



## RESEARCH ARTICLE



# A Comparative Study between the Periumbilical and The Intraumbilical Incisions in Laparoscopic Procedures

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### Abstract

**Background:** Laparoscopic surgery is now a widely accepted treatment modality in every field of general surgery. A periumbilical is a commonly used method for the initial approach of the laparoscope into the abdomen. The intraumbilical incision is being used more frequently, with the increasing cases of single incision laparoscopic surgery (SILS), which has recently been proven to be a feasible alternative for conventional laparoscopic surgery with better cosmetic merit. **Methods:** This was a Prospective Cohort Study. Study was conducted at Department of General Surgery, Burdwan Medical College & Hospital, West Bengal from 1st September 2018 to 31st August 2020 A total of 100 patients were selected and randomly divided in two groups with 50 patients in each group. 50 patients received periumbilical incision and 50 patients received Intraumbilical incision. Data analysis was performed using SPSS statistical package software version 23.0 for Windows (SPSS Inc., Chicago, IL, USA). **Results:** Regarding sex distribution we found in IU group 28 (56%) were females and 22 (44%) were males with a male to female ratio of 1.27:1. and in PU group, 30 (60%) patients were males while 20 (40%) were females. There was no difference in operation time between the two groups.

**Conclusions:** Our results show that despite the widespread belief that an intraumbilical incision will cause more wound infection and incisional hernia, actual wound complication rates do not differ from the cases with periumbilical incision. The cosmetic survey score was significantly higher in the IU group compared to PU group

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## 1 | INTRODUCTION:

Laparoscopy is a procedure conducted using small incisions with the aid of a camera in the abdomen, laparoscope helps with therapeutic and diagnostic interventions. (1) Laparoscopic surgery is now a widely accepted treatment modality in every field of general surgery. (2–7)

A modern surgical method is laparoscopic surgery, also called minimally invasive surgery (MIS), bandaid surgery, or keyhole surgery. Unlike the more traditional, open technique, there are a range of advantages for the patient with laparoscopic surgery. These include reduced haemorrhaging and shorter healing time due to smaller incisions, decreased hospital stay and cosmesis. The key element is the use of a laparoscope, a long fibre optic cable system that allows the affected area to be viewed by snapping the cable from a location that is more distant, but easier to access. The creation of pneumoperitoneum and the safe placement of the initial trocar are considered very important steps in laparoscopic surgery. A periumbilical incision is a commonly used method for the initial approach into the abdomen. (3)

This periumbilical incision, with a linear fascial incision, is most often U shaped on the skin. It is placed below or above the umbilicus, and the skin, subcutaneous fat, and fascia are cut through. In comparison, a vertical longitudinal incision from the skin to the fascia is an intraumbilical incision, stretching just the length of the umbilical ring. Since it is only necessary to separate the skin and fascia, an intraumbilical incision can take less time, be simpler to conduct, and potentially less traumatic.

The intraumbilical incision is being used more frequently, with the increasing cases of single incision laparoscopic surgery (SILS), which has recently been proven to be a feasible alternative for conventional laparoscopic surgery with better cosmesis merit (4–10) Since the umbilicus is relatively deeper than the surrounding abdominal wall, it has more bacteria. A recent study found more than 1,400 types of bacteria from 95 umbilical bacteria cultures. (11)

After surgical preparation, the inside of the umbilical ring is as sterile as the skin outside the umbilicus, and

that the wound infection rate will show no difference, The port site infection of perforated appendicitis is known to be higher than that of other simple laparoscopic procedures, including other perforated cases like gut perforation. (12)

Hence, present study was undertaken and we compared the wound complication rates, easier and safer method of port entry and post surgical cosmesis in cholecystectomy, appendectomy and diagnostic laparoscopy patients according to the initial laparoscopic incision (intraumbilical vs. periumbilical).

### Aims and Objectives:

1. To determine the safer and the easier technique for laparoscopic umbilical port insertion.
2. To compare postoperative outcome and wound complication rate between intra and periumbilical incision for laparoscopic procedures.
3. To compare intraumbilical and periumbilical incision on the basis of cosmesis (visible scar after 3 months).

## 2 | METHOD AND MATERIALS:

**Study Design :** Prospective Cohort Study

**Study Area :** Department of General Surgery, Burdwan Medical College & Hospital

**Study Population :** Patients who were admitted in surgery wards for laparoscopic cholecystectomy, appendectomy and diagnostic laparoscopy during the study period.

**Study period :** 1st September 2018 to 31st August 2020

**Sample Size :** A total of 100 patients were selected and randomly divided in two groups with 50 patients in each group. 50 patients received periumbilical

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incision and 50 patients received intraumbilical incision.

**Inclusion Criteria :** Patient admitted for planned

- Laparoscopic cholecystectomy
- Laparoscopic appendectomy
- Diagnostic laparoscopy

**Exclusion Criteria :**

- Patients with congenital or ischemic heart disease.
- Re-operative abdomen
- Portal hypertension and cirrhosis
- Gravid uterus
- Acute calculus cholecystitis
- Peritonitis

**Study Tools :**

- OPD Tickets
- Indoor Bed Head Tickets
- History and Clinical Examination Notes
- Consent Form
- Operation Theatre Records

**Methodology:** After obtaining institutional ethical clearance and departmental permission; this prospective observational study was conducted in Burdwan Medical College and Hospital among the patients who were admitted in surgical wards for laparoscopic cholecystectomy, appendectomy and diagnostic laparoscopy. The patients were classified according to type of incision made for laparoscopic procedures. They were informed about the study and were assured that best possible treatment will be given. Informed written consent was obtained from them. A total of 100 patients were selected and randomly divided in two groups with 50 patients in each group. 50 patients received periumbilical incision and 50 patients received intraumbilical incision. The patient's relevant demographic data were recorded. Pre-operative major and minor complications, wound complication rate, duration of hospital stay, amount of analgesic consumption on post operative day 1 were recorded and reviewed. Port site infection which is defined as a state of localized erythema, edema, nodule formation at port site, warmth accompanied by subjective pain, with

or without purulent discharge was taken care upto 1 month following surgery. Any case of internal organ injury related with the insertion of umbilical trocar was also recorded.

**Surgical Technique:** All the patients received 3rd generation cephalosporin intravenously at induction of anesthesia, after surgery patients were administered with 2 or more further dose of antibiotics. In both groups the umbilicus were cleaned thoroughly with cotton swabs using alcohol. Routine manual evacuation of debris was performed. After cleaning the umbilicus; skin preparation was done in the usual manner using betadine. Swab culture from both inside and outside of the umbilicus were taken and send for culture.

Scar assessment was performed at postoperative week 12. The Vancouver scar scale was used to evaluate the healing of the port entry site in the umbilical region, and cosmesis analysis was performed.

In case of intraumbilical technique a midline incision was made inside the depression of umbilicus with slight retraction of the skin on both sides of the umbilicus using tissue forceps; a transumbilical incision was extended to the full length of the umbilicus, surgical peritoneum was grasped and opened under vision. A single suture at the midpoint using absorbable suture material was used for sufficient wound closure.

When the periumbilical incision is used; a U shaped incision below the umbilicus was made. The subcutaneous fat was dissected and exposed and rectus sheath was opened then after surgical peritoneum was opened under vision. Wound closure was done in a layer by layer fashion.

**Statistical Analysis :** Data analysis was performed using SPSS statistical package software version 23.0 for Windows (SPSS Inc., Chicago, IL, USA). Comparison of categorical variables was performed with the chi square test of Fisher's exact test. Comparisons of continuous variables were performed using Student's t-test. All tests were two sided, and a p value of 0.05 was regarded as significant.

3 | RESULTS :

**TABLE 1: Distribution of participation according to Gender.**

Sex	Intraumbilical Incision (IU)		Periumbilical Incision (PU)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Male	22	44.0	20	40.0
Female	28	56.0	30	60.0
<b>Total</b>	50	100.0	50	100.0
<b>Male : Female Ratio</b>	1.27:1		1.5:1	
<b>p value</b>	Chi-Square - 0.164		p Value 0.685	

Sex distribution of study participants is mentioned in **Table 1**. In IU group 28 (56%) were Female and 22 (44%) were males with a male to female ratio of 1.27:1. and in PU group, 30 (60%) patients were females while 20 (40%) were males with a male to female ratio of 1.5:1. No significant difference was found regarding sex distribution between IU group and PU group (p-value =>0.685)

**TABLE 2: Distribution of participants according to type of Surgery, BMI and co-morbidities.**

Type of Surgery	Intraumbilical Incision (IU)		Periumbilical Incision (PU)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Cholecystectomy	37	74	35	70
Appendectomy	09	18	10	20
Diagnosis Laparoscopy	04	08	05	10
<b>Total</b>	50	100.0	50	100.0
<b>p value</b>	Chi-Square - 0.219		p Value 0.89	
<b>BMI (Kg/m<sup>2</sup>)</b>				
<18.5 Kg/m <sup>2</sup>	1	2.0	2	4.0
18.5-24.9 Kg/m <sup>2</sup>	19	38.0	20	40.0
25 - 29.9 Kg/m <sup>2</sup>	20	40.0	21	42.0
= 30 Kg/m <sup>2</sup>	10	20.0	7	14.0
<b>Total</b>	50	100.0	50	100.0
<b>p value</b>	Chi-Square - 0.912		p Value 0.822	
<b>Co-morbidity</b>				
Diabetes	6	12.0	5	10.0
Hypertension	5	10.0	4	8.0
Anemia	2	4.0	3	6.0
<b>Total</b>	50	100.0	50	100.0
<b>p value</b>	Chi-Square - 0.362		p Value 0.834	

Table 2 shows that 37 (74%) of IU group and 35 (70%) of PU group underwent laparoscopic cholecystectomy; while 9(18%) of IU and 10 (20%) of PU group underwent laparoscopic appendectomy. And 4 (8%) of IU and 5 (10%) of PU group had diagnostic laparoscopy. Regarding type of surgery two groups were comparable with a p value was 0.89.

Most of the patients of both IU and PU group BMI ranged between 18.5- 29.9 Kg/m<sup>2</sup>. No significant difference was found regarding BMI between IU group and PU group with a p-value of 0.822.

In IU group 6 (12%) patients had diabetes mellitus, 5 (10%) had hypertension and 2 (4%) had anemia. In PU group, 5 (10%) had diabetes mellitus, 4 (8%) had hypertension and 3 (6%) had anemia, no significant difference was observed (p value = 0.834).

**TABLE 3: Distribution of participants according to peri-operative outcomes and VAS score.**

Peri-operative outcomes	Intraumbilical Incision (IU)		Periumbilical Incision (PU)		P value
	Mean	±SD	Mean	±SD	
Duration of	37.600	±7.50	42.200	±9.59	0.107
Estimated Blood	20.200	±7.35	24.600	±6.29	0.646
Start of Diet (Days)	1.220	±0.41	1.060	±0.23	<0.001
Hospital Stay	2.120	±0.74	2.080	±0.72	0.607
<b>VAS Score</b>					
Operation Day	3.840	±0.79	3.940	±0.76	0.424
POD 1	1.980	±0.76	1.720	±0.60	0.618
POD 2	0.580	±0.49	0.740	±0.52	0.292

Table 3 shows that there was no difference in operation time between the two groups (37.600 minutes for IU vs. 42.200 minutes for PU; p value = 0.107). Significant difference was observed in estimated blood loss and start of diet (p value=0.646). Length of postoperative hospital stay was comparable between two group (p value=0.607). Comparison of mean VAS score between two groups on operation and post

operative day 1 and 2. There were no significant differences in Visual Analogue Scale (VAS) score during convalescence ( $p$  value =  $>0.05$ ).

**TABLE 4: Distribution of participants according to cosmetic survey (Vancouver Scar Scale) and Postoperative Complications.**

Cosmetic	Intraumbilical Incision (IU) (n=50)		Periumbilical Incision (PU) (n=50)		P value
	Mean	±SD	Mean	±SD	
Vascularity	1.040	±0.40	1.520	±0.57	<0.001 (S)
Pigmentation	1.100	±0.41	1.660	±0.51	<0.001 (S)
Pliability	1.420	±0.75	1.920	±0.60	0.02 (S)
Height	0.900	±0.30	1.420	±0.60	<0.001 (S)
<b>Post-operative Complications</b>					
Port site Infection	4	08	5	10	0.500
Umbilical Hernia	0	0.0	0	0.0	-
PONV	7	14.0	8	16.0	0.500
Paralytic Ileus	1	2.0	1	2.0	0.237
Haemorrhage	0	0.0	1	2.0	0.500

shows that The cosmetic survey score by Vancouver Scar Scale was found in the IU group Mean & SD value of Vascularity  $1.040 \pm 0.40$ , Pigmentation-  $1.100 \pm 0.75$ , Pliability-  $1.420 \pm 0.75$  & Height  $0.900 \pm 0.30$  respectively. And Mean & SD value of PU group Vascularity  $1.800 \pm 0.49$ , Pigmentation-  $1.520 \pm 0.57$ , Pliability-  $1.660 \pm 0.51$  & Height  $1.920 \pm 0.60$  respectively. Comparison between two groups we had found the statistical significant in Vascularity, Pigmentation, Pliability & Height  $p$  value were  $<0.05$ .

Incidence of postoperative complications in two groups. Wound infection and incisional hernia development showed no significant difference between

the two groups. There were no recorded incisional hernias in any group. There were no mortalities in any group. There were no important harms or unintended effects in any participants

## 4 | DISCUSSION

Although the initial peritoneal access is an important factor in laparoscopic surgery, methods vary widely according to surgeon. Both the IU incision and the PU incision are being used. Most reports of single incision surgery use the IU incision. (13, 14) Not only is the IU incision easier to perform single incision surgery, but a truly scarless surgery can be performed. The scar is less visible in the IU incision. But due to concerns over complications such as wound infection or umbilical hernia, the PU incision is still being used.

Hence, the present study was conducted in the Department of Department of General Surgery, Burdwan Medical College & Hospital upon patients admitted in surgery wards for laparoscopic cholecystectomy, appendicectomy and diagnostic laparoscopy. A total of 100 patients were selected and randomly divided in two groups with 50 patients in each group. 50 patients received periumbilical incision and 50 patients received intraumbilical incision. The purpose of this study was to compare the two different methods of the umbilical incision through outcomes such as hospital stay, postoperative wound infection, nausea, and vomiting and patients satisfaction were examined and compare between both groups

Laparoscopic procedures is the commonly performed surgical intervention in all over the world because of its better outcomes such as less hospital stay, less complication, shorter operative time and better cosmetic results. (15, 16) Many of techniques have been applied for laparoscopic procedures, out of which single incision laparoscopic surgery resulted better outcomes with fewer rate of complications as compared to conventional surgery. (17, 18) In present study we used two different techniques (intraumbilical versus periumbilical incision) in patients undergoing laparoscopic procedures such as

laparoscopic cholecystectomy, appendectomy and diagnostic laparoscopy and compare the outcomes between both groups to analyze which one is better. In this regard 100 patients were included. Majority of patients 28 (56%) were females while 44% were males. These results were similar to many of previous studies in which male patients were high in numbers 55% to 65% as compared to females. (19, 20)

In present study we found no significant difference regarding body mass index and co-morbidities between both groups ( $p > 0.05$ ). A study conducted by. (19)

Lee et al reported similarity in which they no significant difference was observed regarding BMI between both groups, they also reported that in intraumbilical group hypertension found in 13.8% and diabetes found in 6.3% patients while in periumbilical group 12.4% patients had hypertension and 10.7% had diabetes. (20)

The results of study shows there was no difference in operation time between the two groups (37.600 minutes for IU vs. 42.200 minutes for PU;  $p$  value = 0.107). Significant difference was observed in estimated blood loss and start of diet ( $p$  value=0.646). Length of postoperative hospital stay was comparable between two group ( $p$  value= 0.607). A study conducted by Rajkhowa et al. (21) reported mean hospital stay in intraumbilical group was 5 days and in periumbilical group mean hospital stay was 5 days.

There were no differences in the complication rates between the two groups. The incidences of the two most feared complications of the IU incision, wound infection and umbilical hernia, did not differ between the two groups. In the case of wound infection, none occurred in the IU group, and 2 cases of wound infection in the PU group were treated with conservative care in the outpatient clinic. There was no statistical significance. There were no umbilical hernias in the two groups. Antoniou et al (22) reported that when single port totally extraperitoneal is performed through a transumbilical incision, the risk of hernia may increase. However, these findings may be limited to transumbilical single incision surgery, since it requires a relatively longer incision in the umbilicus.

Lee et al (23) reported that single incision laparoscopic appendectomy performed with an IU incision had lower incidence of complications compared to open appendectomy and that infection rates were actually lower in the single incision group. Based on this observation, we compared laparoscopic single port appendectomy using the IU and PU approaches for our study, to observe which approach gave better postoperative results. In our study, the wound complication rates of the PU and IU approach did not show any significant difference. Port site infection was observed for 4 (8.0%) patients in the IU group and 5 (10.0%) patients in the PU group.

A study conducted by Audrey Boufard-Cloutier et al (24) reported similarity and reported that periumbilical incision had high rate of wound infection as compared to intraumbilical, however no significant difference was observed with  $p$ -value  $> 0.05$ . Another study conducted by Awan et al (25) demonstrated that patients received intraumbilical incision method had fewer rate of port site infection as compared to transumbilical method (5% Vs 5.9%).

The periumbilical incision leaves an obvious scar close to the umbilicus. Although there are periumbilical scars with better cosmetic results. When the intraumbilical incision is made, the entire incision is contained within the umbilical ring. Additionally, unlike the smooth skin adjacent to the umbilicus, the umbilicus itself contains many skin folds. The incision is made into one of the creases, and the scar is virtually invisible.

The trocar for a laparoscope was introduced through an intraumbilical incision, and two 5 mm trocars were inserted through separate incisions below the bikini line. Since the umbilical incision is invisible, when this patient is wearing underwear or a swimming suit, there is no visible scar.

Also, the intraumbilical incision is easy to perform. First of all, the fascia lies directly beneath the umbilical skin with virtually no subcutaneous fat. So, it takes very little time to divide the fascia lying directly underneath after incising the skin, and with a minimum of further dissection, the peritoneal cavity is entered. Secondly, the close proximity of the layers also allows for a much faster closure. In most of our patients, a single full layer suture was sufficient

for closure. No additional sutures were made in the subcutaneous fat layer, or the skin. The periumbilical incision, in comparison, needs a more cumbersome process.

Closure is usually done layer-to-layer, meaning the fascia, the subcutaneous fat, and the skin are all separately closed. Third, in the case of an obese patient with a thick layer of subcutaneous fat, the opening and closure of the periumbilical trocar site is often very difficult. In contrast, with lateral retraction of the skin on both sides of the umbilicus, the umbilical ring is easily exposed in even obese patients, so the intraumbilical incision could be easily performed.

Comparison of cosmetic survey score is mentioned in Table 4. The cosmetic survey score by Vancouver Scar Scale was found in the IU group. Mean & SD value of Vascularity  $1.040 \pm 0.40$ , Pigmentation-  $1.100 \pm 0.75$ , Pliability-  $1.420 \pm 0.75$  & Height  $0.900 \pm 0.30$  respectively. And Mean & SD value of PU group Vascularity  $1.800 \pm 0.49$ , Pigmentation-  $1.520 \pm 0.57$ , Pliability-  $1.660 \pm 0.51$  & Height  $1.920 \pm 0.60$  respectively. Comparison between two groups we had found the statistical significant in Vascularity, Pigmentation, Pliability & Height p value were  $< 0.05$ .

Choosing the superior laparoscopic access is not an issue. Laparoscopy has been proven to be a safe, feasible alternative for open surgery in major surgery such as cancer surgery. (26–30) All these types of surgery may benefit from applying the intraumbilical incision.

## 5 | CONCLUSION AND RECOMMENDATIONS :

**At the end of the study on the basis of the results we can conclude that:**

The intraumbilical incision is a safe and feasible alternative for the periumbilical incision that can be easier to perform with better cosmetic results of initial intraperitoneal access that can reduce the operation time and offer superior cosmetic effects to the patient. Our results show that despite the widespread belief that an intraumbilical incision will

cause more wound infection and incisional hernia, actual wound complication rates do not differ from the cases with periumbilical incision. The cosmetic survey score was significantly higher in the IU group compared to PU group.

No significant difference was observed between both procedures regarding operation time, wound infection, nausea and vomiting. However, intraumbilical incision had fewer complications as compared to periumbilical incision.

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