Laparoscopic Pancreatectomy

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**Abstract.** *Background/Aim:* To evaluate complications and risk factors associated with transumbilical incision as an organ removal site in laparoscopic pancreatectomy (LP). *Patients and Methods:* In total, 52 patients who underwent LP between 2009 and 2017 were included in this study. The development of superficial surgical site infection (SSI) and transumbilical port-site incisional hernia was recorded. *Results:* None of the patients had SSI. However, three (5.77%) presented with transumbilical incisional hernia. No variables were significantly associated with the risk of transumbilical incisional hernia. *Conclusion:* No evident risk factors correlated with hernia formation. Hence, incisional hernia might have occurred at a certain probability. In some cases, it was caused by technical problems. However, the use of transumbilical incision as an organ removal site was feasible, and a new incision for organ removal alone was not required.

Laparoscopic treatment for tumors in the pancreatic body and tail has become common in recent years. Laparoscopic distal pancreatectomy (LDP) for such diseases has gained increasing popularity as it is correlated with clear visual field, low incidence of injury, and fast recovery (1). Transumbilical incision is considered the first port in all laparoscopic surgeries in our department. Laparoscopic procedures have been used for organ removal since they were introduced in the 1990s. Hence, the establishment of a new incision, such as the Pfannenstiel incision, for organ

removal is no longer required. A 12-mm port is inserted via the navel, and the umbilical incision is extended craniocaudally to adjust for the size of excised organs. However, there are only few reports on complications correlated with transumbilical incision in laparoscopic pancreatectomy (LP), and its efficacy remains unclear.

The current single-center study aimed to evaluate for complications and risk factors associated with transumbilical incision requiring wound extension for the removal of a resected specimen. Further, the efficacy of this type of incision when used as an organ removal site in LP was assessed.

### Patients and Methods

*Participants.* This cohort study included 59 consecutive patients who underwent LP for pancreatic tumors requiring wound extension for organ removal at our institution between November 2009 and December 2017. In total, seven patients were excluded due to conversion to laparotomy. The study protocol was approved by the Ethics Committee of Showa University (approval number: 3200). Data including demographic characteristics, surgical details, tumor characteristics, postoperative outcomes, and transumbilical complication [surgical site infection (SSI) and incisional hernia] were collected from our hospital database.

*Definitions.* SSI was defined according to the criteria of the American College of Surgeons National Surgical Quality Improvement Program (2). Meanwhile, wound hernia was defined based on the definition of Tonouchi *et al.* (3). The development of SSIs was identified by the infection control team. Transumbilical incisional hernias were assessed via clinical examination and computed tomography (CT) scan during the routine follow-up period every 3 months within the first 2 years after surgery and 3-6 months thereafter.

*Transumbilical incision.* The wound closure and covering methods were used based on a standardized protocol. The navel was incised in a craniocaudal direction from its center, and the first 12-mm port was inserted (Figure 1A). For cosmetic reasons, the transumbilical incision was minimally extended in a craniocaudal direction to adjust

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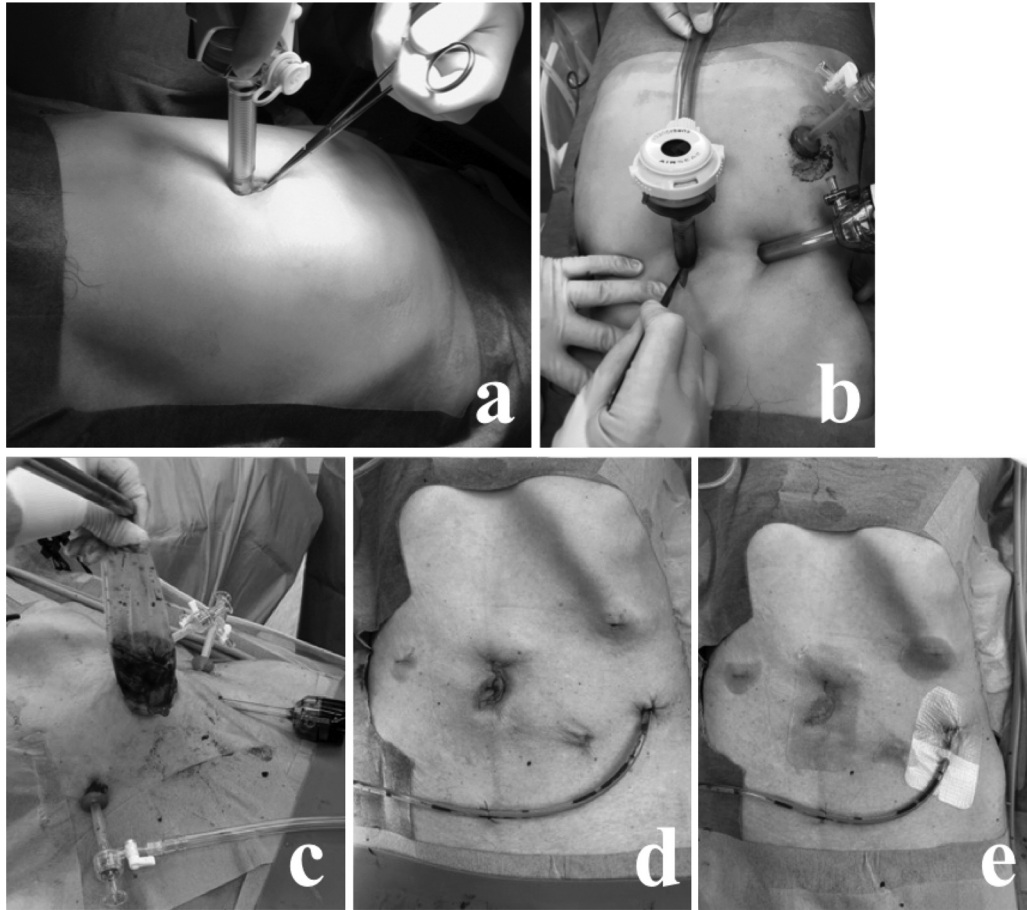


Figure 1. Transumbilical incision for laparoscopic pancreatotomy. A) Insertion of a 12-mm port through the transumbilical incision. B) Extension of the incision to facilitate organ removal. C) Removal of the resected specimen. D) Closure of the incision after closure. E) Coverage of the incision with hydrocolloid dressing.

for the size of the resected organ (2-7 cm) (Figure 1B). The resected specimens were placed in a plastic bag in the abdominal cavity and were removed *via* the transumbilical incision (Figure 1C). The anterior and posterior laminae of the rectal sheath in the incision were nodule-sutured with a monofilament absorbable material. All incisions were washed with 200 ml saline. Buried interrupted dermal sutures were constructed using a 4-0 monofilament absorbable suture material (Figure 1D). The incision was sealed with hydrocolloid dressing for 48 h after surgery (Figure 1E).

**Statistical analysis.** Data are presented as mean±standard deviation (SD), unless otherwise stated. Risk factors were investigated *via* univariate analyses using methods including the  $\chi^2$  test, Fisher's exact test, Wilcoxon rank-sum test, Wilcoxon signed-rank test, and logistic regression. Significant variables were then analyzed *via* a multivariate logistic regression analysis. All analyses were performed using the JMP Pro software version 14 (SAS Institute Inc., Cary, NC, USA). Statistical assessments were two-sided, and a *p*-value of <0.05 indicated statistically significant difference.

Table I. Diseases and surgical procedures.

Disease	Number
Intraductal papillary mucinous neoplasm	14
Carcinoma	12
Neuroendocrine tumor	6
Mucinous cystic neoplasm	6
Solid pseudopapillary neoplasm	5
Serous cystic neoplasm	2
Adenoma	3
Cyst	2
Metastasis	1
Hamartoma	1
Procedure	
Laparoscopic distal pancreatotomy (LDP)	43
Spleen preserving LDP	7
Partial resection	2

Table II. Demographic data of patients with and without transumbilical incisional hernia.

Variables	No incisional hernia (n=49)	Incisional hernia (n=3)	p-Value
Age (years)	63.81±17.54	65.67±15.01	0.984
Gender (male:female)	11:38	1:2	0.553
Height (cm)	156.31±7.72	155.67±10.69	0.753
Weight (kg)	54.16±9.95	62.33±16.92	0.346
BMI (kg/m <sup>2</sup> )	22.10±3.11	25.39±3.74	0.136
Diabetes mellitus	10 (20.83%)	2 (66.67 %)	0.134
Abdominal wall thickness			
Distance A	24.74±7.88	25.47±3.58	0.668
Distance B	15.14±6.35	15.90±5.20	0.639
Operation time	180.27±56.67	167.00±54.29	0.666
Blood loss (g)	152.30±187.33	119.00±144.86	0.982
Splenectomy	40 (81.63%)	3 (100.0%)	1.000
Intraprocedural events	0 (0.00%)	0 (0.00%)	1.000
Specimen major axis (cm)	12.17±3.98	9.67±3.88	0.306
Postoperative complication	17 (36.17%)	0 (0.00%)	0.542
Pancreatic fistula B/C	8 (16.33%)	0 (0.00%)	1.000
Postoperative hospital stay	14.78±8.25	12.33±3.21	0.859

## Results

In total, 52 patients were included, and 12 (23.1%) and 40 (76.9%) were men and women, respectively, with a mean age of 63.92±17.28 years (median: 70.0 years; range=19-87 years).

The diseases targeted for surgery and the procedures are depicted in Table I. The diseases included intraductal papillary mucinous neoplasm (IPMN) (n=14), carcinoma (n=13), neuroendocrine tumor (NET) (n=6), mucinous cystic neoplasm (MCN) (n=6), solid pseudopapillary neoplasm (SPN) (n=5), serous cystic neoplasm (SCN) (n=2), adenoma (n=3), and others (n=4). Patients underwent LDP (n=43), spleen-preserving LDP (n=7), and partial pancreatic resection (n=2). In total, 52 pure laparoscopic pancreatectomy procedures were successfully performed, and no positive surgical margins was observed. To assess the correlation between abdominal wall thickness and incisional complication, the distance from the surface of the umbilical region to the area directly below the peritoneum (distance A) and that from the bottom of the navel to the area directly below the peritoneum (distance B) were evaluated *via* CT scan before surgery.

None of the patients had superficial or deep/organ SSI. However, three (5.77%) presented with transumbilical incisional hernia. The median time to hernia formation was 13.0 (range=3-24) months. The hernial orifice diameter was approximately 3-5 cm. Three patients with postoperative incisional hernia did not have symptoms such as spontaneous pain and impaction requiring surgery. The hernia contents were intra-abdominal adipose tissue and small intestine. In groups with and without umbilical wound hernias, variables including were not significantly associated with incisional

hernia (Table II). Moreover, there were no significant risk factors for transumbilical incisional after LP.

## Discussion

Transumbilical incision has been considered a standard laparoscopic technique in recent years, and it is used as the first port in organ removal. The most significant advantage of this incision is that a new incision for organ removal is not required. To identify the risk factors for postoperative transumbilical incisional complication after LP, we retrospectively analyzed the clinical and surgical factors of pure laparoscopic pancreatectomy. The incidence rates of SSI and hernia in patients with transumbilical incision were 0.00% and 5.77%, respectively. Moreover, there were no evident risk factors for complications associated with transumbilical incision. Herein, we report the efficacy of transumbilical incision in laparoscopic gastrointestinal surgery. The results showed that the incidence rate of SSIs and incisional hernias correlated with transumbilical incision were significantly higher in colorectal than in gastric resection in laparoscopic surgery. Moreover, female sex and diabetes mellitus (DM) were considered the independent risk factors for hernia formation, and SSI was not associated with hernia formation (4, 5). In addition, a high body mass index (BMI) has been shown to be significantly associated with a greater risk of incisional hernia formation in laparoscopic hepatectomy (6). In previous decades, umbilical incision was avoided as the navel is not clean. Meanwhile, midline abdominal incisions through the navel were correlated to wound infections. However, the incidence rate was low at 4.5%, and transumbilical incision was considered safe (7) in

recent years. In terms of complications, laparoscopic procedures were associated with a reduced incidence of port-site infections and other wound-related complications (8). The incidence rate of SSI correlated with transumbilical incision in laparoscopic gastric and colorectal resections were low at 2.64% (4) and those in laparoscopic colectomy were at 4.31% (5). Meanwhile, SSI was not observed in patients who underwent laparoscopic hepatectomy (6) and LP in the current study. According to a large cohort study, the incidence rate of superficial SSI in LDP was 0.16% (9). Considering the differences in surgical procedure, the development of SSI might be correlated with exposure to intestinal bacteria associated with intestinal manipulation during gastrointestinal surgery. Lap-H and LP were considered sterile low-contamination procedures. The risk factors for SSI in laparoscopic colon resection include increased BMI and a history of DM (10-12).

In incisional hernia, the incidence rate of port-site hernia ranged from 0% to 25.9%. Moreover, female sex, DM, SSI, wound extension, and high BMI were considered as risk factors for hernia formation (5, 13). There are few studies on transumbilical incisional hernia in LP. In previous reports and the current study, the incidence rates of hernia were 1.85%-7.14% in Lap-H (6, 14-16) and 3.58% in laparoscopic gastrectomy and colectomy (4). In the current study, 3 (5.77%) of 52 patients presented with transumbilical incisional hernia, and this finding is similar to that of previous reports regardless of surgery type. In particular, in Lap-H, which is similar to parenchymal organ surgery, high BMI was a risk factor of hernia formation (6). In addition, it was believed to be associated with obesity and abundance of subcutaneous fat, which, in turn, can increase the technical difficulty of nodular sutures and can affect hernia formation. Previous reports have not shown any relationship between the abundance of subcutaneous fat and incisional hernia formation. Hence, to assess the effect of abdominal wall thickness on hernia formation, postoperative incisional hernia formation was assessed *via* preoperative CT scan. There were two types of distances, which were as follows: distance A, defined as distance from the surface of the umbilical region to the peritoneum, and distance B, defined as distance from the bottom of the navel to the peritoneum. Whether they could be risk factors for hernia formation was assessed. The distances in patients with and without hernias were as follows: distance A: 24.74±7.88 and 25.47±3.58 mm ( $p=0.668$ ), distance B: 15.44±6.35 and 15.90±5.20 mm ( $p=0.639$ ). There were no significant differences between the two groups. These results showed that incisional hernia can occur at a certain probability. However, large-scale studies should be conducted to further assess these results.

In terms of other postoperative complications, none of the patients presented with adhesive ileus or port-site recurrences in the navel incision area. These results indicated that

umbilical incision does not have any specific harmful effects intraperitoneally after surgery. Meanwhile, pancreatic fistula, which spreads inflammation into the abdominal cavity, does not contribute to the development of complications correlated with transumbilical incision. However, a higher number of cases should be included in future studies.

In our institution, transumbilical incision is routinely used in all abdominal laparoscopic procedures, not only as the first port but also as an organ removal site, which is reasonable and associated with excellent aesthetic outcomes. The reasons for using transumbilical incisions are as follows: 1) cosmetic outcomes, 2) ease for extension, 3) small skin incision, and 4) no requirement for a new incision for organ removal alone.

The main features of this research are as follows: First, the current study aimed to evaluate the use of transumbilical incision as an organ removal site rather than just an incision port. Second, the present study had almost no missing data caused by postoperative routine follow-up. Hernia in patients with poor clinical symptoms was diagnosed by performing cautious evaluation *via* CT scan. Thus, the identification of hernia incidence can be more reliable. A highly comprehensive evaluation including a clinical and physical assessment and follow-up CT scan every 3-6 months in the outpatient department was performed routinely in our institution. Third, transumbilical incision coating and perioperative management in all laparoscopic procedures were standardized. Hence, variation and bias were significantly reduced.

The current study has several limitations. First, this was a retrospective study. The wound length was unknown, and there was bias in variable settings. Second, selection bias existed because only patients who safely underwent laparoscopic procedures were selected. Third, there was a lack of data on the suturing method using rectal sheaths. There were two methods of suturing: nodular and continuous sutures. During the first half of the observation period, continuous suturing was performed. However, data on the suturing methods were not included in some surgical records. Thus, the suturing methods were not included in the comparison items. Nodular sutures were commonly observed in the second half of the observation period, and the latter can be a reliable suturing method to prevent incisional hernia.

Only few studies focused on transumbilical incisional complications and its efficacy. The incidence rate of transumbilical incisional hernia formation was high in patients with increased BMI, and a high BMI was considered a risk factor of hernia formation in our previous, not in the current, study. Furthermore, wall thicknesses such as the distance between the epidermis and the abdominal cavity in the navel area measured *via* preoperative CT scan did not significantly differ between groups with and without incisional hernia. Hence, these results showed that some



transumbilical incisional hernias may occur at a certain probability, and some hernias can be caused by uncertainty of nodular suturing due to technical difficulties. Either way, nodular suturing for wound closure should be performed cautiously and accurately in all cases. Postoperative physical assessment and imaging may be required to accurately detect incisional hernias.

## Conclusion

Transumbilical incision including wound closure and use of covering methods can be feasible with good tolerability and rationality in modern laparoscopic abdominal surgery.

## Conflicts of Interest

None of the Authors have any conflict of interest to declare in relation to this study.

## Authors' Contributions

KT, MM and TA designed the study concept and wrote the paper. All Authors read and approved the final manuscript.

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