

# Is single port incisionless-intracorporeal conventional equipment-endoscopic surgery feasible in patients with retrocecal acute appendicitis?

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**Purpose:** Since laparoscopic appendectomy was first described, various modifications, such as single port incisionless-intracorporeal conventional equipment-endoscopic surgery (SPICES), have been described for reducing pain and improving cosmetic results. In the retrocecal and retrocolic positions, attachments to the lateral peritoneum and cecum may lead to difficulties during SPICES, which is performed with only one port. Here, we present the effects of variations in the position of the vermiform appendix in treating acute appendicitis with SPICES.

**Methods:** We retrospectively reviewed 52 children who underwent SPICES for acute appendicitis between March 2010 and November 2011 in our institution. One group (group A) consisted of 30 patients (mean age, 10.5 ± 2.5 years) with retrocecal appendix, while the other group (group B) included 22 patients (mean age, 10.9 ± 2.3 years) with the appendix lying free in the peritoneal cavity.

**Results:** There were no significant differences between groups in terms of patient age, gender, success rate of SPICES, mean operating time, mean follow-up period, overall complication rates or mean postoperative hospitalization period.

**Conclusion:** These results suggest that SPICES is a safe and feasible approach even in patients with retrocecal acute appendicitis.

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Laparoscopy, Laparoscopic surgical procedure, Appendicitis, Appendectomy

## INTRODUCTION

Since the first successful laparoscopic appendectomy (LA) was performed by Semm [1] in Germany for a noninflamed appendix during gynecological surgery, numerous modifications of the procedure have been described for reducing pain and improving cosmetic results. The modifications have especially focused on reducing the number of ports [2-4]. As the need to minimize patient scars and maximize patient safety has increased, new devices such as the all-in-one laparoscope have continued to improve. These modifications and devices have led surgeons to use single port incisionless-intracorporeal conventional equipment-endoscopic surgery (SPICES) frequently [5]. This technique requires only an 11-mm conventional port, an all-in-one laparoscope and conventional working instruments. SPICES was first successfully used in appendectomy by Akgur et al. [5] in Turkey in 2010.

Although preileal, postileal, pelvic, subcecal and ectopic positions of the appendix

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vermiformis have been reported, the retrocecal and retrocolic positions are the most common [6,7]. In these positions, attachments to the lateral peritoneum and cecum may lead to difficulties during SPICES, which is performed with only one port. This technique also has limitations in handling, in contrast to 3-port LA and to the single incision laparoscopic surgery (SILS) with R-port or Triport.

The aim of the present study is to evaluate the effect of variations in the position of the vermiform appendix in treating acute appendicitis with SPICES.

## METHODS

We retrospectively reviewed 52 children who underwent SPICES for acute appendicitis between March 2010 and November 2011. The procedure was performed by the first author at Gaziantep Children's Hospital. The patients were divided into two groups according to the position of appendix. Group A consisted of 30 patients (12 females and 18 males; mean age,  $10.5 \pm 2.5$  years; range, 5 to 15 years) with retrocecal appendix, while group B included 22 patients (9 females and 13 males; mean age,  $10.9 \pm 2.3$  years; range, 6 to 15 years) with preileal, postileal, pelvic, subcecal or ectopic appendix.

The diagnosis of appendicitis was made based on clinical history and physical examination. We preferred open appendectomy in cases of generalized peritonitis and firm right lower quadrant mass.

Single dose cefuroxime and ornidazole were administered to all patients. SPICES was performed with patients in the Trendelenburg position with a gentle downward left tilt under general anesthesia. A single intraumbilical 1-cm vertical incision was made after stomach and bladder decompression, and an 11-mm port was inserted. We used the 0 degree all-in-one laparoscope including a 6-mm operating channel and a parallel eyepiece (KARL STORZ GmbH & Co. KG, Tuttlingen, Germany) in all cases. Initial diagnostic laparoscopy was routinely undertaken. Afterwards, the appendix was dissected from the retroperitoneal bands and grasped with a 5-mm atraumatic long grasper. A 16 G angiocath was percutaneously inserted in the peritoneal cavity. The needle was withdrawn, and a SWING suture, described by Akgur et al. [5], was passed through the sheath of the angiocath. The appendix was slung using this suture. The meso-appendix was dissected using ultrasonic shears (Harmonic Scalpel, Ethicon Endo-Surgery Inc., Cincinnati, OH, USA). The appendiceal base was then ligated intracorporeally with a 2-0 polyglactin suture using a fisherman's knot formed extracorporeally. The appendix was transected and the abdominal cavity was washed. Following the release of the SWING suture, the appendix was

removed inside the port to minimize the chance of wound contamination.

The data collected included age, gender, operating time, length of hospital stay, second port insertion, conversion to open surgery and complications. The statistical analyses were performed using the SPSS ver. 11.5 (SPSS Inc., Chicago, IL, USA). The data was expressed as the mean  $\pm$  standard deviation. Mann-Whitney U and t-tests were used for the statistical analysis.  $P < 0.05$  was accepted as statistically significant.

## RESULTS

There were no significant differences between the groups in terms of patient age ( $P = 0.549$ ) and gender ( $P = 0.948$ ) (Table 1).

SPICES was successfully performed in 27 patients (90%) and 21 patients (95.5%) in groups A and B, respectively. There were 2 conversions (6.7%) to open surgery and 1 (3.3%) second port insertion in group A, while a second port was inserted in 1 patient (4.5%) in group B. There were no significant differences between groups in the success rate of SPICES ( $P = 0.470$ ). Although conversion rate looks higher in group A, there was no significant difference between the groups ( $P = 0.221$ ).

The mean operating time for SPICES was  $41.0 \pm 9.0$  minutes (26 to 62 minutes) in group A and  $36.5 \pm 7.8$  minutes (25 to 55 minutes) in group B, but the difference between the groups was not statistically significant ( $P = 0.088$ ). No complications occurred during the operative period in either group.

The mean postoperative hospitalization period was  $2.2 \pm 0.5$  days (1.5 to 3.5 days) in group A and  $2.3 \pm 0.6$  days (1.5 to 3 days) in group B. This difference was not statistically significant ( $P = 0.460$ ).

The mean follow-up was  $11.4 \pm 6.1$  months (range, 6 to 28 months) in group A and  $10.0 \pm 6.5$  months (range, 6 to 28

**Table 1.** Summary of patients' characteristics and results

Variable	Group A	Group B
No. of patients	30	22
Male/female	18/12	13/9
Age (yr), mean $\pm$ SD	$10.5 \pm 2.5$	$10.9 \pm 2.3$
Success rate (%)	90	95.5
Operating time (min), mean $\pm$ SD	$41.0 \pm 9.6$	$36.6 \pm 8.0$
Postoperative hospitalization (day), mean $\pm$ SD	$2.2 \pm 0.6$	$2.3 \pm 0.7$
Postoperative complications (%)	3.3	4.5

SD, standard deviation.

months) in group B. Statistical analysis showed no differences between the two groups ( $P = 0.147$ ). In group A, laparotomy was performed for adhesion-related intestinal obstruction 2 months after SPICES. Transient seroma in the umbilical area developed in one patient in group B. The overall complication rates showed no statistically significant differences between the groups. SPICES has only one incision in the umbilical area, which has the advantage of hiding the scar, so the cosmetic outcomes were sufficient with no residual scar formation at the angiocath insertion area.

In group B, the appendix was located in the left lower quadrant in 2 patients. One of the patients had intestinal malrotation, and the other had situs inversus totalis.

## DISCUSSION

LA is commonly used as an alternative to open surgery. In comparison with open surgery, the 3-port LA reduces postsurgical pain, shortens hospital stay, allows early food intake, and enhances cosmetic outcomes [8-10]. It reduces the irritation of the intestine and the incidence of postoperative adhesions. LA also allows the surgeon to assess associated abnormalities within the abdominal cavity. As laparoscopic minimal invasive surgery has drawn greater attention and new equipment is developed, SILS has been increasingly widely used in appendectomy [11,12]. Performing SILS through the umbilicus, a congenital scar provides reliable cosmetic results. Only one incision is made; thus, the risk of complications such as port site hernia, hematoma and infection are reduced. In the past decade, a number of SILS modifications for appendectomy have been described: 1) Extracorporeal laparoscopic-assisted appendectomy through a single umbilical port site is difficult to perform, causes wound contamination and usually requires a second port, 2) SILS with R-port or Triport requires a 2-cm incision that is larger than children's umbilical margins, and 3) SPICES is a feasible approach with excellent cosmetic results in children [5,13].

In 31% of cases, the tip of the appendix is in the pelvis, and in 65% of cases, it extends upwards behind the cecum. In 20% of cases of retrocecal appendix, the appendix rests freely, while in 5% of cases, it is truly extraperitoneal [6]. The remaining cases with retrocecal appendix have peritoneal adhesions. The overall conversion rate to open surgery from LA was reported as 4.1%, and retrocecal position of the appendix remains a common cause of conversion to open surgery [14]. Additionally, retrocecal appendix dissection presents challenges for extracorporeal laparoscopic-assisted appendectomy, and this localization may lead to parallel problems in SPICES. SPICES has limitations in handling compared to the 3-port LA and SILS with R-port or Triport,

which are performed using at least 2 conventional graspers.

In the present study, the conversion rate of SPICES in patients with retrocecal appendicitis was not significantly different compared to other localizations of appendicitis. The SWING suture, a new homemade grasper that does not require a different stab incision, seems to have an important role in achieving such a low conversion rate. It replaces the second port and is capable of repositioning the appendix, like conventional graspers. The last stages of single-port LA, including the dissection of the meso-appendix, ligation of appendiceal base, and transection of the appendix can be performed intracorporeally using this suture.

The most important part in SPICES is to sling the appendix with SWING suture. The truly extraperitoneal appendix needs the dissection and releasing of the appendix from attachments to the peritoneum before slinging of the appendix. It is difficult to dissect the truly extraperitoneal appendix by using only one grasper in SPICES. Therefore, in 2 cases in group A, we were not able to sling the appendix because of the truly extraperitoneal position, and open appendectomy was performed. The overall conversion rate to multitrocar surgery was also 3.8% in the present study. In one case in each group, the omentum covered the appendix firmly, and the second port was inserted.

The success rates, mean operating times and mean hospital stay lengths in our study were not different from those of studies reporting extracorporeal laparoscopic-assisted appendectomy and SILS with R-port or Triport [11,13,15]. Similarly low conversion rates to multitrocar surgery and open appendectomy have also been reported in appendicitis performed with SPICES [5]. These results may encourage surgeons to perform the appendectomy with one port, but it is important not to be reluctant to insert a second or even a third port, especially in cases with truly extraperitoneal appendix and severe adhesions. Insistence can result in morbidity.

The mean operating time was longer in the group with retrocecal appendix, but this difference was not statistically significant. This may be because more time was spent on the dissection of peritoneal adhesions in group A. Additionally, one case of postoperative adhesion-related intestinal obstruction may be the result of extended dissection in group A. SILS with R-port or Triport requires at least a 2-cm incision, which is larger than the umbilical area, especially in children, and thus may result in a scar. In contrast, only a 1-cm incision is performed in SPICES. We suggest that care should be taken to keep the incision within the umbilical ring for the best cosmetic outcome.

Situs inversus totalis, intestinal malrotation and an extremely mobile cecum are the anatomic abnormalities that cause left-sided appendix [16,17]. The diagnosis of left-sided acute

appendicitis may be difficult, and it is made based on physical examination, abdominal ultrasonography, and computed tomography. In addition to being useful for appendectomy, laparoscopy can be diagnostic in patients with confusing cases [17]. In 2 cases, the malpositioned appendix lay free in the peritoneal cavity, and we performed SPICES without extended dissection. Approximately 100 cases of left-sided acute appendicitis have been reported in the literature [18]. To the best of our knowledge, these are the first reported cases of left-sided acute appendicitis performed with SPICES.

In conclusion, SPICES is a feasible approach with sufficient cosmetic results in children with acute appendicitis. It can be performed easily and safely in patients with retrocecal acute appendicitis. Further prospective studies are needed to determine the validity of our data.

## CONFLICTS OF INTEREST

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

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