BASIC PRINCIPLES OF LAPAROSCOPIC APPENDECTOMY

OSNOVNI PRINCIPI LAPAROSKOPSKE APENDEKTOMIJE

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Introduction

Acute appendicitis is the most frequent abdominal disease and requires urgent appendectomy.

The first reported appendectomy was performed in 1735 because of a perforated appendix with a stercoral fistula by the military surgeon Claudius Amyand [1], and the first appendectomy with the correct preoperative diagnosis was performed by Lawson Tait [2] in 1880. In 1889 McBurney described point tenderness in the right lower abdominal quadrant, indicative of appendicitis and popularized the muscle-splitting incision [3].

For more than 100 years McBurney’s appendectomy was the gold standard in the treatment of acute appendicitis, and right up until the recent development of laparoscopic surgery, little in the diagnosis and treatment of appendicitis has changed since then.

Laparoscopic appendectomy for a non-inflamed appendix was first reported in 1983 by the gynecologist Semm [4]. In 1987 Schreiber reported a laparoscopic assisted appendectomy for the treatment of acute appendicitis [5]. Since then many reports have been published indicating that laparoscopic appendectomy is safe and feasible in most settings [4–7].

Although laparoscopic appendectomy was performed several years before laparoscopic cholecystectomy, it has only recently become a common laparoscopic procedure. One of the reasons is that laparoscopic appendectomy through McBurney’s incision is a simple, quick and efficient procedure which can be performed by most surgeons. Laparoscopic appendectomy, on the other hand, requires some level of...
knowledge of laparoscopic surgery and more expensive equipment. Possible advantages, such as fewer infections of wounds, shorter hospital stay, faster recovery and return to everyday activities, are most often accompanied by a longer operative procedure (which is shorter as the number of performed appendectomies rises) and higher costs. The laparoscopic method has proven advantages in women with pains in the lower right quadrant, improving diagnostic accuracy, decreasing the number of negative appendectomies and enabling efficacious treatment of gynecological diseases [5]. Laparoscopic appendectomy is a safe procedure in the pregnant patients in the second trimester [8]. When treating chronic appendicitis, laparoscopic appendectomy has proven advantages, as well [9].

The position of the patient and the surgical team

The patient is placed in the supine position, combined with the Trendelenburg position and left lateral position (10–15 °, inclined towards the surgeon). The surgeon and an assistant stand on the left side, and the monitor is on the right side of the patient (Figure 1).

During operation some surgeons stand between the patient’s legs, and the assistant stands on the patient’s left side. The video monitor is placed on the patient’s right side.

Position of trocars and instruments

The surgical procedure is performed under general anesthesia. The bladder is decompressed with a Foley catheter to avoid injury while inserting the suprapubic ports. Pneumoperitoneum is established with a Veress needle through the umbilicus and then a laparoscope is introduced. Under direct vision, one 12 mm trocar is inserted into the suprapubic region, a little to the left, and one 5 mm trocar is inserted in the right lower quadrant, at the level of the first 12 mm port, to provide triangulation (Figure 1). Afterwards, the abdominal cavity is inspected.

**Technique of laparoscopic appendectomy**

The end of the appendix is seized for the mesoappendix by a grasper placed through the right lower abdominal 5 mm port. The mesoappendix is skeletonized from the top to the base using a harmonic scalpel placed through the left lower quadrant port (Figure 2). Various techniques described for dissection of the mesoappendix include electrocoagulation, clips, endoloop ligatures or linear intestinal stapler. After that, an endoloop is introduced through the same port, three endoloops are passed over the tip of the appendix and secured at the base of the appendix. Two ligatures are placed 5 mm part, close to the caecum, and a third tie is placed 1 cm distal to the first two. The appendix is transected between the ties, leaving two loops on the caecum end (Figure 3). As an alternative method, instead of an endoloop, a linear stapler can be introduced (Figure 4), or three Hem-o-lok clips may be placed [10], size XL (Fig-
After resection of the appendix, a sterile specimen retrieval bag is placed into the abdomen through a 12 mm suprapubic trocar and the appendix placed inside. If an exudate is present, a drain is placed in the pouch of Douglas.

In case of uncomplicated appendicitis it is recommended to secure the base of the appendix by using only one ligature [11], and by only one Hem-o-lok clip in all forms of appendicitis [12].

The method of securing the base of the appendix with Hem-o-lok clip can be recommended as a useful alternative and speed up the acceptance and use of laparoscopic appendectomy in developing countries such as countries of South-Eastern Europe. It is especially important in countries where resources for surgical training with endoloop are insufficient; moreover, stapler is very expensive, whilst the application of Hem-o-lok clips is very simple and can be done by almost any surgeon without extensive training.

It is important to emphasize that moderate postoperative inflammatory changes were observed with the use of the stapler, and with the Hem-o-lok [13], which may have implications on postoperative recovery. However, the cost and time of the application as well as tissue reaction are also some of the aspects that need to be considered when using different techniques in securing the base of the appendix during laparoscopic appendectomy.

Complicated Appendicitis

Retrocaecal Appendix

If the appendix is not identified during the initial exploration, the caecum is mobilized sharply with scissors, electrocautery or harmonic scalpel along the Toldt line. Atraumatic bowel graspers are used for retraction of the caecum - reflecting the caecal pole up and to the left will expose the appendix. In this location, however, the appendix, especially the tip, may be covered by adhesions, making the operation difficult. In that case, retrograde dissection should be performed. The trocar placement is the same as for the usual antegrade resection. Once the caecum and the base of the appendix have been identified, the appendix can be transected with a stapler or between clips or endoloops.

In cases of difficult, retrocaecal appendix, articles published in literature describe “fingeroscopy”, which is a laparoscopic assisted procedure, where mobilization of the appendix is performed with a finger [14], after which laparoscopic appendectomy is performed.

Gangrenous Appendix

When the appendix is gangrenous, the anatomy is often obscure. In the area of the caecum or in the pelvis an exudate is found. The appendix is identified with careful blunt dissection, and removed in the usual manner.

Perforated Appendix

If the perforation is close to the tip of the appendix, closure with an endoloop is possible. If the perforation is close to the base of the endoloop, ligation or stapling of the stump, close to the perforated or necrotic areas, may be impossible. The caecum should be mobilized adequately and the appendix removed by applying the stapler across the base appendix.

Appendicular Abscess

If an appendicular abscess is suspected, the Trendelenburg position is avoided to prevent contamination of the upper abdomen. The abscess is identified by bluntly dissecting the adherent bowel loops away. The abscess cavity is aspirated, dried and irrigated; then the appendectomy is performed as described above. A drain should be placed in the abscess cavity.

Conversion to Open Procedure

The only absolute contraindication for laparoscopic appendectomy is the inability to obtain a pneumoperitoneum safely under general anesthesia [15]. Insufficient experience with laparoscopic appendectomy or advanced and complicated appendicitis may be indications for conversion to an open procedure.
procedure. However, with increased experience, most appendicular conditions can be managed laparoscopically. Moreover, most skilled laparoscopic surgeons find that complicated appendicitis can often be managed better through the laparoscope than through a McBurney incision [15]. The view is better, abscesses are more easily identified and treated, and the entire abdomen may be explored and lavaged.

Nevertheless, a prudent surgeon will occasionally have to convert a laparoscopic appendectomy into an open procedure for various reasons that include the inability to gain exposure, fear of intestinal injury, inability to recognize the base of the appendix, extensive adhesions and uncontrolled bleeding.

Complications of Laparoscopic Appendectomy

Most reports of laparoscopic appendectomy indicate a low incidence of intraoperative and postoperative complications [16-22].

Bleeding

Bleeding is usually overestimated during laparoscopic procedures because of the magnification of the camera, but most conversions to open procedure occur for this complication [8]. Aggressive dissection of the mesoappendix may lead to bleeding, and it can be from the retroperitoneum, during dissection of an inflamed, retrocecal appendix. Careful dissection with control of the mesoappendix can prevent this complication. Bleeding is not difficult to recognize. Suction, pressure of the site of bleeding with an instrument or gauze and an additional trocar facilitate identification and control of the site of bleeding. Control can be achieved by coagulation, clips, or by an endoloop. In very rare situations conversion to open procedure is needed.

Fecalith

This is a rare, but frustrating complication [23]. During dissection of a distended, gangrenous appendix, a fecalith may drop into the peritoneal cavity. Retained fecaliths may cause an intrabdominal abscess. Therefore, fecaliths need to be dealt with carefully and cautiously so that they would not be lost between the loops of the intestine and the pelvis. Fecaliths should be thrown into an endobag and the careful lavage should be performed. This complication will be found more often as laparoscopic appendectomy becomes a more common method in the treatment of acute appendicitis [24]. Surgeons should be aware of this complication in order to treat fecalith adequately when recognized intra or postoperatively. Gentle treatment of an inflamed, gangrenous appendix and the use of an endobag prevent this complication. Since an abscess develops in all described cases of a dropped fecalith after open appendectomy, it is recommended to remove the fecalith when it is established that one has dropped intraoperatively. If the presence of a fecalith is confirmed postoperatively, its removal by relaparoscopy is possible [23]. A retained fecalith which is manifested as an intrabdominal abscess is treated like any other abscess [24].

Incomplete Appendectomy

Stump appendicitis is a delayed obstruction and inflammation of residual tissue left after an incomplete appendectomy [25]. This is a serious but very rare complication. However, incomplete appendectomy may lead to recurrent appendicitis. Some reports suggest an increased incidence of incomplete appendectomy with laparoscopy, but most published cases appeared after open appendectomy.

This complication arises when the appendix is cut a long way from the base. Poor identification of the join between the appendix and the caecum appears to play an important role. Following the taenia coli from the caecum to the appendix helps to identify the base. Alternatively, dissection and ligature of recurrent branches of the appendicular artery help to mark the base of the appendix [26]. It is therefore necessary to treat the join of the base of the appendix with the caecum carefully. This rare complication must be taken into account if a patient who has undergone appendectomy has recurring symptoms and signs of acute appendicitis.

Postoperative Abscesses

Postoperative abscesses are uncommon with laparoscopic appendectomy. With improvement of camera quality, better lavage and cleaning of the operative field, this complication is rarely seen, and recent reports have noted a significant decrease in abscesses after laparoscopic appendectomy [27]. There are reports of subhepatic and subphrenic abscesses, possibly due to the spread of infected fluid while the patient is in the Trendelenburg position, but this is an unproven theory. Abscesses are treated by ultrasound guided puncture and drainage, with antibiotic therapy.

Stump Leak

A stump leak is a very rare complication. It may be related to excessive coagulation of the stump, causing tissue necrosis, or inadequately placed endoloop. It is manifested by a serceral fistula.

Wound Infection

Infection of a surgical wound is less frequent than in open appendectomy, even in cases of gangrenous appendicitis. The reduction in the level of wound infection has probably been achieved due to the extraction of the appendix through the port or in a plastic bag (endobag).

Conclusion

Laparoscopic appendectomy is increasingly becoming the method of choice in the treatment of acute appendicitis due to its advantages over open appendectomy. The risk of wound infection is low-
er, postoperative pain is milder and the hospital stay is shorter. The reasons for unsuccessful procedures vary; the most common noted are: the position of the appendix, bleeding and abscess.

Two conditions make laparoscopic appendectomy especially difficult: retrocaecal position and the presence of an abscess. Even in these cases, laparoscopy makes the open approach easier, indicating the exact site of the incision. In cases of generalized peritonitis, the laparoscopic method facilitates the complete cleansing of the abdominal cavity.

In South-Eastern Europe the use of laparoscopic appendectomy is still very limited even though it is one of the simplest laparoscopic procedures. It requires only five laparoscopic appendectomies to acquire efficiency, therefore laparoscopic appendectomy could be the first laparoscopic operation during laparoscopy training of surgeons.

Some of the advantages of laparoscopy are reduced traumatization of tissues and less irritation of the bowels, milder postoperative pain, shorter hospital stay, faster recovery and return to everyday activities, which is especially important for patients who wish to return to work. The economic importance and implications favoring this approach cannot be ignored.

References