

Contents lists available at [ScienceDirect](http://ScienceDirect.com)

Journal of Pediatric Surgery CASE REPORTS

journal homepage: www.jpascasereports.com

Operative procedures of single-incision laparoscopic repair of pediatric epigastric hernia have become simple and feasible with the use of a novel suture-assisting needle



Kyoichi Deie^{a,c}, Hiroo Uchida^{b,*}, Hiroshi Kawashima^c, Yujiro Tanaka^c, Hizuru Amano^c, Naruhiko Murase^b, Takahisa Tainaka^b

^a Department of Pediatric Surgery, University of Tokyo Hospital, Tokyo 113-8655, Japan

^b Department of Pediatric Surgery, Nagoya University Graduate School of Medicine, 65 Tsurumai, Showa, Nagoya 466-8550, Japan

^c Department of Pediatric Surgery, Saitama Children's Medical Center, Saitama 339-8551, Japan

ARTICLE INFO

Article history:

Received 5 November 2015

Received in revised form

18 November 2015

Accepted 18 November 2015

Key words:

Epigastric hernia

Children

Single-incision

Laparoscopic surgery

Suture-assisting needle

ABSTRACT

We describe a simple and feasible procedure for single-incision laparoscopic repair of a pediatric epigastric hernia using a novel suture-assisting needle. A multichannel port was inserted through the umbilical vertical incision. After the orifice of the hernia was identified, a suture-assisting needle, which can hold a suture at its tip, with a 2-0 thread was pierced through the skin into one side of the rectus muscle sheath into the abdominal cavity. Next, after releasing the thread, the needle was pulled out to the subcutis and pierced through another side of the rectus muscle sheath. The needle, grasping the thread again, was subsequently pulled out through the abdominal wall outside, and the thread was tied extracorporeally. This knot was buried subcutaneously. Operative procedures of single-incision laparoscopic repair of an epigastric hernia have become simple and feasible with the use of a novel suture-assisting needle with an excellent cosmetic result.

© 2016 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

An epigastric hernia, occurring at a defect along the linea alba anywhere from the xiphoid process to the umbilicus, is a state in which preperitoneal fat is wrapped in the peritoneum and protrudes subcutaneously. This hernia in children is a comparatively rare congenital disease. It is difficult for an epigastric hernia to heal by itself after the age of 4–6 years. Therefore, for epigastric hernias accompanied by symptoms and for those that do not heal spontaneously, surgery would be performed. Conventional repair of an epigastric hernia involves a visible transverse or midline incision over the site of the defect, removal of the incarcerated fat, and suture of the linea alba. It is difficult to recognize the weak section of the linea alba from the abdominal wall during the operation, whereas the dehiscence of the linea alba can easily be confirmed by a laparoscope from the intraabdominal side.

Single-incision laparoscopic surgery in children has gradually become increasingly performed in the past several years. As this surgery is superior to conventional laparoscopic surgery and open surgery in terms of cosmetic results, many reduced-port surgeries have been performed as a radical operation for common diseases such as inguinal hernia and appendicitis [1,2]. However, this operation has a possible disadvantage of technical difficulty including limited manipulation of the forceps.

To overcome this problem, we use a LAPA-HER-CLOSURE™ (Hakko Medical, Nagano, Japan) as a suture-assisting device, which is a special 19G needle with a wire that can hold a suture at its tip (Fig. 1a). The LAPA-HER-CLOSURE™ was originally developed to bring the suture thread to the desired location during laparoscopic percutaneous extraperitoneal closure (LPEC) for the treatment of pediatric inguinal hernia and femoral hernia [1,3]. This needle can grasp and release the thread freely, by retracting or extending the wire stored away in the needle (Fig. 1b and c). Recently, it has been used for gastrostomy and closing the wound of a laparoscopic port [4]. In addition, this device was used for traction of the esophagus in a neonate with long-gap type A esophageal atresia [5].

Abbreviation: LPEC, laparoscopic percutaneous extraperitoneal closure.

* Corresponding author. Tel.: +81 52 744 2959; fax: +81 52 744 2980.

E-mail address: hiro2013@med.nagoya-u.ac.jp (H. Uchida).

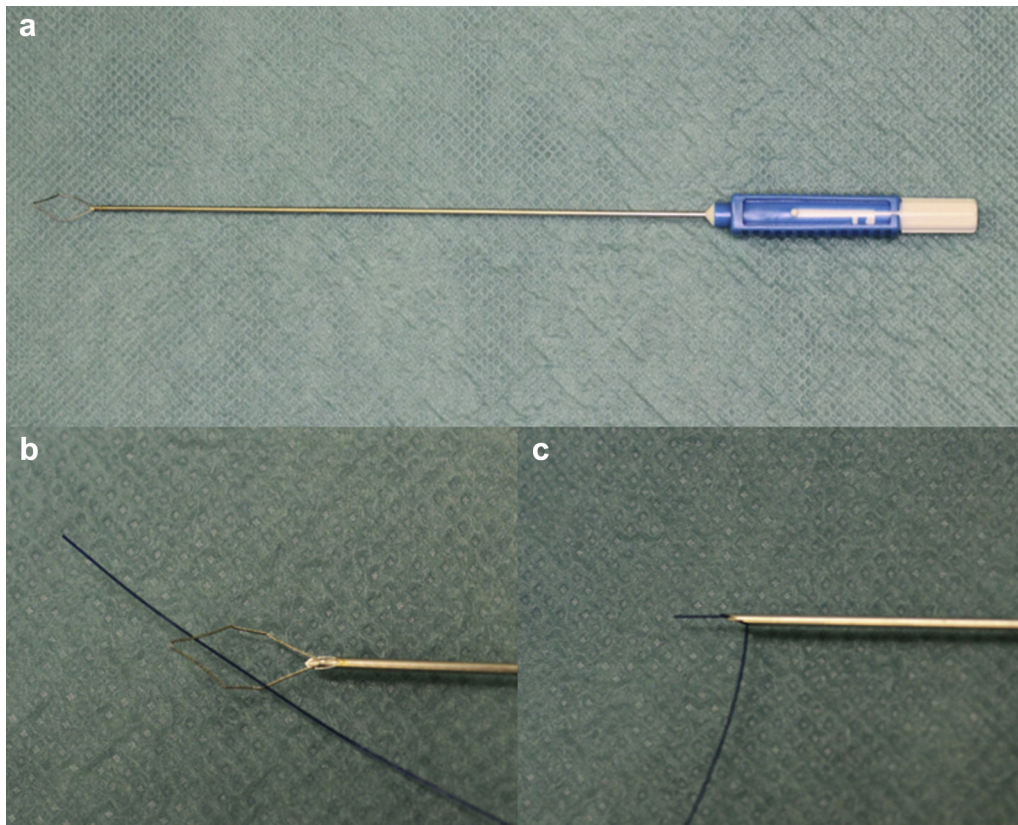


Fig. 1. The suture-assisting device. (a) This device is a special 19G needle with a wire to hold a suture at its tip. (b & c) This device can grasp and release a strand of thread freely, by extending or retracting the wire stored away in the needle.

The suture-assisting needle is a novel instrument and is associated with easy handling.

By using a LAPA-HER-CLOSURE™, we were able to perform safe, simple, and feasible single-incision laparoscopic repair of pediatric epigastric hernia.

1. Case description

1.1. Case reports and preoperative preparation

1.1.1. Case 1

A 7-year-old boy was seen at our hospital with a swelling on the midline of the upper abdomen that had been present for one year. An epigastric hernia was diagnosed. Due to the increased abdominal pressure, an abdominal protrusion measuring 10×5 mm between the xiphoid process and the umbilicus in the linea alba was observed by physical examination. There was an epigastric defect on the cranial side that was situated more than 3 cm from the umbilicus as observed. After follow-up at our hospital for approximately one year without spontaneous cure of the hernia, he underwent single-incision laparoscopic surgery.

1.1.2. Case 2

A female was diagnosed as having an epigastric hernia at three months of age at our hospital, after swelling of the skin of the upper umbilicus and an umbilical hernia were observed by physical examination. Due to the increased abdominal pressure,

an abdominal protrusion measuring 15×10 mm on the cranial side 2 cm from the umbilicus between the xiphoid process and the umbilicus in the linea alba was observed. After two-year follow-up without spontaneous cure of the hernia, she underwent single-incision laparoscopic surgery at the age of 3 years.

1.1.3. Preoperative preparation

Before the operation, the location of the hernia orifice was determined by palpation and ultrasonography, and the patient's skin was marked.

1.2. Surgical procedures

1.2.1. Positioning of patient and ports

Under general anesthesia, the patient was placed in the supine position. The surgeon stood at the patient's feet side, and a monitor was placed over the patient's head. A vertical midline laparotomy was performed through a single vertical umbilical incision (20 mm). A wound retractor (Lap Protector 504; Hakko Medical, Nagano, Japan) was inserted through the incision, and a silicon cap (EZ access 504; Hakko Medical) was mounted on the wound retractor. Two reusable 5 mm ports (Mini-Mini Trocar Sleeves; Hope Denshi, Chiba, Japan) which consisted of a 5 mm camera port and a 5 mm working port, were placed in the silicon cap (Fig. 2). Carbon dioxide pneumoperitoneum was set at 8–10 mm Hg after port insertion. To reduce the interference between forceps, the 3 mm forceps, of which the tip is bent

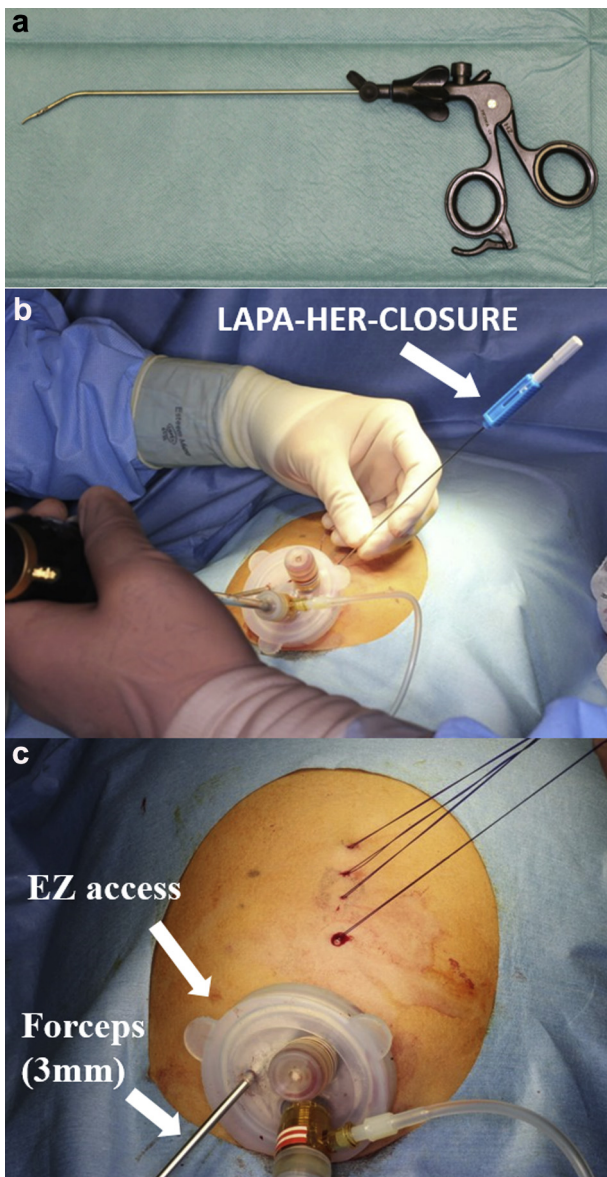


Fig. 2. Pediatric epigastric hernia repair using single-incision laparoscopic surgery. The wound retractor is inserted through a single vertical umbilical incision. A silicon cap is mounted on the wound retractor. Two reusable 5 mm ports are placed and the 3 mm forceps is inserted using the stab method directly in the silicon cap. (a) The tip of the 3 mm forceps is bent. (b) The suture-assisting device with a 2-0 non-absorbable suture has been pierced through the skin. (c) Four sutures were subjected to extracorporeal knotting and these knots were placed subcutaneously.

(HEIWA MEDICAL INSTRUMENTS, Yamaguchi, Japan) (Fig. 2a), was directly inserted in the silicon cap using the stab method (Fig. 2).

1.2.2. Operative steps

We pushed the preoperative marking site from the patient's body surface and laparoscopically confirmed the location of the hernia orifice by the presence of preperitoneal fat protruding in the abdominal cavity. After saline was injected into the preperitoneal space, the peritoneum and falciform ligament

were incised. The hernia orifice was exposed and the preperitoneal fat was removed (Fig. 3a). A LAPA-HER-CLOSURE™ with a 2-0 non-absorbable suture was pierced through the skin into one side of the rectus muscle sheath and through the peritoneum into the abdominal cavity (Figs. 2b and 3b). The thread, which had been grasped in the needle, was released, and it was grasped by the forceps (Fig. 3c). Only the needle was pulled out to the subcutis and pierced through another side of the rectus muscle sheath and peritoneum into the abdominal cavity (Fig. 3d). The thread, which was grasped in the forceps, was subsequently grasped in the needle again (Fig. 3e). The needle with the suture was pulled out through the abdominal wall to outside the body. The suture was tied extracorporeally and the knot was buried subcutaneously (Fig. 2c). A total of 4 sutures were placed using the same method. A new piece of thread was used for each of the four sutures. Finally, the hernia defect was closed (Fig. 3f).

1.2.3. Postoperative care

The operative time was 80 min in case 1, and 90 min in case 2 (including repair of the umbilical hernia). There were no intra- and post-operative complications in both cases. They were discharged from the hospital on postoperative day 1, and immediately resumed normal daily activities. At postoperative follow-up two years later, there were no recurrences. The wound scar has been obscure and cosmetically excellent (Fig. 4).

2. Discussion

Epigastric hernia is a comparatively rare disease from children to adults, and the incidence of ventral hernia is about 0.5–5.7% [6]. About 20% of epigastric hernias are multiple [7]. It is considered that epigastric hernias are defects that result from a unique pattern of aponeurotic decussation in the upper abdominal wall, or arise in an abnormally wide orifice in a blood vessel [6]. If the hernia does not heal spontaneously or symptoms of the hernia continue, surgical repair is considered.

In adult patients with an epigastric hernia, laparoscopic operation is performed by using a mesh graft for the hernia orifice or by closing it from the abdominal cavity [8]. There have been some reports on laparoscopic surgery of epigastric hernia in children [9]. However, in these laparoscopic procedures, as two ports are used to repair the defect, they were not superior in comparison with the conventional operation in terms of cosmetics. Furthermore, Albanese et al. [9] described that suture of the hernia orifice in laparoscopic surgery of an epigastric hernia was technically difficult to perform with only one forceps.

Therefore, to achieve simple and safe repair with excellent cosmetics, we used a LAPA-HER-CLOSURE™ for single-incision laparoscopic repair of an epigastric hernia. Similar methods of single-incision endosurgical repair of epigastric hernia by using an epidural needle have been reported [7,10]. Compared with an epidural needle, it is easy to master the skill of handling a LAPA-HER-CLOSURE™ with a thread, which has a simple mechanism. The wound retractor with the silicon cap was used in our operative procedures, but the cost was not higher than the cost of other institutes' operative procedures. It is because the cost of a disposable wound retractor with a cap which we used is equal to the cost of one trocar which is generally used in many institutes, and two trocars used in our institute are reusable.

It was reported that the umbilical sliding-window method of minimally invasive abdominal surgery was useful in terms of cosmetics [11]. However, in this procedure, when the location of the

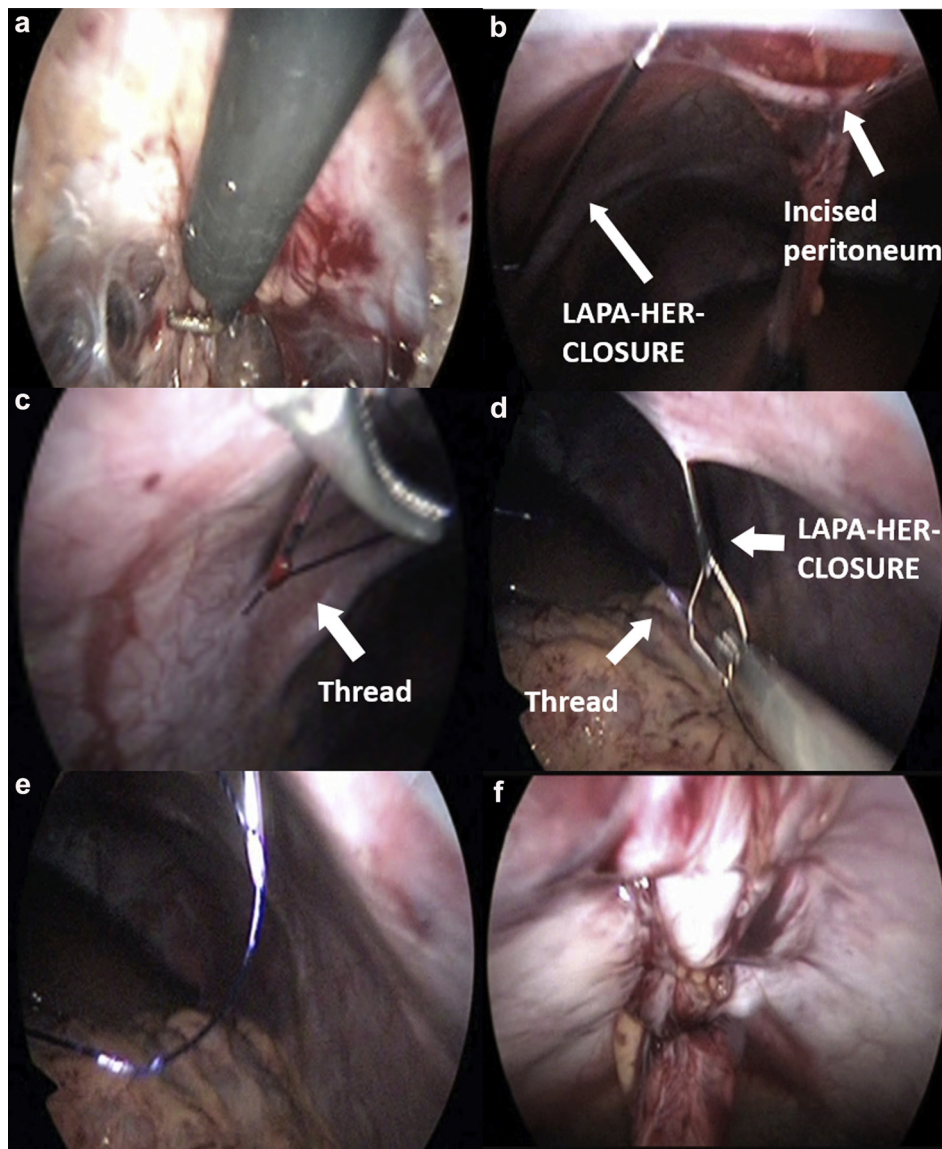


Fig. 3. Surgical technique of epigastric hernia repair using single-incision laparoscopic surgery. (a) The hernia orifice was exposed and preperitoneal fat was removed laparoscopically. (b) The suture-assisting device with a 2-0 non-absorbable suture was pierced through the skin, through the rectus muscle sheath and through the peritoneum into the abdominal cavity. (c) The thread, which had been held by the suture-assisting device, was grasped by the forceps. (d) The suture-assisting device was pulled out to the subcutis and then pierced through another side of the rectus muscle sheath and through the peritoneum to the abdominal cavity. (e) The thread was grasped by the suture-assisting device again and pulled out through the abdominal wall to outside of the body. (f) A total of 4 sutures were placed using the same method, covering the defect.

hernia is far from the umbilicus, it is difficult to maintain the operative field. In addition, it was reported that because skin extension becomes poorer in older children, the umbilical sliding-window procedure was more difficult. Moreover, epigastric hernias are sometimes multiple [6], but our technique can also be performed in these cases.

The operative times in our cases were relatively long, because a junior surgeon with little experience in laparoscopic surgeries performed the surgeries. The patients stayed at the hospital overnight after the operation. In Japan, the general medical expense support system for children allows longer admissions and their parents do not have to worry about payment. The families of patients in Japan generally request that the patient be allowed to stay overnight at the hospital after an operation, even if the operation is a relatively small operation such as an inguinal herniorrhaphy. There were no intra- and post-operative complications in either of our cases.



Fig. 4. Cosmetic outcome in case 1 at one year postoperatively.

3. Conclusion

Single-incision laparoscopic repair using a novel suture-assisting needle for pediatric epigastric hernia is a simple and feasible procedure with excellent cosmetic results.

Disclosure statement

The authors have received no financial support, and do not have any potential conflicts of interest to report.

References

- [1] Uchida H, Kawashima H, Goto C, Sato K, Yoshida M, Takazawa S, et al. Inguinal hernia repair in children using single-incision laparoscopic-assisted percutaneous extraperitoneal closure. *J Pediatr Surg* 2010;45(12):2386–9.
- [2] Deie K, Uchida H, Kawashima H, Tanaka Y, Masuko T, Takazawa S. Single-incision laparoscopic-assisted appendectomy in children: exteriorization of the appendix is a key component of a simple and cost-effective surgical technique. *Pediatr Surg Int* 2013;29(11):1187–91.
- [3] Tainaka T, Uchida H, Ono Y, Tanano A, Shirota C, Yokota K, et al. A new modification of laparoscopic percutaneous extraperitoneal closure procedure for repairing pediatric femoral hernias involving a special needle and a wire loop. *Nagoya J Med Sci* 2015;77(3):497–501.
- [4] Miyano G, Miyahara K, Halibieke A, Lane GJ, Okazaki T, Yamataka A. Intra-abdominal laparoscopy-assisted “open” vessel ligation of testicular vessels: a potential treatment for varicocele. *J Laparoendosc Adv Surg Tech A* 2011;21:749–51.
- [5] Tanaka Y, Uchida H, Kawashima H, Sato H, Takazawa S, Jimbo T, et al. Successful two-stage thoracoscopic repair of long-gap esophageal atresia using simple internal traction and delayed primary anastomosis in a neonate: report of a case. *Surg Today* 2012;43:906–9.
- [6] Coats RD, Helikson MA, Burd RS. Presentation and management of epigastric hernias in children. *J Pediatr Surg* 2000;35:1754–6.
- [7] Tatekawa Y, Yamanaka H, Hasegawa T. Single-port laparoscopic repair of an epigastric hernia using an epidural needle. *Int J Surg* 2012;25:262–4.
- [8] Garcia-Moreno F, Sotomayor S, Perez-Lopez P, Perez-Kohler B, Bayon Y, Pascual G, et al. Intraperitoneal behaviour of a new composite mesh (Parietex Composite Ventral Patch) designed for umbilical or epigastric hernia repair. *Surg Endosc* 2014;28(12):3479–88.
- [9] Albanese CT, Rengal S, Bermudez D. A novel laparoscopic technique for the repair of pediatric umbilical and epigastric hernias. *J Pediatr Surg* 2006;41:859–62.
- [10] Babsail AA, Abelson JS, Liska D, Muensterer OJ. Single-incision pediatric endosurgical epigastric hernia repair. *Hernia* 2014;18(3):357–60.
- [11] Odaka A, Hashimoto D. Umbilical approach using the sliding-window method to avoid a large abdominal incision: report of two pediatric cases. *Pediatr Surg Int* 2005;21(11):928–31.