

Recent Progresses of Pediatric Endoscopic Surgery in Japan

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Introduction

Pediatric laparoscopic cholecystectomy was introduced by Holcomb et al.¹ in 1991. The torrent of reports that followed expanded the applicability of pediatric endoscopic surgery to splenectomy, nephrectomy, pyloric stenosis, ovarian tumor, Hirschsprung's disease, fundoplication, etc.

Endoscopic surgery for pediatric patients was a challenge for pediatric anesthesiologists as long as data were not available on physiological changes induced by carbon dioxide insufflation. Experimental and clinical studies were required to prevent complications. It was also necessary to develop new instruments for pediatric endoscopic surgery, as treatment might be needed in children of all ages, including neonates.

In the field of general gastrointestinal surgery, laparoscopic cholecystectomy has been providing important opportunities for training surgeons in endoscopic surgery. However, cholecystectomy is not performed in children as frequently as in adults. Except for such diseases as inguinal hernia and acute appendicitis, conditions requiring pediatric endoscopic surgery are generally rare, and the number of cases experienced by individual pediatric surgeons is limited. Consequently, there has been a need to develop a system for training in endoscopic surgery considering the special requirements for treating children.

This article reviews the performance of pediatric endoscopic surgery in Japan and explains the Skill Qualification Program for Pediatric Endoscopic Surgery² conducted by the Japan Society for Endoscopic Surgery aiming to certify "reliable surgical procedures ensuring safety and considering the special characteristics of children."

Present State of Pediatric Endoscopic Surgery

To illustrate the present state of endoscopic surgery in children, details of endoscopic surgery conducted for diseases in pediatric surgery from 1990 to the end of 2005 are presented below based on the result of the eighth questionnaire survey³ conducted by the Japan Society for Endoscopic Surgery in 2005.

Laparoscopic surgery (number of cases by type of operation)

The total number of cases was 9,452 (**Fig. 1**). The most frequently performed operation was appendectomy in 2,124 cases, followed by inguinal hernia repair in 1,945 cases, contralateral exploration for inguinal hernia in 1,681 cases, surgery for gastroesophageal reflux disease in 695 cases, "other" surgical operations in 605 cases, diagnostic laparoscopy in 380 cases, treatment of Hirschsprung's disease in 307 cases, splenectomy in 287 cases, and pyloromyotomy for hypertrophic pyloric stenosis in 283 cases. The list is further followed by treatment for undescended testes and ovarian cysts and tumor resection. The number of laparoscopic cholecystectomy cases was 176. There were 95 cases of laparoscopic surgery in neonates during the survey period.

Thoracoscopic surgery (number of cases by type of operation)

The total number of cases was 3,040 (**Fig. 2**). The most frequently performed operation was surgery for pneumothorax in 1,295 cases, followed by "other" surgical operations in 835 cases. Among the cases in 2004 and 2005, 323 of the total 391

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cases underwent “other” surgical operations, most of which (280 cases) were surgery for pectus excavatum. There were 4 cases of thoracoscopic surgery in neonates during the survey period.

Topics in Pediatric Endoscopic Surgery

Congenital esophageal atresia

The forerunner of this operation was the treatment of type-A atresia in a 2-month-old infant

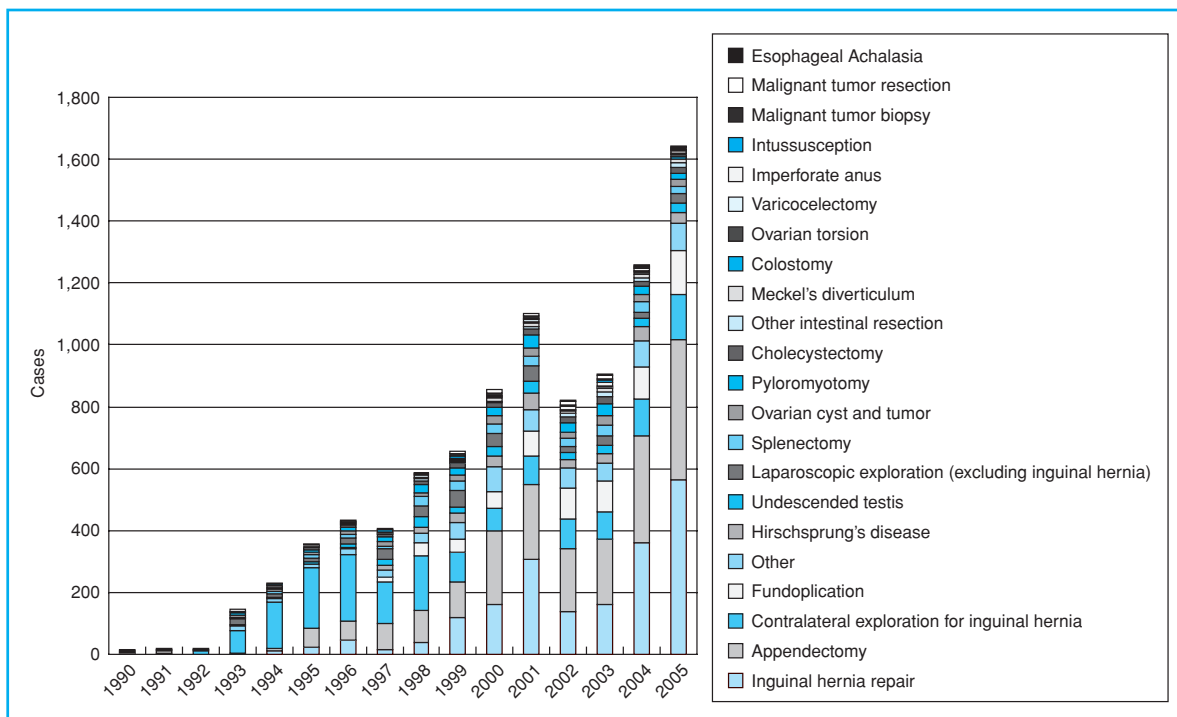


Fig. 1 Number of cases by type of operation (laparoscopic surgery)

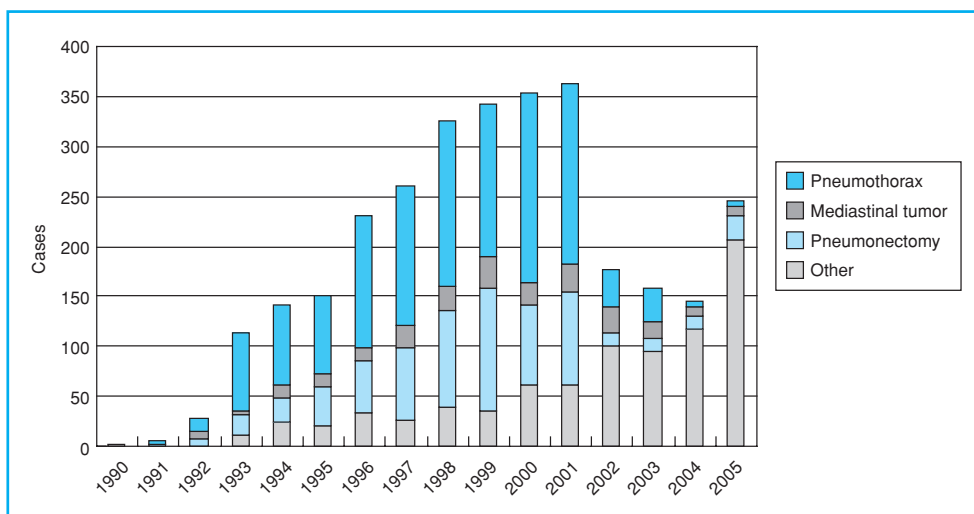


Fig. 2 Number of cases by type of operation (thoracoscopic surgery)

by Lobe et al.⁴ in 1999, and Rothenberg et al.⁵ reported a neonatal case of type-C esophageal atresia in 2000. Experience in Japan is limited to reports from a few institutions^{6,7} dating back to about 2005. There remain some problems to be solved, such as suture failure and the length of operation.

Gastroesophageal reflux disease

Georgeson⁸ and Lobe et al.⁹ reported laparoscopic fundoplication in pediatric cases in 1993. Although the use of laparoscopic surgery for the prevention of gastroesophageal reflux disease in children is gaining popularity also in Japan,¹⁰ there are controversial issues such as the development of new gastrointestinal symptoms including postoperative dysphagia, belch impairment, and abdominal distension, as well as questions about the long-term ability to prevent respiratory infections and the need to resume oral proton pump inhibitors after recurrence.^{11,12} Usually, gastrotomy is added in the case of a pediatric patient who lacks sufficient ability for oral ingestion due to certain disabilities.

Conducted in a relatively large number of cases, laparoscopic fundoplication for gastroesophageal reflux disease has been selected as the procedure examined in the Skill Qualification Program for Pediatric Endoscopic Surgery explained below.

Choledochal cyst

Laparoscopy-assisted small-incision surgery has been the primary method in Japan because of the need to avoid problems related to the treatment of bile ducts in the portal region and those in the parapancreatic region.¹³ However, there is an increasing number of reports of complete laparoscopic surgery in other countries.

Hirschsprung's disease

Hirschsprung's disease is one of the diseases with the longest history of treatment using pediatric endoscopic surgery.^{14,15} Similarly to conventional open surgery, laparoscopic surgery is performed following the Swenson method, the Duhamel method, Soave method, etc. With respect to the timing of operation, it has become possible to conduct one-stage surgery in the neonatal period, and an increasing number of cases are treated without colostomy.

Imperforate anus

Laparoscopic surgery for imperforate anus has been used since the report of this procedure by Georgeson et al.¹⁶ in 2000. The benefit of laparoscopic surgery has been shown particularly in that the procedure provides a better field of view during stoma treatment requiring manipulation in a small pelvis and is minimally invasive to the muscle complex during the formation of a pull-through route.^{17,18}

Inguinal hernia

The usual method of laparoscopic surgery for pediatric inguinal hernia employed in Western countries is to apply a Z suture or pursestring suture on the internal inguinal ring peritoneum and make a ligation within the peritoneum to close the hernial orifice. In Japan, many patients are operated on using laparoscopic percutaneous extraperitoneal closure (LPEC).¹⁵

Other

Endoscopic surgery is performed for an extremely large variety of pediatric diseases in Western countries because there are no restrictions imposed by the national health insurance system. In Japan, attempts are being made to expand the applicability of pediatric endoscopic surgery, including the treatment of malignant tumors and diaphragmatic diseases, as well as neonatal diseases such as congenital duodenal, jejunal, and ileal atresia and intestinal malrotation.

Endoscopic Surgical Skill Qualification (ESSQ) System

ESSQ system in the field of pediatric surgery in Japan started in 2008. Laparoscopic fundoplication for gastroesophageal reflux disease was selected as the procedure to be examined in the field of pediatric surgery, as it consists of various surgical maneuvers such as division of short gastric vessels, dissection and freeing of gastric fundus, and suturing technique.²⁰ To be eligible for entry in ESSQ in pediatric surgery conducted by the Japan Society for Endoscopic Surgery, one must be a board-certified pediatric surgeon and have experience of performing operations in 50 or more cases, including 20 or more cases of "advanced surgery" procedures. There is a further strict condition that these cases must include at least 20 cases of operations on infants of 3

years or less of age.²¹ Skill assessment is performed by evaluating an unedited videotape of the surgeon completing the entire procedure in a double-blinded fashion. Nine surgeons (including examiners) passed the first skill qualification examination in pediatric surgery (56% pass rate),

and the second examination was conducted in fiscal 2009.

Further development of ESSQ system, which is unique in the world, is expected to help ensure the safety of medical care and improve the level and standardization of skills.

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