

Laparoscopic surgery in children: abdominal wall complications

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Abstract. Minimal invasive surgery has become the standard of care for operations involving the thoracic and abdominal cavities for all ages. Laparoscopic complications can occur as well as more invasive surgical procedures and we can classify them into non-specific and specific. Our goal is to analyze the most influential available scientific literature and to expose important and recognized advices in order to reduce these complications. We examined the mechanism, risk factors, treatment and tried to outline how to prevent two major abdominal wall complications related to laparoscopy: bleeding and port site herniation .

Keywords. laparoscopy, complications, bleeding, port site herniation

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Introduction

Over the last 25 years, in the area of pediatric surgery and urology there has been a development of endoscopy and minimally invasive surgery, that has changed the practice of the medical specialty. Since Jacobaeus in 1910 adopted laparoscopy in humans, also in pediatrics there has been a remarkable development in imaging techniques, with very

high-resolution cameras and optics as small as 1.5 mm. Furthermore, the creation of small instruments for pediatric surgery has allowed the use of video-endoscopy in very small patients. The role of laparoscopy as a diagnostic tool in pediatrics was largely diffused as early as 1971 by Dr. Stephen Gans. As the instrumentation for laparoscopy and thoracoscopy has improved, the technique has also evolved, the surgical experience has increased and many procedures such as cholecystectomy or fundoplication for gastroesophageal reflux are accepted as standard today.

Minimally invasive surgery has become the standard of care for operations involving the thoracic and abdominal cavities for all ages [1]. Pediatric laparoscopy offers well-known advantages: fewer wound-associated complications, less post-operative pain, a shorter recovery and better cosmetic results. The basic techniques of pediatric laparoscopy do not differ significantly in the child if compared to the adult patient. Size and weight are no longer considered contraindications to laparoscopic approach. Laparoscopic complications can occur as well as more invasive surgical procedures and we can mainly classify them into non-specific (related to every surgical procedure) and specific (related only to the technique: laparoscopic procedure). Since prevention of the latter is a very debated topic today, our goal is to examine the most influential available literature and to expose important and recognized advices in order to reduce these complications [2].

Methods

We examined the mechanism, risk factors, treatment and tried to outline how to prevent laparoscopic complications. We concentrated our attention upon two major abdominal wall complications: trocar site hernia (TSH) and iatrogenic bleeding due to device insertion, a non and specific complication respectively. Articles from the literature were selected in relation to their importance based on the number of citations and relevance to the pediatric population.

Discussion

The incidence of TSH varies between 0.18% and 2.8%, with a significantly higher incidence when using trocar of >10 mm [3].

The diameter of the trocar, obesity and age play a fundamental role when proceeding to close the fascia, which is the most important factor to prevent onset of TSH [4,5]. The latter, which takes place at the level of trocar access sites, is one of the possible postoperative parietal complications [2]. Risk factors include the size of access and removal of any site drainage under suction [6]. In order to prevent this complication it is a safe rule to follow these recommendations: suture the fascia where there is the trocar access, its removal always under direct vision, including that one introduced in the umbilicus by the open Hasson technique. Current evidence suggests to suture the fascia whenever using >10 mm size devices with non-absorbable or low-absorbable material, independently from the age of the patient. When using a trocar of 5 mm some Authors suggest that is necessary to suture the fascia only below the age of 6 years old [7]. A very debated issue [8] is whether trocar types can affect the chance of developing TSH: current evidence doesn't show any difference between single types. Eventually, TSH is usually located in the umbilical area because larger trocar are placed mostly in this area [9,10].

Cost et al reviewed retrospectively all pediatric urological laparoscopic procedures, in order to verify the incidence of port site hernia and the related risk factors [11]. A total of 261 cases was identified with follow-up available in 218 (83.5%). In 187 cases there were sufficient data to evaluate outcomes for each port site separately, and compare the size, location and fascia

closure status to hernia development. Seven hernias (3.2%) were diagnosed at a median of 1.2 months (range 0.1 to 15.1) postoperatively. They observed that patients with hernia were younger than those without a hernia. No significant relationship was observed between hernia development and port size or location. They concluded that while development of hernia after pediatric urological laparoscopy is rare, it is more likely to occur in infants.

Looking at literature data it is difficult to anticipate which patient will develop trocar site hernia during follow-up. It's our impression that we can't draw conclusions regarding the risk factors for incisional hernia, especially in children due to small retrospective series of patients. More data and observational studies are necessary.

Another important complication is iatrogenic bleeding caused by the puncture of abdominal wall vessels. The major vessel involved in this complication is epigastric artery. Recent surveys have demonstrated that the rate of injury to the vessel is 0,02-0.04 % [12,13]. The superior epigastric artery arises from the internal thoracic artery and anastomoses with one or more branches of the inferior, which arises from the external iliac artery and runs beneath the rectus, above the peritoneum (Figure 1) [14].

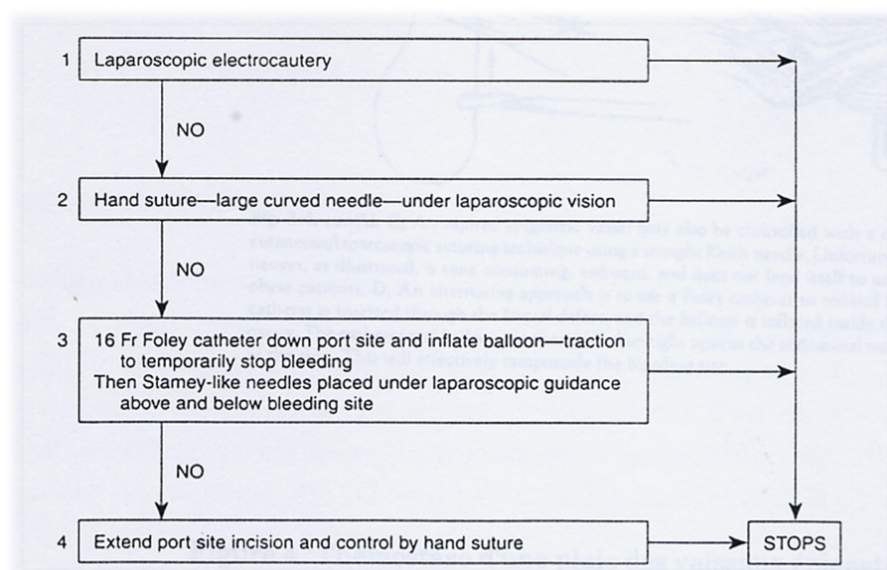
Figure 1. Course of inferior epigastric artery



Some authors have studied in the adults, the anatomical course of the inferior epigastric artery in relation to standard anatomic landmarks in order to suggest safe areas for trocar

introduction. To avoid an injury to the vessels, they suggested introducing trocars 5,5 cm (mean \pm 1 standard deviation) away from midline slightly more than one-third of the distance between the median and a sagittal plane running thorough anterior superior iliac spine. The bleeding can exhibit during the surgical procedure as frank hemorrhage spreading inside the peritoneal cavity or as a post-operative diffuse hematoma within the abdominal wall. Sometimes the bleeding trocar insertion site can be buffered by the same trocar and cannot be seen during surgery, but shows up, then significantly during the postoperative phase after their removal [12,15]. Whenever occurs, it is useful to keep in mind a valid algorithm to take on the bleeding. The diagram illustrated in figure 2 is a valid example.

Figure 2. From Ennui, incidents, accidents et catastrophes en coeliochirurgie . Experience d'une equipe de chirurgie pediatrique – J.S Valla -1995 Fondation Lenval, Nice, France



To prevent bleeding of the abdominal wall is necessary to consider some risk factors such: the skill of the surgeon, the visibility of the instrument, the angle of insertion, the position of the patient, the elevation angle of the wall and the volume of the pneumoperitoneum.

In order to prevent this complication we can propose the following step:

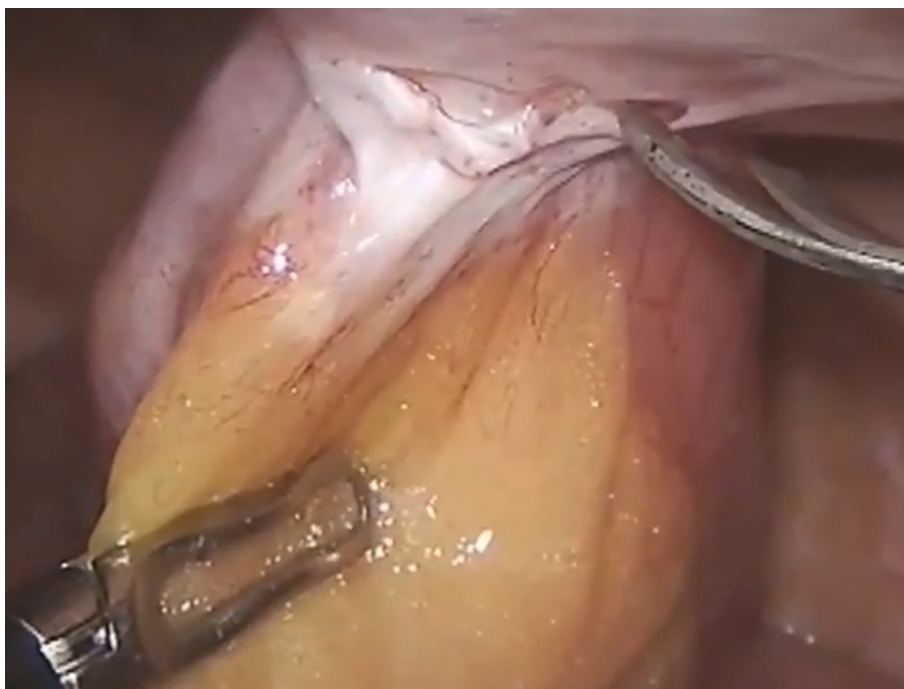
- Trans-umbilical approach with Hasson technique;
- Secondary trocar insertion always under direct sight and perpendicularly to the abdominal wall;
- Transillumination to identify the superficial epigastric artery [16];
- Movements of digital push around devices insertion sites;
- Keep in mind, if possible, to insert devices in the “safety triangle”, delineated below by the apex of the bladder and by umbilical obliterated arteries laterally;
- Recognition of the avascular zone pushing laterally to epigastric vessels;

- Conical tip trocars or “Bladeless”.

Recently Cornette et Al [1] have conducted a systematic review of the literature on prevention of trocar injury. They concluded that there is evidence that radially expanding trocars reduce vascular complications when compared to bladed trocars. Furthermore, Chapelle et Al. [8] have done a Cochrane Database Systematic Review on trocar type in laparoscopy. They deduced that information were lacking on the incidence of major trocar-related complications, such as visceral or vascular injury, when comparing different trocar types with one another. Nevertheless, caution is necessary when interpreting these results because the incidence of life-threatening complications following the use of a trocar was extremely low. Despite very low quality evidence for minor trocar related complications, once again, the use of a radially expanding device compared to cutting trocar could reduce incidence of trocar site bleeding.

They concluded that large, well-conducted observational studies are necessary to answer the questions addressed in this review because serious complications, such as visceral or vascular injury, are extremely rare. However, for other cases, such as trocar site herniation (Figure 3), bleeding or infection, large observational studies may be called for as well.

Figure 3. Intraoperative evidence of hernia developed through previous laparoscopic access.



Conclusion

Complications are an inevitable part of surgery. Due to the rapid introduction of new technologies and techniques in endoscopic surgery, awareness, teamwork, education and counseling, are essential aspects of risk-management system to ensure patient safety. When complications occur, a systemic and coordinated response is required for immediate correction, to provide explanations and support to the patient. The identification of errors or

lessons learned from surgical accidents, are useful to introduce new strategies to prevent and treat complications more appropriately.

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