A 20-year experience in Minimally Invasive Surgery (MIS): learning from mistakes

Mario Lima Sara Ugolini

Table of Contents

Date of initial submission: 31/08/2016

Abstract. *Introduction:* Minimum Invasive Surgery (MIS) has been largely adopted in pediatric surgical procedure and the overall rate of adverse events specifically related is low. The aim of this study is to report our experience within a twenty-year period. *Material and Methods:* Starting from 1995 to 2015 a total of 43.195 were carried out, of which 4.456 performed by the minimal - access. *Results:* Of the total amount of 4.456 MIS procedures, up to 29 (0.6%) adverse events were recorded. *Discussion and Conclusions:* The aim of this study was to enhance common knowledge and improve awareness of concerns for patient safety. We identified an incidence of adverse events of about 0.6%, which is consistent with previously reported series, being haemorrhage or hematoma the most frequent technical complication.

Keywords. pediatric surgery, minimal-access injury, Minimal Invasive Surgery complications, Minimal Invasive Surgery, intraoperative complications, child

Corresponding author:

Professor Mario Lima, MD

Department of Pediatric Surgery

University of Bologna

Policlinico Sant'Orsola-Malpighi

Via Massarenti 11, 40138 Bologna, ITALY

mario.lima@unibo.it

1. Introduction

Minimal Invasive Surgery (MIS) has been largely adopted over the last few years and the overall incidence of associated complications is low [1-5]. Nevertheless, multidisciplinary strategies supporting the patient along the preoperative, intraoperative and postoperative phases can be demanding. Short-term complications include vascular, nerve or visceral injury, infection and wound herniation, with a reported rate of about 1 to 2 percent [6-12] of which up to half occur when gaining the access to the cavity [13,14]. Laceration of major retroperitoneal vessels (aorta or inferior vena cava) and delayed recognition of bowel perforation are associated with high morbidity and mortality [15]. We present a twenty-year experience quantifying MIS complication at the Department of Pediatric Surgery in Bologna.

2. Material and Methods

We aim to report our twenty-year experience in MIS in order to retrospectively review a collected database of all patients undergoing intervention starting from 1995 to 2015 at the Department of Pediatric Surgery of Sant'Orsola teaching hospital. A total of 43.195 consecutive patients presented within the study period for gastrointestinal, thoracic or urologic conditions; out of them, 4.456 cases have been performed by means of minimal-access. The recorded data were the indication for surgery, patient age and short term complications such as vessels, nerve or bowel injury, hematomas, wound infections, persistent pneumothorax, needle or instruments rupture.

3. Results

A total of 43.195 surgical procedures were carried out, starting from 1995 to 2015 (Tab.1). Out of the total amount of 4.456 MIS operation, 29 (0.6%) have developed complications such as needle rupture, trocar injury, instruments rupture, perforation, peritoneal injury, persistent pneumothorax and haemorrhage or hematoma being the most frequent (28%) as depicted in Tab.2 and Figures 1-9. Each case allowed rapid repair of the injury and was accompanied by an uneventful clinical course.

4. Discussion:

The minimally invasive surgery is becoming the access of choice for many pediatric procedures and the reported specific associated complications seem to be comparable to those described in adult series [1-5]. The aim of this study was to enhance common knowledge and improve awareness of concerns for patient safety. We identified an incidence of adverse events of about 0.6%, which is consistent with previously reported series, being haemorrhage or hematoma the most frequent technical complication. Complications can occur at any time: injury of abdominal wall vessels (minor bleeding) or of great vessels (major bleeding) when entering the abdomen, anesthesiological issues related to pneumoperitoneum (i.e. hypercapnia, hypothermia), organ injury within the dissection phase, spillage when retailing resected specimen or omental herniation or bleeding at the time of trocar withdrawal at the end of the procedure. In the specific, we've reported haemothorax, perforation of the duodenum while performing a pylorotomy, sliding of a wrap after a Nissen, persistent pneumothorax, candida postoperative infection after a pyloplasty and circular stapler and needle ruptures (Fig.1-9). Most of the morbidity is reported to be linked to the trocar introduction in the enclosed space where the blind insertion of the umbilical port may cause inadvertent severe

injury [13-15], especially in small kids where the abdominal is thin and distance from the great vessels limited [16]. Nevertheless, failure of medical devices or instruments ruptures within the body cavity can be challenging and a meticulous preoperative control and cautious pressures and forces applied seem to be fundamental. Furthermore, some risk factors related to the patient (i.e. thin/obese, respiratory or cardiac diseases, adhesions due to previous surgeries) may contribute[17]. We observed that no technique or medical technology is without risks and no skilled surgeon is immune against complications [14]. In our opinion is crucial to recognize and manage an injury intraoperatively [18], and conversion to an open procedure may be needed, since an adverse event presenting in the delayed postoperative may have a severe effect on the outcome. Moreover, following the development of newly introduced medical devices, robot-assisted MIS may lower the risks associated with complex procedures in remote areas thanks to enabling features such as wristed arms and depth perception [19].

Figure 1. Nissen procedure (A, B) and postoperative haemothorax (C, D, E)

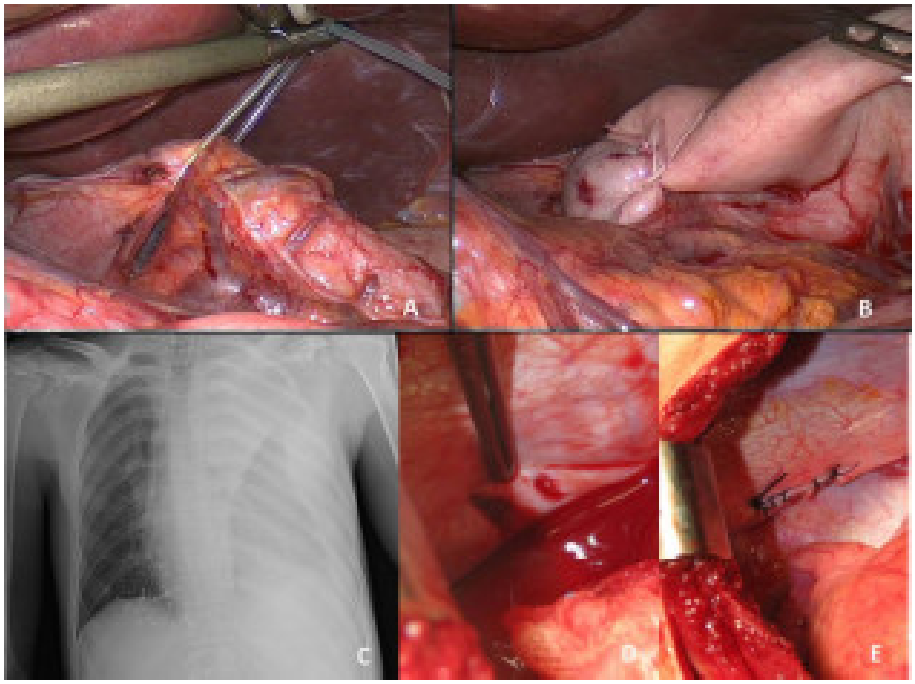


Figure 2. Laparoscopic extramucosal pylorotomy: perforation

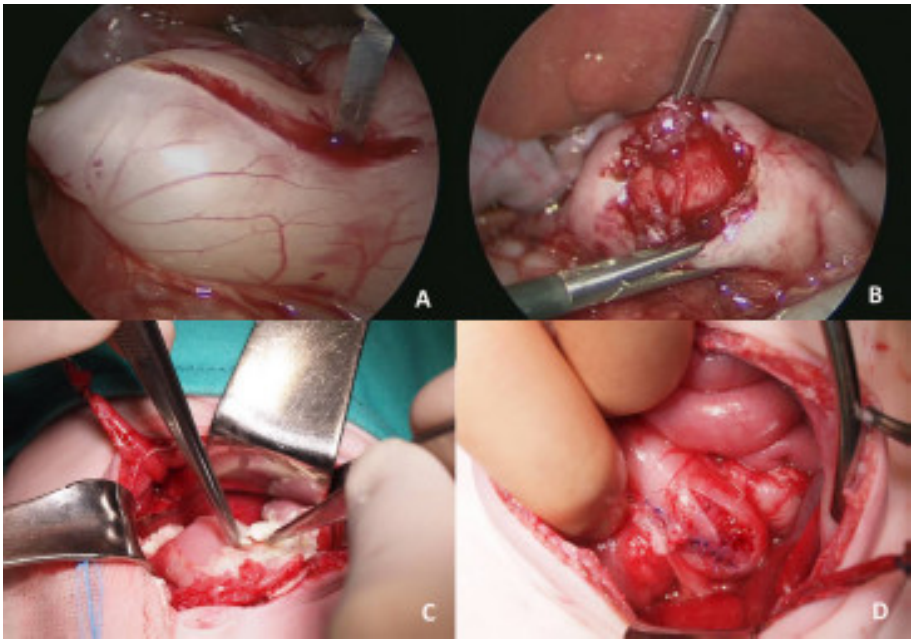


Figure 3. Sliding of a wrap (C, D, E, F) in a Nissen procedure (A, B)

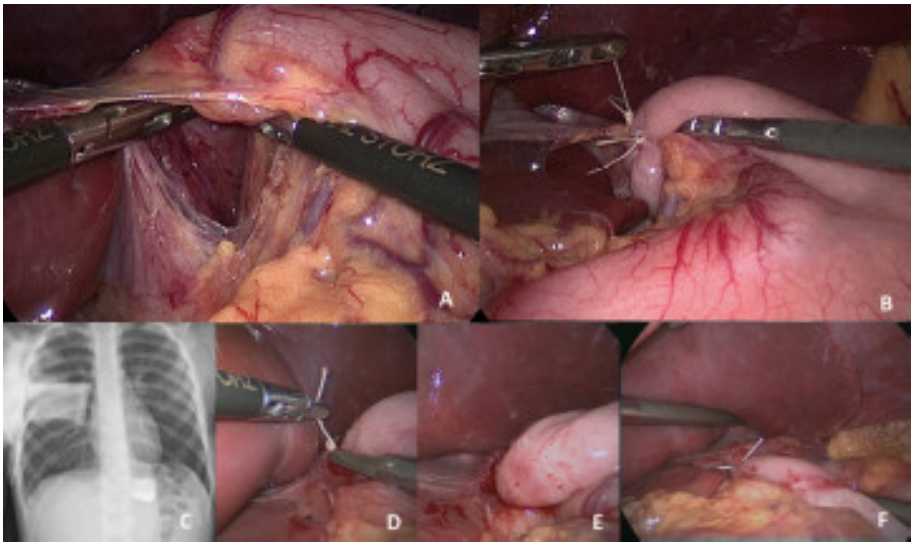


Figure 4. Distal sliding of a wrap in Nissen procedure causing obstruction

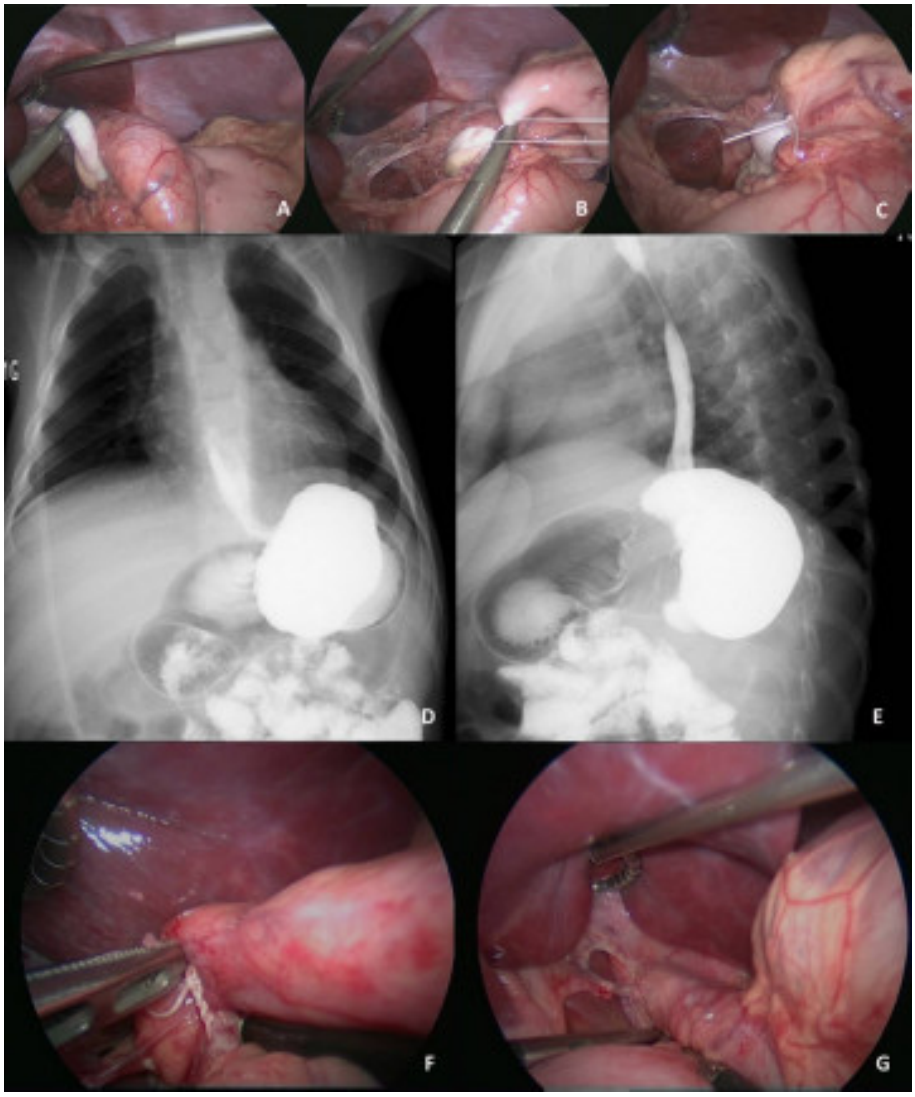


Figure 5. Persistent postoperative pneumothorax after thoracoscopic pulmonary resection of CPAM

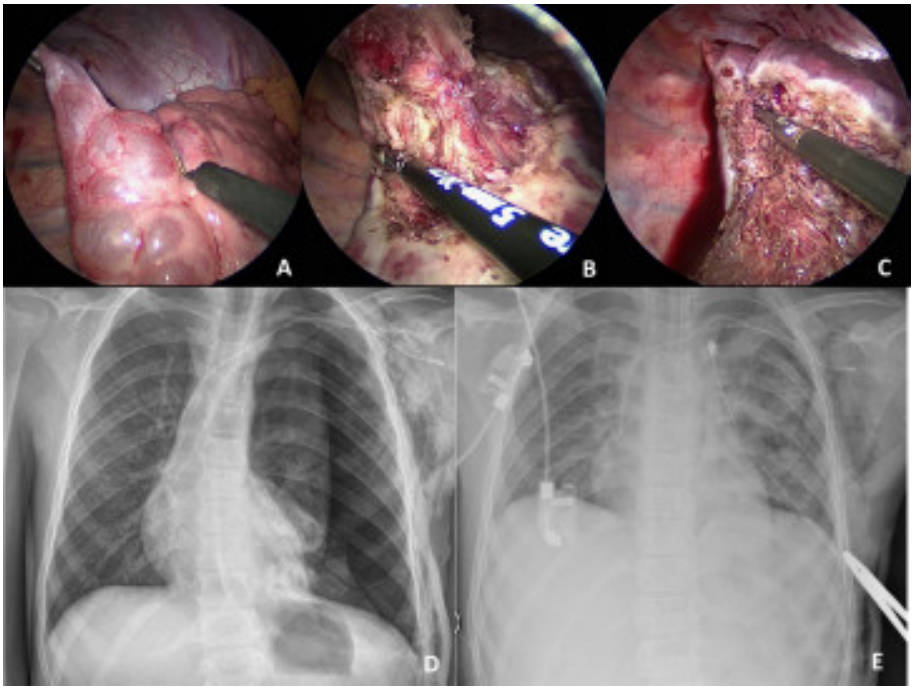


Figure 6. Thoracoscopical repair of two cases of congenital diaphragmatic hernia and relapse of herniating viscera at postoperative X-rays

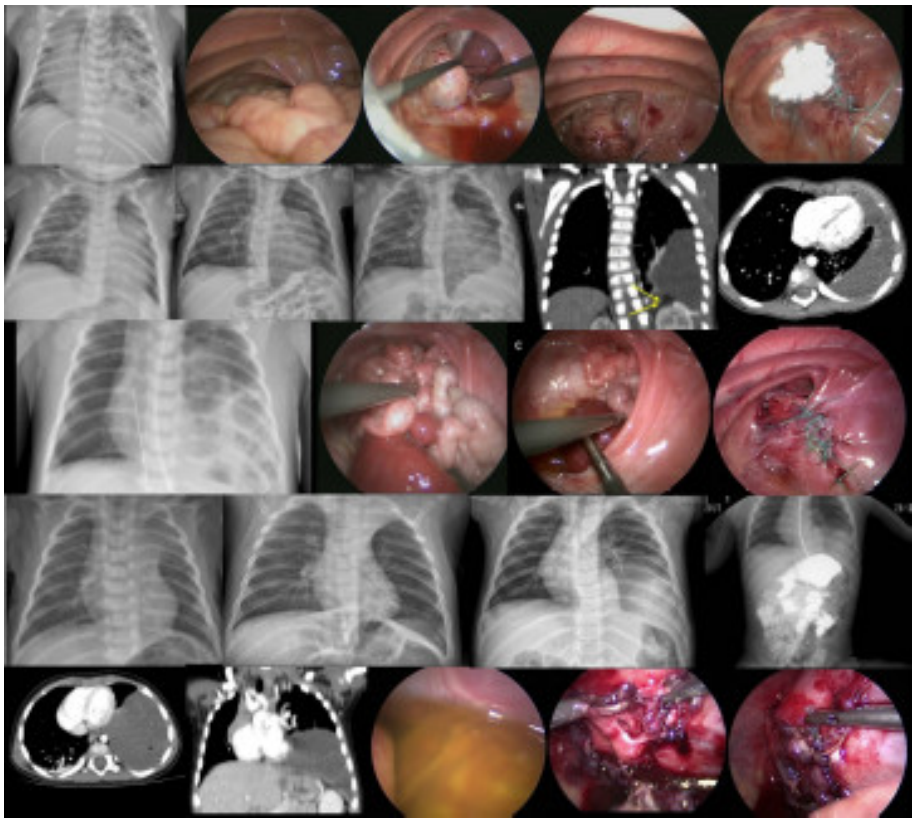


Figure 7. Postoperative candida infection after a laparoscopic pyeloplasty

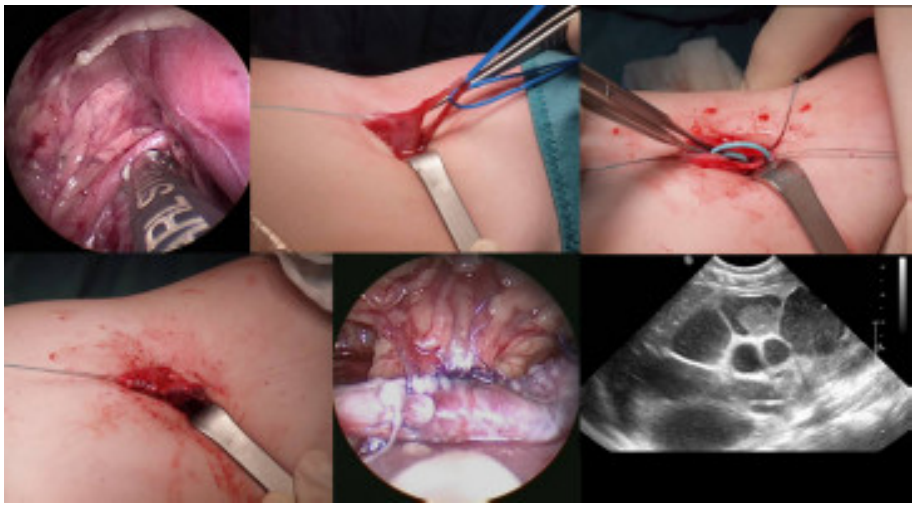


Figure 8. Intra-wall needle rupture

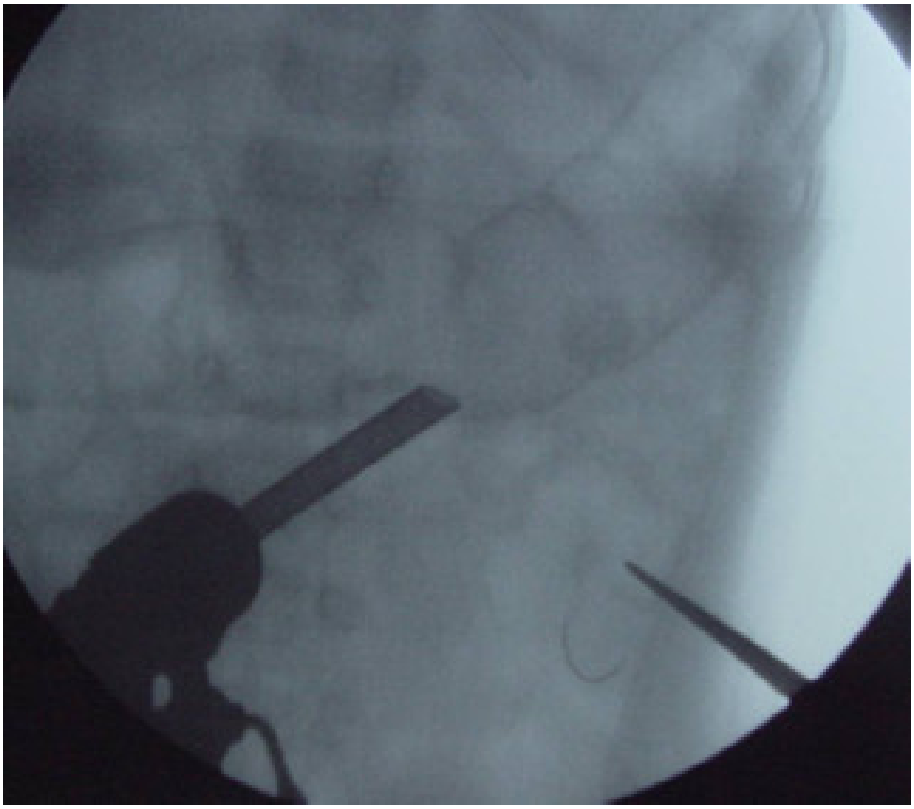
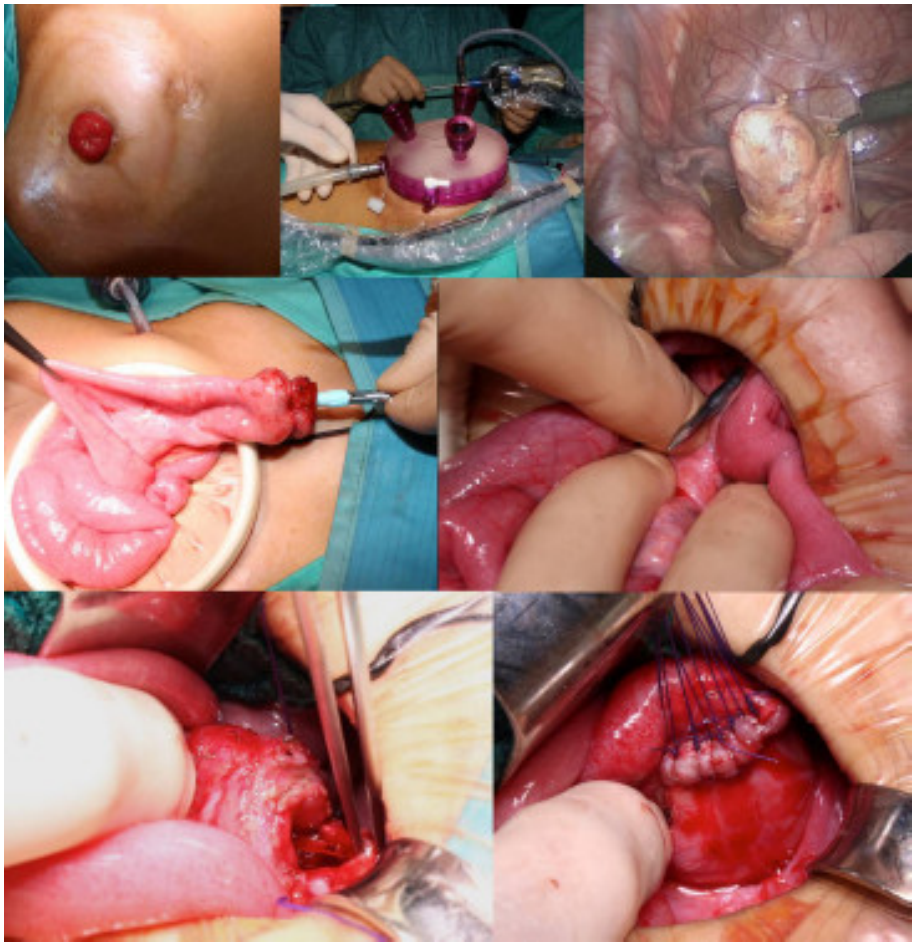
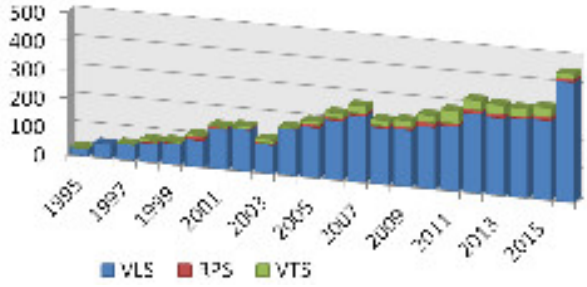


Figure 9. Failure of a medical device (circular stapler) when performing an ileo-anal anastomosis





Tab. 1: Case series within the study period at Department of Pediatric Surgery, Policliico Sant'Orsola Malpighi

Adverse event	Laparoscopy	Thoracoscopy	Retroperito-neoscopy	Number of events
Needle rupture	2	1	-	3

Adverse event	Laparoscopy	Thoracoscopy	Retroperito-neoscopy	Number of events
Trocar injury	2	-	-	2
Instruments rupture	4	2	-	6
Perforation	3	-	-	3
Peritoneal injury	-	-	4	4
Harmorrage / hematoma	3	3	2	8
Persistent pneumothorax	-	3	-	3
Total	**15**	**9**	**6**	**29**

Tab. 2 Number of adverse events occurred, illustrated by type of minimal-access

5. References

1. Davenport M. Laparoscopic surgery in children. Ann R Coll Surg Engl 2003; 85: 324-330.

2. Bencini L, Moraldi L, Bartolini I, Coratti A. Esopheageal surgery in minimally invasive era. World J GastrointestSurg 2016. 27;8(1):52-64.

3. Pandian TK, Nimesh DN, Fahy AS, et al. Laparoscopic esophagomyotomy for achalasia in children: a review. World J Gastrointest Endosc 2016; 25 (8): 56-66.

4. Dingemann J, Ure BM. Systematic review of Level 1 evidence for laparoscopic pediatric surgery: Do our procedures comply with the requirements of Evidence-Based Medicine? Eur J PediatrSurg 2013;23:474-479.

5. Blatnik JA, Ponsky TA. Advances in minimally invasive surgery in paediatrics. CurrGastroenter Rep 2010; 12:211-214.

6. Peters CA. Complications in pediatric urological laparoscopy: results of a survey. J urol 1996; 155:1070.

7. Chen MK, Schropp KP, Lobe TE. Complications of minimal-access surgery in children. J Pediatr Surg 1996; 31:1161.

8. Molloy D, Kaloo PD, Cooper M, Nguyen TV. Laparoscopic entry: a literature review and analysis of techniques and complications of primary port entry. Aust N Z J Obstet Gynaecol 2002; 42:246.

9. Deziel DJ, Millikan KW, Economou SG, et Al. Complications of laparoscopic cholecistectomy: a national survey of 4292 hospitals and an analysis of 77,604 cases. Am J Surg 1993; 165:9.

10. Saville LE, woods MS. Laparoscopy and major retroperitoneal vascular injuries. Surg Endosc 1995 Oct;9(10):1096-100.

11.Trottier DC, Martel G, Boushey RP. Complications in laparoscopic intestinal surgery: prevention and management. Minerva Chir 2009; 64:339.

12.St.Peter SD, Keckler SJ, Nair A, et al. Laparoscopic cholecystectomy in the pediatric population. J Lap AdvSurgTechn 2008; 18(1): 127-130.

13.Magrina JF. Complications of laparoscopic surgery. Clin Obstet Gynecol 2002; 45:469.

14.Cornette B, Berrevoet F. Trocar injuries in laparoscopy: techniques, tools and means for prevention. A systematic review of the literature. World J Surg, 2016; 40: 2331-2341.

15.Fuller J, Ashar BS, Carey-Corrado J. Trocar-associated injuries and fatalities: an analysis of 1399 reports to the FDA. J Minim Invasive Gynecol 2005; 12:302.

16.Van Haasteren G, Levine S, Hayes W. Pediatric Robotic Surgery: early assessment. Pediatrics 2009; 124:1642.

17.Driessen SRC, Sandberg EM, Rodrigues SP, et al. Identification of risk factors in minimally invasive surgery: a prospective multicentre study. Surg Endosc, 2016, Oct [ePub]

18.Warren O, Kinross J, Paraskevas P, et al. Emergency laparoscopy – current best practice. World J EmergSurg, 2006; 1:24.

19.Van Haasteren G, Levine S, Hayes W. Pediatric Robotic Surgery: early assessment. Pediatrics 2009; 124:1642