

# Subcutaneous endoscopically assisted ligation using miniport for the treatment of girls with inguinal hernia

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**Background** This report describes the first miniport method using subcutaneous endoscopically assisted ligation (SEAL) for the treatment of girls with inguinal hernia. To validate its safety and efficacy, the authors evaluated their early experiences.

**Methods** Between April 2014 and December 2014, 19 SEALs using miniport were performed on 14 patients at the Fukaya Red-Cross Hospital, Saitama, Japan. Their mean age was 6 years (range, 11–128 months). This technique was performed using two ports (a 5 mm port placed using the open technique and an additional 2 mm miniport). A 5 mm laparoscope was inserted via the umbilicus. The miniport was introduced percutaneously in the inguinal region under laparoscopic guidance and manipulated around the medial or lateral hemicircumference of the internal ring extraperitoneally to place a purse-string around the internal ring. The hernia sac and patent processus vaginalis were closed at the level of the internal inguinal ring extraperitoneally with circuit suturing using the 2 mm miniport. Only the umbilical fascia was closed with an absorbable suture. No skin sutures were applied. We collected data regarding operative time, complications, and recurrence.

**Results** The mean operative time was  $20 \pm 6$  min (unilateral,  $n=9$ ) or  $42 \pm 8$  min (bilateral,  $n=5$ ). The mean follow-up period was  $12.8 \pm 2.5$  (range, 9–19) months.

## Introduction

There are numerous minimally invasive surgery techniques that can be used for pediatric inguinal hernias [1–10]. Subcutaneous endoscopically assisted ligation (SEAL) is a novel technique in minimal access surgery for pediatric inguinal hernias [7,8,10]. Here, we report our experience with SEAL using miniport, which is a new technique that has been proven to be safe and effective for the treatment of inguinal hernias in girls. However, a high recurrence rate with the previous SEAL technique was the main concern with its use [7]. To overcome this recurrence issue, we designed a new technique in which we closed the hernia sac percutaneously, aided by a 5-mm laparoscope and a 2-mm miniport. Our SEAL technique has evolved and now includes the application of an external purse string suture around the hernia sac, without any division of the hernia sac. The aim of this study was to introduce our modified SEAL technique for the treatment of inguinal hernia in girls.

## Patients and methods

A total of 19 SEAL procedures were performed on 14 girls at Fukaya Red-Cross Hospital, Saitama, Japan (April

No intraoperative complications associated with the procedure occurred and no hernial recurrences have been identified so far.

**Conclusion** SEAL using miniport proved to be a successful operative procedure compared with other laparoscopic percutaneous extraperitoneal closure procedures and produced excellent cosmetic results. SEAL using miniport for the treatment of girls with inguinal hernias appears to be safe, effective, and reliable. *Ann Pediatr Surg* 12:73–76 © 2016 Annals of Pediatric Surgery.

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**Keywords:** inguinal hernia, miniport, SEAL

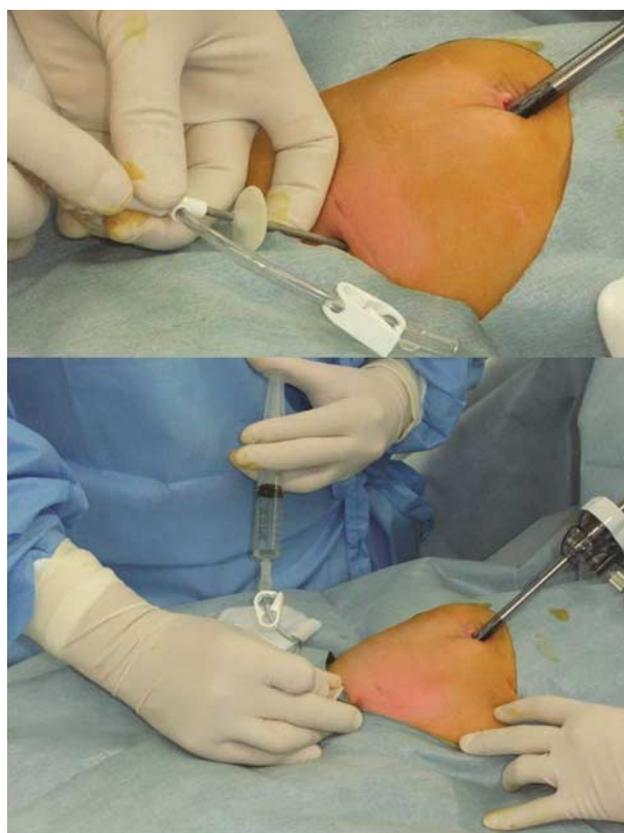
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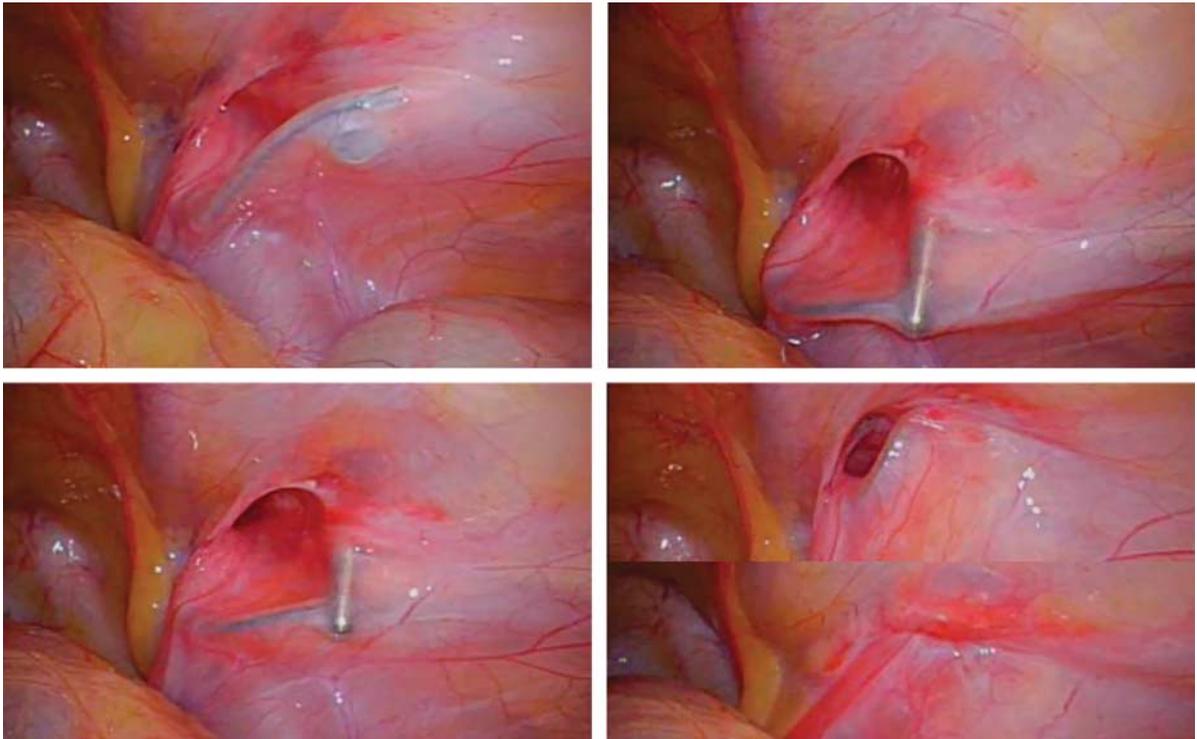
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**Fig. 1**



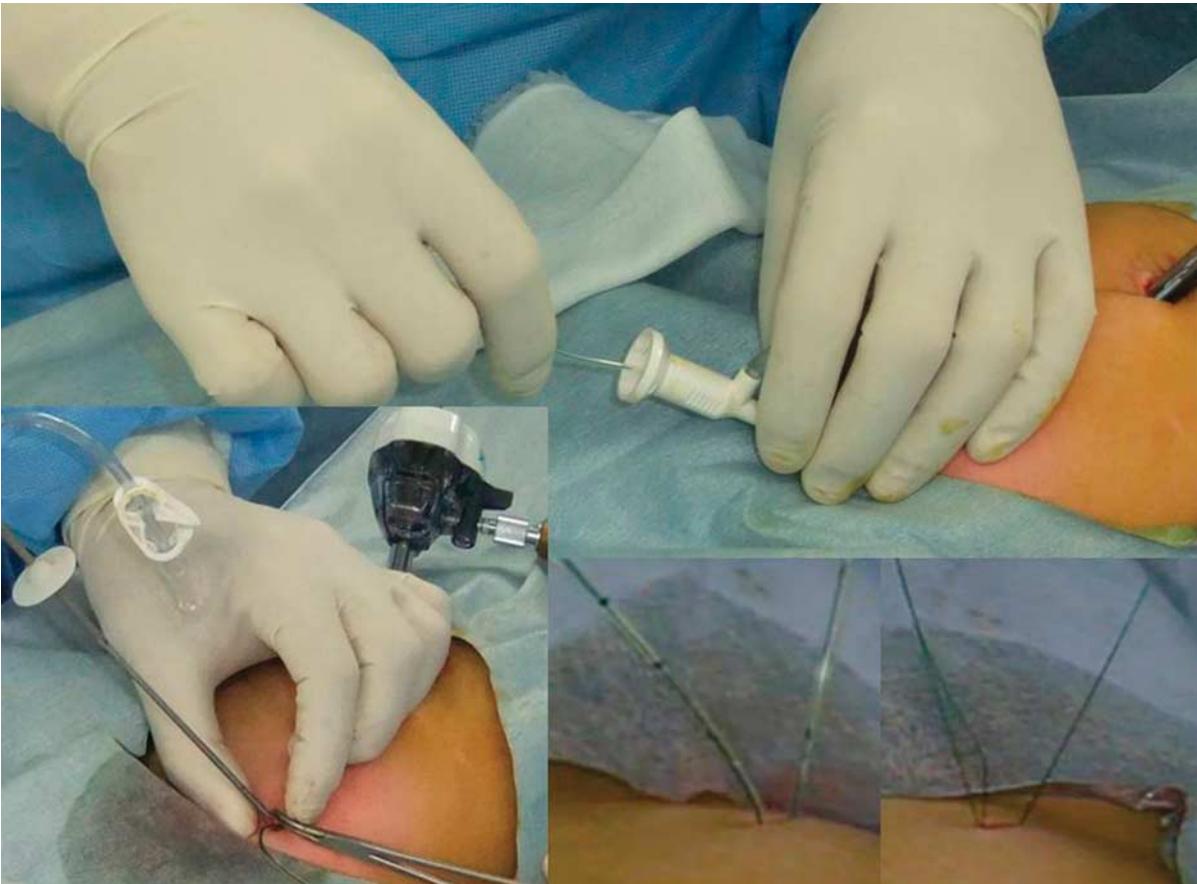
How to introduce the miniport into the preperitoneal space.

Fig. 2



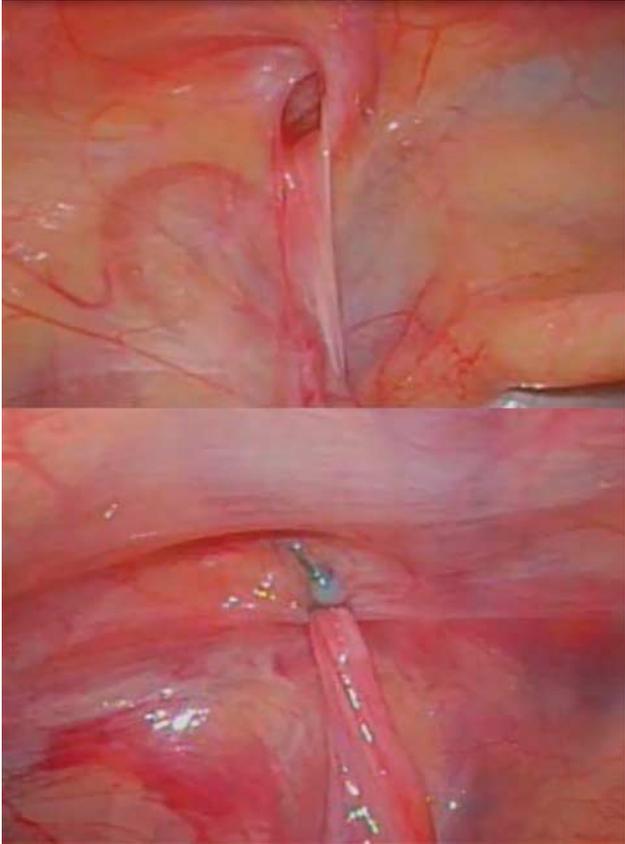
Modified subcutaneous endoscopically assisted ligation technique 1.

Fig. 3



Modified subcutaneous endoscopically assisted ligation technique 2.

Fig. 4



The orifice of the hernia sac was completely closed.

2014–December 2014). The diagnosis of an inguinal hernia was confirmed during a preoperative examination for each patient. The SEAL procedure was selected on the basis of parental preference after informed consent was obtained. We analyzed the short-term outcomes of 14 girls who underwent the SEAL procedure. The main outcome measurements of this study included operative time, intraoperative and postoperative complications, and recurrence.

This study protocol was approved by the ethical committee and informed consent was obtained from the parents; the technique, expected results, and possibilities of surgical exploration were explained to them.

#### Surgical technique

General endotracheal tube anesthesia was used in all cases. The viewing monitor was placed at the left side of the patient. The operator stood on the right side of the patient, and the camera assistant stood on the other side. Through a 5-mm intraumbilical incision, a 5-mm port for a 5-mm 0° laparoscope was placed using an open technique. The abdomen was insufflated to 8–10 mmHg of pressure. The 2-mm grasping forceps through a 2-mm port was used to send and retrieve a 4-Fr indwelling feeding tube. A 23-G needle attached to a 10-ml syringe filled with saline was introduced at the 12 o'clock position of the internal inguinal ring and saline was injected to create space behind the peritoneum. A 2-mm stab incision

was made over the internal inguinal ring, and the tip of the miniport was then introduced into the preperitoneal space. Using the miniport, saline was injected around the internal inguinal ring to make enough retroperitoneal space for the SEAL (Fig. 1). Two 3-0 nylons through the 4-Fr indwelling feeding tube were introduced through the miniport to encircle the posterior hemicircumference of the ring. The tip of the tube was backed off using the 2-mm grasping forceps through the miniport, anterior to the ring to exit from the original stab of entry (Figs 2 and 3). A 4-Fr indwelling feeding tube was pulled out and the two 3-0 nylons remained (Fig. 3). They were tied extracorporeally under laparoscopic visualization. The orifice of the hernia sac and patent processus vaginalis was encircled without any skip areas (Fig. 4). Stab incision at the site of miniport entry permits knot placement in correct deeper plane, preventing skin puckering and knot protrusion. This prevents stitch infections and enhances cosmesis.

#### Results

Fourteen girls (mean age =  $6.0 \pm 3.3$  years; range = 11–128 months) were identified for the report. A total of 19 procedures were performed, and the mean operative time was  $20 \pm 6$  min (unilateral,  $n = 9$ ) or  $42 \pm 7$  min (bilateral,  $n = 5$ ). With experience, the surgery time gradually decreased. The mean follow-up period was  $12.8 \pm 2.5$  (range = 9–19) months. The patients felt little pain after surgery and so most patients did not need painkiller, and no intraoperative complications associated with the procedure occurred. The cosmetic result was very good in all cases. There were no operative complications and there was no evidence of early recurrence.

#### Discussion

Minimal-access surgery has clear advantages in pediatric inguinal hernia repair. Among the various laparoscopic techniques, laparoscopic-assisted percutaneous extraperitoneal closure (LPEC) of the internal ring has become a well-developed technique.

This procedure utilizes the extracorporeal closure of the hernia sac and eliminates the need for intra-abdominal laparoscopic skills compared with the current laparoscopic extraperitoneal closure techniques [1,4,5]. The method that we have developed is simple to perform; therefore, this procedure can be recommended for pediatric inguinal hernia. The present data were limited due to the short duration of the follow-up period. A longer follow-up period would enable evaluation of the longer-term recurrence rates. Our modified SEAL technique for the treatment of inguinal hernia in girls proved to be as successful as LPEC and produced excellent cosmetic results.

However, a major criticism of using the SEAL procedure for the repair of inguinal hernias, especially in boys, remains its higher recurrence rate, as compared with LPEC or single-incision LPEC. The incidence of recurrence has been reported as 0–4.3% [4,5,7]. In a recent review of recurrences after laparoscopic hernia repair, the most common site of recurrence was along the medial internal ring at the site of the passage of the cord structures [5,11].

We believe that, when using single-port techniques with extracorporeal knotting, including the SEAL technique and the percutaneous internal ring suturing technique, passing anterior to the vas deferens and spermatic vessels was the main method to protect them; this could leave a small gap that could lead to recurrence [4,5,7,8,12,13]. The potential for recurrence is the limiting factor in both techniques. The original SEAL technique has not been standardized and there can be a high risk for collateral damage and recurrence in inexperienced hands. Actually, there have been no reports about the long-term outcomes from the SEAL technique [7,8,10]. Methods of laparoscopic repair have recently evolved toward applying an external purse string suture around the hernia sac, without any division of the sac and leaving no gap [1,9,14]. This is the reason we first performed our modified SEAL procedure only in girls to avoid the risk of recurrence and injury to the vas deferens or the blood supply to the testes. This type of damage may cause atrophy and diminished size of the testis, and iatrogenic cryptorchidism. Since the techniques have been established and the operators have become more skilled, we are now planning to extend the procedure to boys.

### Conclusion

Our data suggest that the SEAL using miniport is a safe and effective operative procedure compared with other laparoscopic percutaneous extraperitoneal closure procedures and produced excellent cosmetic results for inguinal hernias in girls. We think the SEAL using miniport renders the technique easier and safer by reducing chances of complications. The long-term follow-up of the SEAL using miniport is awaited.

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### Conflicts of interest

There are no conflicts of interest.

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