

# Small incisional surgery for small intestinal diseases is less invasive than laparoscopic surgery

Hidejiro Kawahara (✉ [kawahide@outlook.jp](mailto:kawahide@outlook.jp))

Kokuritsu Byoin Kiko Nishisaitama Chuo Byoin <https://orcid.org/0000-0002-8618-1556>

Nobuo Omura

Kokuritsu Byoin Kiko Nishisaitama Chuo Byoin

Tadashi Akiba

Tokyo Jikeikai Ika Daigaku Fuzoku Kashiwa Byoin

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## Technical innovations

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# Abstract

**Background:** The small intestine is not fixed to the retroperitoneum, and lesions in the small intestine can be resected through a very small skin incision, similar to laparoscopic surgery, if it is placed accurately. In 2010, we reported on small incisional surgery (SIS) for small intestinal diseases, in which the skin incision was placed at the umbilicus based on anthropometric analysis. However, the feasibility and usefulness of SIS for resection of small intestinal lesions have not been elucidated.

**Methods:** From January 2015 to December 2018, seven consecutive patients diagnosed with small intestinal tumors preoperatively underwent partial resection of the small intestine with a 4-cm skin incision at the umbilicus at Kashiwa Hospital, Jikei University, were retrospectively registered. After the partial resection of the small intestine extracorporeally, intestinal reconstruction was manually performed by end-to-end anastomosis. Four of the patients had cancer, and three patients had Meckel's diverticulum with inflammation.

**Results:** The length of the skin incision was 4 cm in all patients. No patient required enlargement of the skin incision. The mean surgical time was 52.0 (43-58) min. The mean blood loss was less than 5.0 ml. The mean postoperative hospital stay was 9.0 (8-10) days. No postoperative complications were encountered.

**Conclusion:** SIS with a 4-cm skin incision at the umbilicus for resection of small intestinal lesions seems feasible and safe, similar to single incision laparoscopic surgery.

## Introduction

Recently, laparoscopic surgery has been performed for various diseases with smaller surgical incisions instead of open surgery. However, the small intestine is not fixed to the retroperitoneum, and lesions in the small intestine can be resected through a very small skin incision if it is placed accurately. In 2010, we reported on small incisional surgery (SIS) for small intestinal diseases, in which an incision was placed at the umbilicus based on anthropometric analysis [1]. In this previous study, each visceral position (X cm, Y cm), measured by the coordinate originating in relation to the umbilicus in all cases, was as follows: duodenojejunal flexure ( $1.3 \pm 1.3$ ,  $9.4 \pm 2.1$ ) and ileocecal valve ( $-7.3 \pm 1.0$ ,  $-2.8 \pm 1.7$ ) (Fig. 1). The distance between the duodenojejunal flexure and ileocecal valve was approximately 15 cm. The length of the small intestine was approximately 2,500 cm, and it was located between the two positions. When the incision was made at the umbilicus, almost the entire length of the small intestine, including the disease site, could be delivered through the umbilical incision. However, the feasibility and usefulness of SIS for the resection of small intestinal lesions has not been elucidated.

## Methods

## Patients

From January 2015 to December 2018, seven consecutive patients diagnosed with small intestinal tumors preoperatively underwent SIS with a 4-cm skin incision at the umbilicus at Kashiwa Hospital, Jikei University, were retrospectively registered. Four of the patients had cancer, and three patients had Meckel's diverticulum with inflammation (Table 1).

## Surgical Technique

First, a 4-cm incision with placement of a wound protector was made at the umbilicus. After the detection of the disease site in the small intestine under direct vision, the small intestine, including the disease site, was delivered through the wound (Fig. 2). Partial resection of the small intestine was performed extracorporeally, and intestinal reconstruction was manually performed by end-to-end anastomosis.

## Results

The length of the skin incision was 4 cm in all patients. No patient required enlargement of the skin incision. The mean surgical time was 52.0 (43-58) min. The mean blood loss was less than 5.0 ml. The mean postoperative hospital stay was 9.0 (8-10) days. No postoperative complications were encountered. No postoperative recurrence was identified more than three years after surgery in patients with small intestinal cancer.

## Discussion

In our previous study [1], the location of the duodenojejunal flexure and the ileocecal valve had few anatomical variations. The duodenojejunal flexure was anthropometrically located at approximately 9 cm cephalad from the umbilicus and approximately 1 cm left side from the umbilicus. The ileocecal valve was anthropometrically located approximately 7 cm right from the umbilicus and 3 cm below the umbilicus. When the surgical incision was made at the umbilicus, almost the entire length of the small intestine, including the disease site, could be delivered through the umbilical incision without any laparoscopic assistance.

Recently, laparoscopic surgery has been performed for various diseases with smaller incisions instead of open surgery. In laparoscopic colorectal surgery, mobilization of the digestive tract and lymphatic dissection have usually been performed intracorporeally [2-5]. As laparoscopic mobilization or dissection of the small intestine is not needed for the intestine, which is not fixed to the retroperitoneum, SIS can be performed with a relatively small incision without any laparoscopic assistance, which is similar to single incision laparoscopic surgery (SILS) [6,7]. If the disease site in the small intestine cannot be delivered through the umbilical incision because the disease site is located near the ileocolic valve, SILS should be modified to mobilize from the cecum to the ascending colon to easily remove the disease site of the small intestine [8-10].

In conclusion, SIS with a 4-cm skin incision at the umbilicus for resection of small intestinal lesions seems feasible and safe, similar to SILS.

## **Abbreviations**

SIS: Small incisional surgery; SILS: Single incision laparoscopic surgery

## **Declarations**

## **Ethics approval and consent to participate**

Not applicable.

## **Consent for publication**

The written consent to publish images or other personal or clinical details of participants was obtained from the patient.

## **Availability of data and materials**

All data generated or analysed during this study are included in this published article.

## **Competing interests**

The authors declare no competing interests.

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## **Authors' contributions**

HK and NO performed operation. All authors analyzed and interpreted the patient data, and have been involved in drafting the manuscript. TA had given final approval of the version to be published. All authors read and approved the final manuscript.

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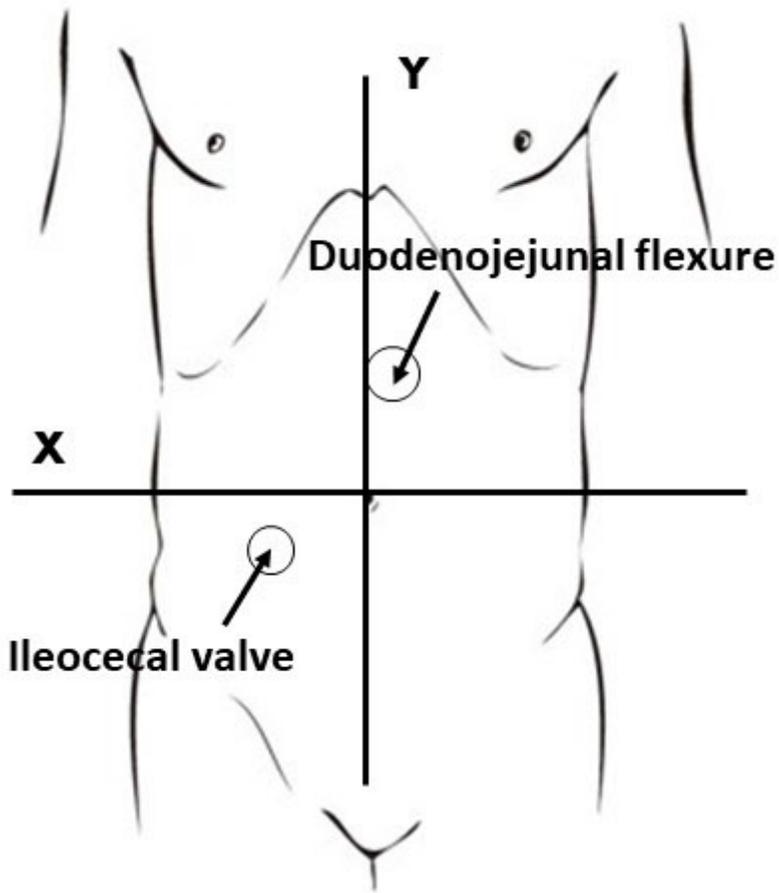
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## Tables

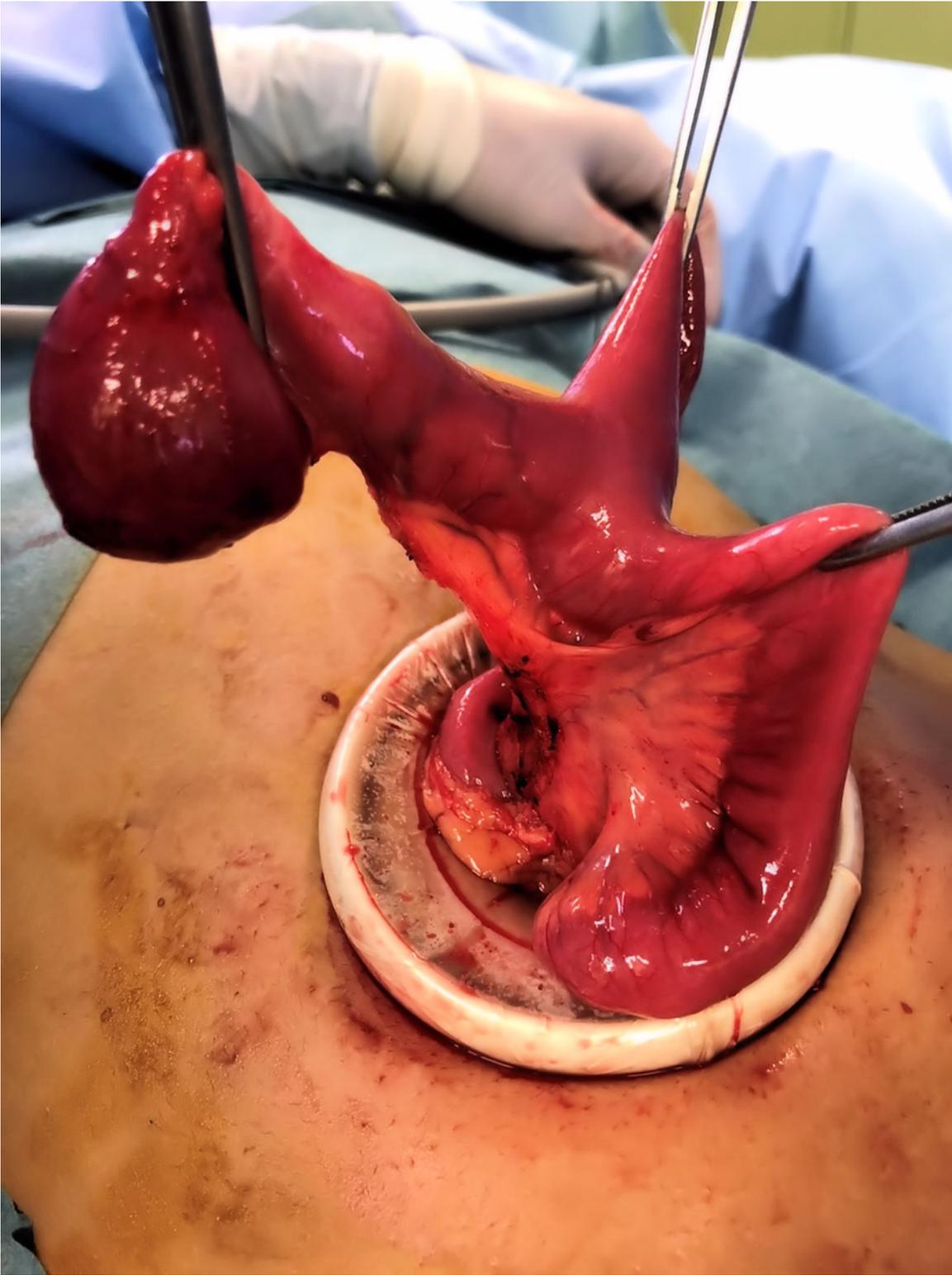
Due to technical limitations, the tables are provided in the Supplementary Files section.

## Figures



**Figure 1**

Location in relation to the umbilicus The location of the duodenojejunal flexure and the ileocecal valve were shown by the coordination originated in relation to the umbilicus.



**Figure 2**

Surgical view of the umbilical lesion The small intestine including disease site was delivered through the umbilical wound.

## **Supplementary Files**

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- [Tablesmallincision.xlsx](#)