

## ORIGINAL ARTICLE

# A comparison of the periumbilical incision and the intraumbilical incision in laparoscopic appendectomy

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**Purpose:** The intraumbilical incision is being used more frequently, with increasing cases of single incision laparoscopic surgery. Since the umbilicus is deeper than the surrounding wall, it has abundant bacteria. No study has compared the adverse outcomes of periumbilical and intraumbilical incisions. We analyzed the wound complication rates of perforated appendicitis patients according to the types of umbilical incision. **Methods:** A retrospective review was done of 280 patients with perforated appendicitis. One hundred fifty nine patients were treated with the intraumbilical incision, and 121 patients were treated with the periumbilical incision. We compared the perioperative outcomes according to each laparoscopic incision. **Results:** There was no difference in operation time, postoperative hospital stay and analgesic requirement between the two groups. One case in the intraumbilical group (0.6%) and three cases in the periumbilical group (2.5%) developed wound infections. The umbilical complication rate showed no difference. **Conclusion:** The wound complication rate of intraumbilical and periumbilical incisions are not different. Although this retrospective study has inherent limitations, the intraumbilical incision seems to be a safe and feasible alternative for the periumbilical incision that can be easier to perform, with better cosmetic results.

**Key Words:** Intraumbilical, Laparoscopic technique, Appendectomy

## INTRODUCTION

Laparoscopic surgery is now a widely accepted treatment modality in many fields of general surgery [1-6]. The creation of pneumoperitoneum and the safe placement of the initial trocar are considered very important steps in laparoscopic surgery. A periumbilical incision (a small incision on the superior or inferior border of the umbilicus) is a commonly used method for the initial approach of the

laparoscope into the abdomen [7]. This periumbilical incision is most often U-shaped at the skin, with a linear fascial incision. It is placed below or above the umbilicus, and it cuts through the skin, the subcutaneous fat, and the fascia. In contrast, the intraumbilical incision is a vertical linear incision from the skin to the fascia, extending only the length of the umbilical ring. Since only the skin and fascia need to be divided, an intraumbilical incision may take less time, is easier to perform, and is theoretically less

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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 cosmetic merit [8-14].

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 [15].

To date, there has not been a study that directly compared the complication rates of the intraumbilical and periumbilical incisions. The authors hypothesized that 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. Also, we hypothesized that, with adequate wound closure, there will be no difference in the incidence of incisional hernia.

The wound morbidity of perforated appendicitis is known to be higher than that of other simple laparoscopic procedures, including nonperforated cases [16]. In this study, we compared the wound complication rates of perforated appendicitis patients according to the initial laparoscopic incision (intraumbilical vs. periumbilical).

## METHODS

### Patients

A retrospective review was done of perforated appendicitis patients treated by a total of 15 surgeons at two hospitals from January 1, 2008 to December 31, 2008. A total of 323 patients were treated with perforated appendicitis. Forty three patients were excluded due to factors such as open surgery or conversion to open surgery, and a total of 280 patients were included. Assignment of patients to the intraumbilical group (IU group) or the periumbilical group (PU group) was based entirely on the attending surgeon's preference. Collected data included age, sex, weight, height, body mass index (BMI), and comorbidities. Comorbidities were assessed by chart review, determining whether the patient had hypertension, diabetes, coronary artery disease, or chronic obstructive pulmonary disease. Outcome variables were wound complication

rate, duration of hospital stay, patient pain according to the visual analogue scale (VAS), and amount of required analgesics on postoperative day 1.

All complications were recorded from an in-depth chart review. Postoperative umbilical complications included any cases of wound infection, incisional hernia, and hematoma formation. Wound infection was defined as a state of localized erythema, edema, or heat, accompanied by subjective pain, with or without purulent discharge. An incisional hernia was defined as a protrusion or bulge present at or near the umbilical incision. Any cases of internal organ injury related with the insertion of the umbilical trocar were recorded.

Postoperative pain at rest was recorded at  $24 \pm 3$  hours after surgery, using a VAS graded from 0.0 to 10.0. All analgesics used were converted to an equivalent amount of intravenous morphine sulfate so that a more meaningful comparison could be done.

The results were evaluated by chi-square or Student's t-test. All tests were two-sided, and a P-value  $\leq 0.05$  was regarded as significant.

The study was approved by the Institutional Review Board of the Ethical Committee of both hospitals.

### Surgical technique

All patients received 1st generation cephalosporin intravenously at induction of anesthesia. After surgery, patients were administered two or more further doses of antibiotics.

When the intraumbilical incision was used, the umbilicus was 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. A midline incision was made inside the depression of the umbilicus. With slight retraction of the skin on both sides of the umbilicus using tissue forceps, no eversion of the umbilicus was necessary for an accurate incision (Fig. 1). The intraumbilical incision was extended to the full length of the umbilical ring. Directly beneath the skin of the umbilicus lies the fascia. Therefore, with a minimum of further dissection, the peritoneal cavity was easily entered. Since most umbilical rings measure over 10 mm in diameter,

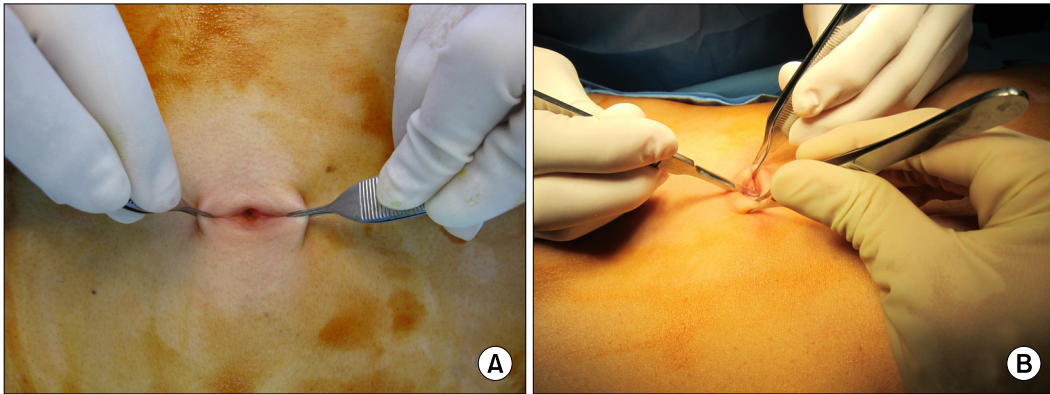


Fig. 1. The intraumbilical incision.

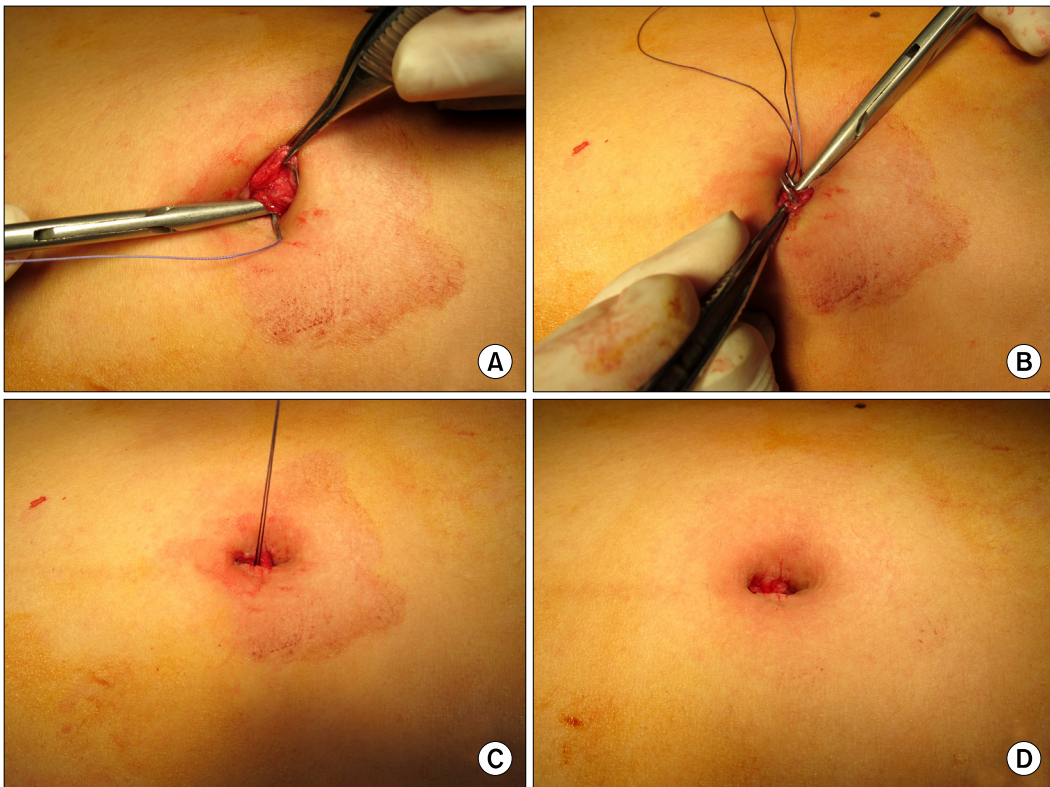


Fig. 2. A single full layer suture at the midpoint, with the needle pointing upward at both sides.



Fig. 3. A piece of balled-up gauze is placed, and an adhesive bandage is applied.

there was rarely any difficulty in inserting an 11 mm trocar. Laparoscopic appendectomy using conventional methods was done. To avoid contamination of the fascia or skin, the appendix was retrieved from the peritoneal cavity with a Lap-bag (SJ Medical, Paju, Korea) through the umbilical port in all cases. A single suture at the midpoint using absorbable suture material (Vicryl, Ethicon Inc., Somerville, NJ, USA) was sufficient for wound closure, without the need for any additional sutures of the subcutaneous fat or skin. A full layer suture was done, with the needle pointing upward at each side to avoid organ injury (Fig. 2). This single suture allowed approximation of the layers, and essential closure of the skin. A piece of ball-up gauze was placed in the umbilicus, and an adhesive bandage was applied (Fig. 3).

When the periumbilical incision was used, a U-shaped incision below the umbilicus was made. The subcutaneous fat was dissected and the exposed fascia was opened using electrocoagulation. After opening of the fascia, either direct trocar insertion or insertion after insufflation with a Veress needle was done. After appendectomy, wound closure was done in a layer-by-layer fashion, with separate closure for the fascia, the subcutaneous fat, and the skin.

A 200 mL Jackson-Pratt drain was inserted into the pelvic cavity for all perforated cases with intraperitoneal contamination. For postoperative pain control, patient controlled analgesics was not used, and analgesics such as nonsteroidal antiinflammatory agents were injected on request of the patients.

## RESULTS

The intraumbilical incision was used for 159 patients,

**Table 1.** Patient demographics

Variable	IU group (n = 159)	PU group (n = 121)	P-value
Age (yr)	35.7	40.2	0.105
Male : female	10.6 : 9.4	11.6 : 8.4	0.467
Body mass index (kg/m <sup>2</sup> )	22.38	22.49	0.798
Hypertension, n (%)	22 (13.8)	15 (12.4)	0.859
Diabetes, n (%)	10 (6.3)	13 (10.7)	0.194

IU, intraumbilical; PU, periumbilical.

and the periumbilical incision was used for 121 patients. There were no statistically significant differences in patient demographics (Table 1). The mean age of the IU group was 35.7 years, and the mean age of the PU group was 40.2 years. The IU group consisted of 84 males (52.8%) and 75 females (47.2%), and the PU group consisted of 70 males (57.9%) and 51 females (42.1%). The mean BMI of the IU and PU groups was 22.38 kg/m<sup>2</sup> and 22.49 kg/m<sup>2</sup>, respectively.

There was no difference in operation time between the two groups (74.9 minutes for IU vs. 80.8 minutes for PU;  $P = 0.073$ ) (Table 2). Duration of postoperative hospital stay was 5.16 days in the IU group and 6.06 days in the PU group, with no significant difference. The required amount of analgesics, converted to morphine equivalents in milligrams, was 4.4 in the IU group and 3.9 in the PU group. The mean VAS score was 4.5 in the IU group and 4.3 in the PU group. These numbers had no statistical significance. Wound infection and incisional hernia development showed no significant difference between the two groups. There were no recorded incisional hernias in any group. There was one case of umbilical infection in the IU group (0.6%) compared with three cases of umbilical infection in the PU group (2.5%), with no statistical significance ( $P = 0.319$ ). There were no incidences of internal organ injury caused by trocar insertion in any group.

## DISCUSSION

Since the start of laparoscopic appendectomy in the ear-

**Table 2.** Postoperative clinical data

	IU group (n = 159)	PU group (n = 121)	P-value
Operative time (min)	74.9	80.8	0.073
Postoperative hospital stay (day)	5.16	6.06	0.051
Morphine equivalent (mg)	4.4	3.9	0.074
Visual analogue scale	4.5	4.3	0.285
Wound infection, n (%)	1 (0.6)	3 (2.5)	0.319
Incisional hernia, n (%)	0 (0)	0 (0)	-
Internal organ injury <sup>a</sup> , n (%)	0 (0)	0 (0)	-

IU, intraumbilical; PU, periumbilical.

<sup>a</sup>)Internal organ injury related with trocar insertion.

ly 1980s, continuous efforts have been made for better cosmetic results. Chow et al. [8] reported a method of SILS performed through an intraumbilical incision. This method left virtually no scar after surgery. Vidal et al. [17] reported a type of single-incision laparoscopic surgery performed with a suprapubic approach. Because of the pubic hair covering the low-lying incision, cosmetic results were remarkable. In spite of these trends, the periumbilical incision is still widely used.

In our study, the wound complication rates of the IU group and the PU group did not show any significant difference. To support our theory that the inside of the umbilical ring is as sterile as the outside after surgical preparation, we obtained swab cultures from both inside and outside the umbilicus, after preparation. The cultures were obtained from 10 patients. All cultures, whether inside or outside the umbilicus, showed no growth after 7 days (data not shown).

Additionally, excluding wound infection, one patient in the IU group (0.6%) and five patients in the PU group (4.1%) experienced some sort of minor wound problem on umbilicus. The patient in the IU group visited the outpatient clinic 8 days after discharge showing a small granuloma at the intraumbilical incision site. Dressing was done, with subsequent healing of the wound. Of the five patients in the PU group, three experienced slight discharge of the periumbilical wound, one showed an umbilical bulla, and one patient showed dehiscence of the wound, requiring sutures under local anesthesia in an out-

patient setting. All patients in both groups were completely healed within 2 weeks.

Lee et al. [18] reported in a study that compared single incision laparoscopic appendectomy performed with an intraumbilical incision and open appendectomy that infection rates were actually lower in the single incision group, even though there were more complicated cases in this group. This may be due to the fact that when using the intraumbilical incision, the subcutaneous layer is not penetrated, thus leaving less potential for seroma formation or hematoma formation, which can lead to wound infection.

Laparoscopic appendectomy is not a very difficult procedure. It is safe to consider it as a basic procedure that every laparoscopic general surgeon must master before starting other operations. When an experienced surgeon performs a laparoscopic appendectomy, and removal of the inflamed appendix is uneventful, the aesthetic satisfaction of the patient must be taken into consideration. According to a recent survey, approximately 30% of people deemed umbilical appearance "important" for their body image [19]. This same survey showed that 45% of men believed that umbilical appearance played a role in their partner's attractiveness. These results show the importance of the umbilicus. In the case of severe disease, for example cancer, these issues seem irrelevant. But when discussing benign conditions that are much more common, for example appendicitis or cholecystitis, these factors must be considered.

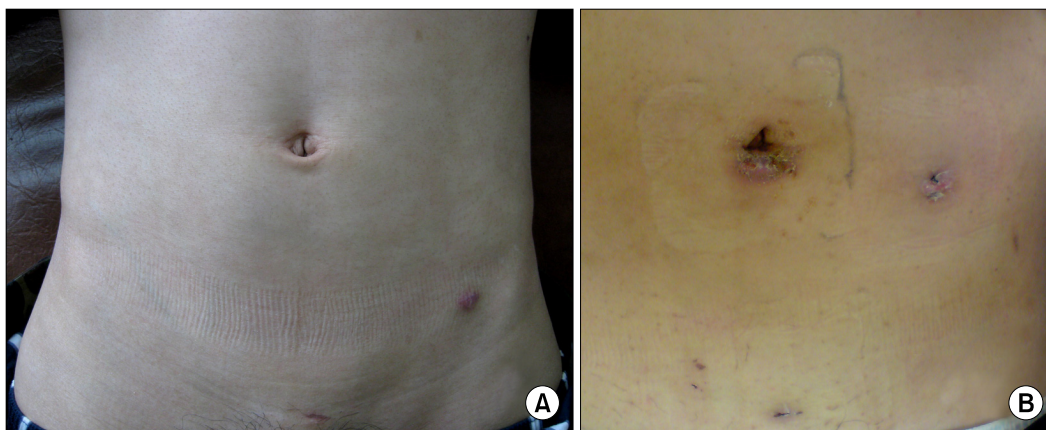


Fig. 4. Representative outcomes of the intraumbilical incision, 1 week after surgery (A) and the periumbilical incision (B).

The periumbilical incision leaves an obvious scar close to the umbilicus. Although there are periumbilical scars with better cosmetic results, Fig. 4B shows a good example of a cosmetically unappealing periumbilical wound. 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 patient shown in Fig. 4A received laparoscopic appendectomy. 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.

Choosing the superior laparoscopic access is not an issue limited to appendectomy. Laparoscopy has been proven to be a safe, feasible alternative for open surgery in major surgery such as cancer surgery [20-24]. All these types of surgery may benefit from applying the intraumbilical incision.

This study was somewhat limited in that it was a retro-

spective study. Also, patient assignment to either group was based entirely on the attending surgeon's preference. Also, factors that may contribute to wound infections such as perioperative glucose, body temperature, or oxygenation levels were not assessed.

In conclusion, the intraumbilical incision is a safe and feasible alternative for the periumbilical incision that can be easier to perform with better cosmetic results. 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.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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