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**Abstract**

Appendicitis is one of the most common medical conditions affecting children. It is usually treated with open or laparoscopic appendectomy, which is probably a basic surgical procedure for young pediatric surgeons to perform. Appendicitis is common in older children, but care must be taken in younger children because it can be difficult to diagnose, and children are prone to perforated peritonitis.

**Keywords**

Appendectomy • Laparoscopic surgery • Appendicitis

**36.1 Open Appendectomy****36.1.1 Preoperative Management**

Patients that are complicated by peritonitis, such as those with perforated appendicitis, should be given sufficient fluid transfusions before surgery to stabilize their hemodynamics. Antibiotics should also be administered from the preoperative period onward.

**36.1.2 Operations****36.1.2.1 Incision (Figs. 36.1 and 36.2)**

The most common incision employed during open appendectomy is a transverse right lower quadrant skin crease incision through or below McBurney's point.

The external oblique muscle is split in the direction of its fibers. Then, the internal oblique muscles and the transverse muscle are cut in the direction of their fibers to reach the peritoneum. The peritoneum is grasped and then opened with a scalpel. The resultant peritoneal opening is enlarged with scissors.

**36.1.2.2 Exposure of the Appendix (Fig. 36.3)**

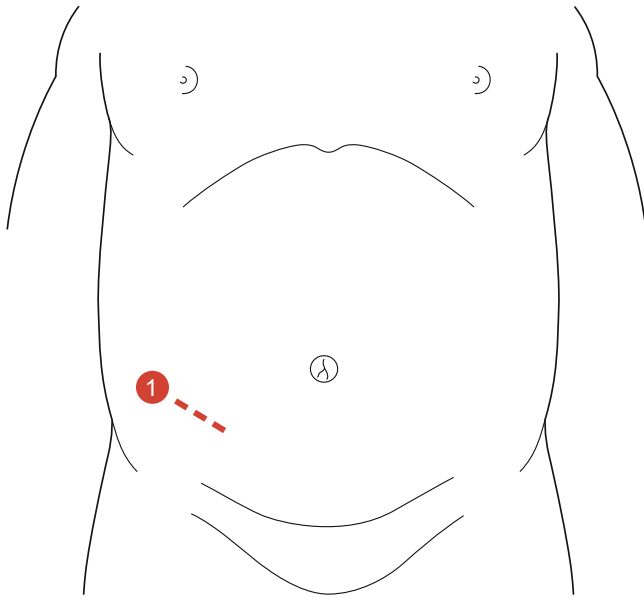
When the greater omentum or small intestine is located below the incision, it should be moved to the cranial side. Next, the teniae coli are grasped and followed to the proximal side to reach the appendix. If the appendix cannot be identified easily, the cecum and appendix are dissected from the retroperitoneum using blunt or sharp dissection. Once the appendix has been identified, the mesoappendix or the appendix itself is held with Pean or Babcock forceps, and the appendix is pulled out of the incision. If the appendix cannot be identified, the muscle-splitting incision should be enlarged by medially transecting the rectus muscle in order to achieve adequate exposure of the operative field.

**36.1.2.3 Appendectomy (Figs. 36.4 and 36.5)**

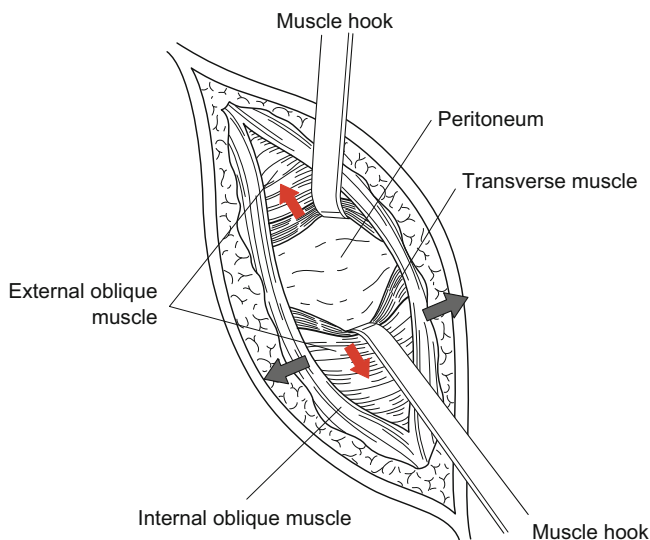
The traction provided by Babcock forceps makes it easy to control the appendix. The mesoappendix is divided using hemostats and ligated in sequence. Once any blood vessels have been dealt with, the appendix is crushed approximately

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**Fig. 36.1** Incision. A transverse right lower quadrant skin crease incision through McBurney's point

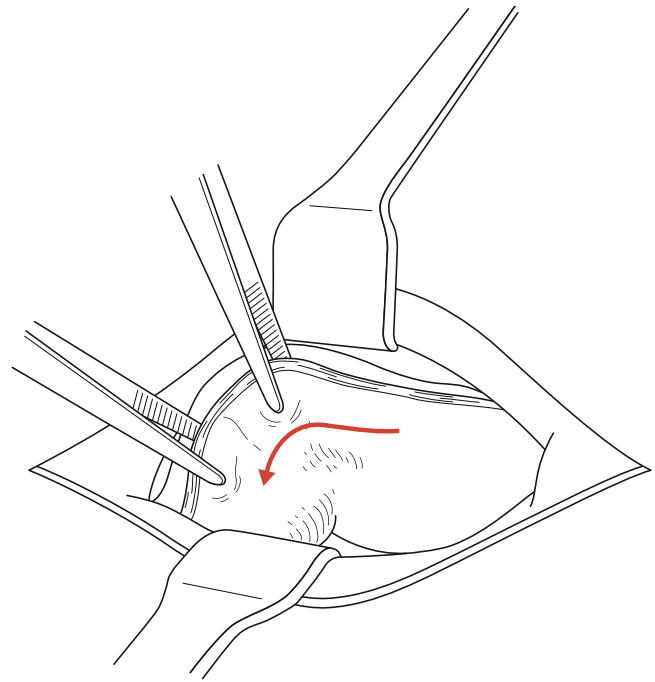


**Fig. 36.2** Muscle-splitting incision to expose the peritoneal cavity

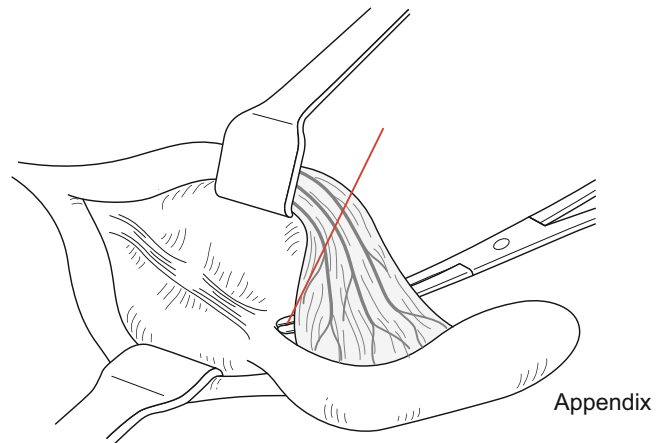
5 mm above its origin, and a clamp is attached a few millimeters distal from the crushed tissue. Next, the appendix is tied off in the crushed region and removed via sharp division just proximal to the clamp. The resected stump of the appendix is often buried within the cecum using a purse-string suture, but stump inversion is not always necessary.

**36.1.2.4 Suction and Irrigation**

In patients that develop perforated appendicitis or abscesses, the pelvis and right paracolic spaces are suctioned and irrigated with saline. In cases involving pan-peritonitis,



**Fig. 36.3** Exposure of the appendix. The teniae coli are grasped and followed to the proximal side to reach the appendix

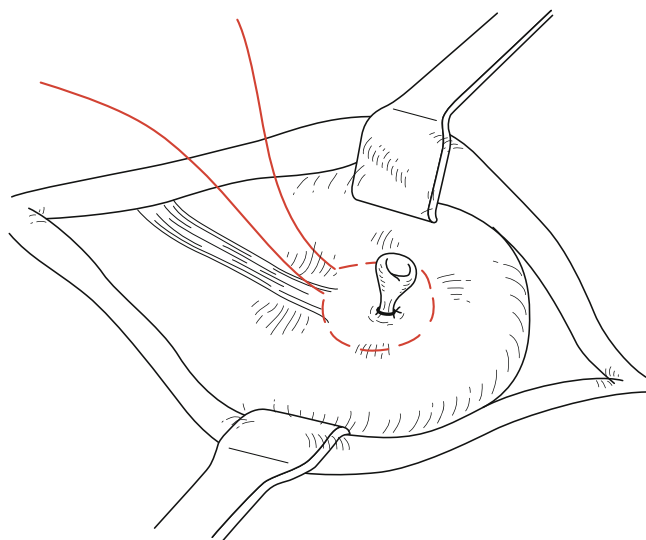


**Fig. 36.4** Division of the mesoappendix

pediatric patients are placed in the reverse Trendelenburg position, and irrigation is performed with a sufficient amount of saline so that the solution pools in the pouch of Douglas. Closed drains can be placed in the pouch of Douglas and/or at any abscess sites.

**36.1.2.5 Wound Closure**

After closing the peritoneum with sutures, the wound site is cleaned. Subsequently, the muscle layer is closed with sutures, and the skin is sutured so as not to leave any dead space.



**Fig. 36.5** Use of a purse-string suture. The resected stump of the appendix is buried within the cecum with a purse-string suture

### 36.1.2.6 Postoperative Management

Oral intake is restarted once intestinal peristalsis has returned. The use of postoperative antibiotics varies depending on the extent of the patient's appendicitis. Postoperatively, care must be taken to prevent wound infection and residual abscess formation.

## 36.2 Laparoscopic Appendectomy

Laparoscopic appendectomy is indicated for mild to serious cases of appendicitis involving pan-peritonitis. As observation, suction, and irrigation of the peritoneal cavity are often employed in patients with appendicitis complicated by peritonitis, such patients are considered to be good candidates for laparoscopic appendectomy. However, in children with a poor general status, such as those who require intensive resuscitation after developing shock, the conventional open approach is preferable.

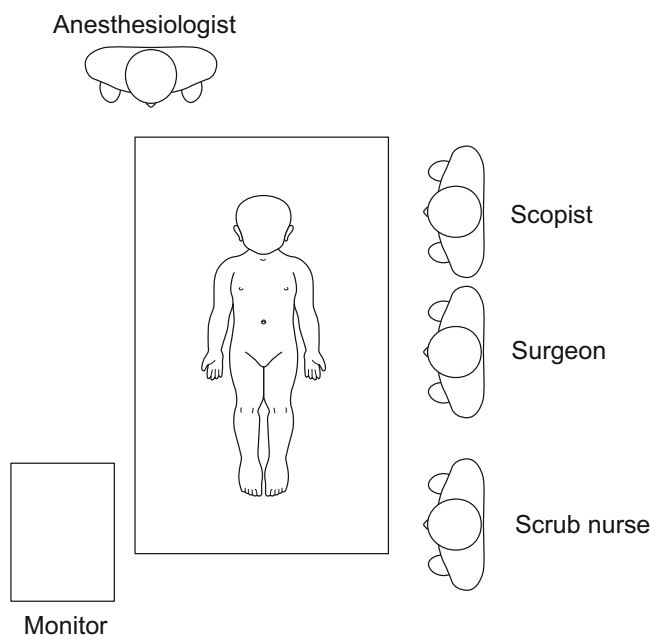
### 36.2.1 Preoperative Management

The preoperative management strategies employed before laparoscopic appendectomy are the same as those used before open appendectomy.

### 36.2.2 Operations

#### 36.2.2.1 Positioning of the Patient, Surgical Team, and Monitor (Fig. 36.6)

The patient is put in the supine position with both arms alongside their body on the operating table. A nasogastric



**Fig. 36.6** Positioning of the patient, surgical team, and monitor

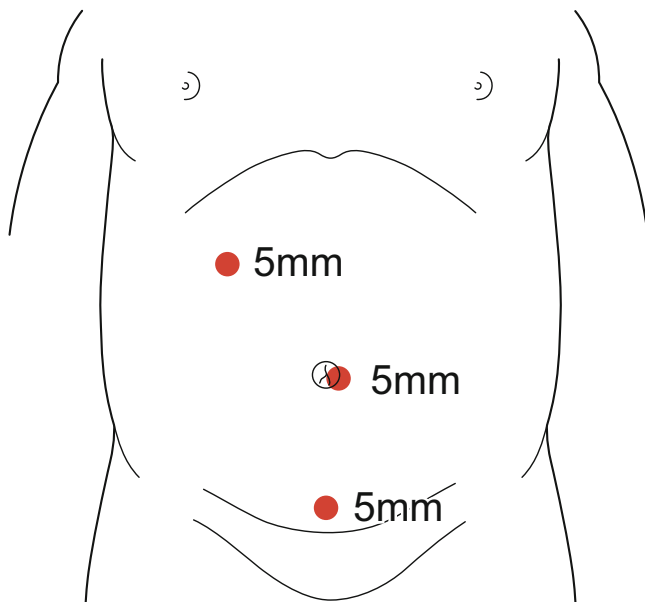
tube is installed, and a urinary catheter is inserted to prevent bladder injuries. The surgeon stands on the left side of the patient, and the scopist stands on the cranial side of the surgeon. A monitor is placed at the patient's right foot. The operation table is tilted in the Trendelenburg position and to the left. Thus, the right colon and small intestine shift to the left.

#### 36.2.2.2 Port Positions (Fig. 36.7)

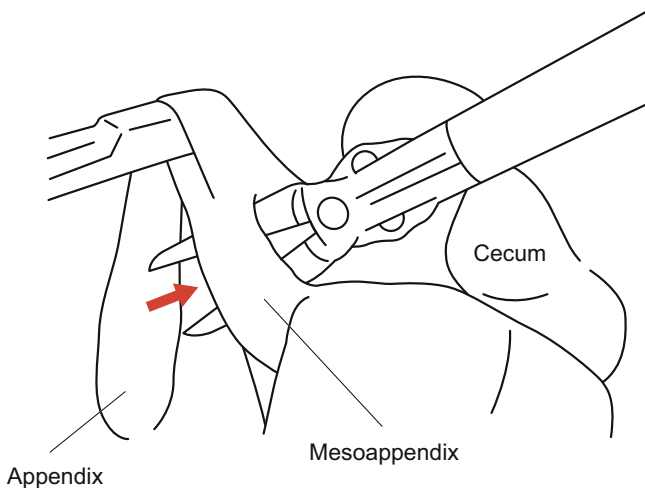
A semicircular intraumbilical incision for a 10-mm camera port is made on the left side of the umbilicus using an open laparoscopic technique. Pneumoperitoneum is maintained at 8–10 mmHg. Two working ports of 5 mm in size are inserted through a right subcostal mid-clavicular incision and a suprapubic incision, respectively. An additional 5-mm working port can also be inserted in the left abdominal region. The number, position, and diameter of the second and third trocars are decided based on the technique used, as well as the position and appearance of the appendix, and the experience of the surgeon.

#### 36.2.2.3 Exposure of the Appendix and the Laparoscopic Appendectomy (Figs. 36.8, 36.9, and 36.10)

In cases in which peritonitis develops before the mobilization of the appendix, the abdominal cavity should be rinsed with saline. In cases involving an appendicular infiltrate or abscess formation, care should be taken to avoid spreading pus or injuring the bowel. If the greater omentum or small intestine covers the appendix, they should be gently moved



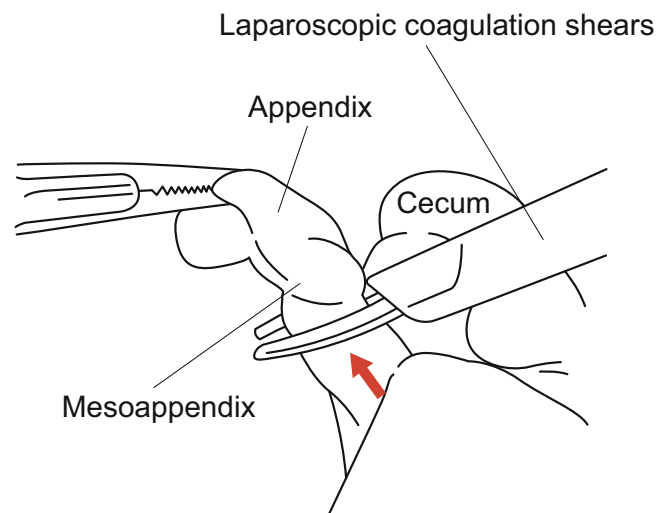
**Fig. 36.7** Port positions. The number, position, and diameter of the trocars are decided based on the technique used, as well as the position and appearance of the appendix, and the experience of the surgeon



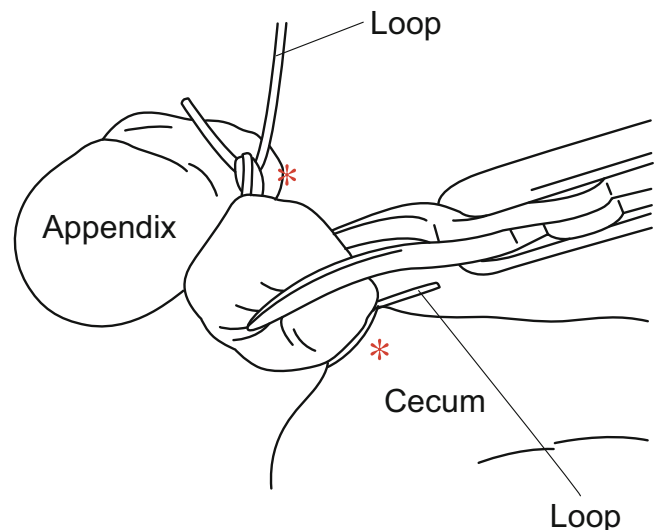
**Fig. 36.8** Treatment of the mesoappendix (1). A window is constructed in the mesoappendix

away. In particular, the greater omentum must be handled carefully to avoid unnecessary bleeding. In cases involving a retrocecal appendix, the retroperitoneum is dissected, and the appendix or cecum is mobilized. In cases involving gangrenous/necrotic appendicitis, grasping the appendix itself might damage the appendix or cause its contents to leak; thus, care must be taken to grasp the mesoappendix.

The mesoappendix can be divided using cautery, laparoscopic coagulation shears, clips, or a vascular/gastrointestinal stapler. When using laparoscopic coagulation shears, care must be taken regarding the direction of the



**Fig. 36.9** Treatment of the mesoappendix (2). The mesoappendix is dissected using laparoscopic coagulation shears



**Fig. 36.10** Treatment of the appendiceal stump. The appendiceal stump is ligated with two loops and resected between two sites (a single ligature is acceptable)

active blade to avoid damaging the surrounding organs due to cavitation of the tip.

After being pedicled on the cecum, the appendiceal stump is ligated using two loops or a laparoscopic gastrointestinal stapler. If a fecalith is suspected to be present at the root of the appendix, it should be guided to the resected side. The appendix is then resected between the two loops.

Next, the appendix is removed through the sheath of the umbilical trocar so that the infected appendix does not touch the anterior abdominal wall. If the appendix is large, it is stored in a sterile bag and removed through the umbilical incision following the removal of the trocar.

When the basis of the appendix is severely inflamed, it is safer to use a laparoscopic gastrointestinal stapler to amputate the appendix and part of the cecum wall. To make the use of a laparoscopic stapler possible, one port has to be enlarged to 10/12 mm in size.

#### **36.2.2.4 Suction and Irrigation**

In cases of perforated appendicitis or peritonitis, suction and irrigation are performed with a sufficient amount of saline. Irrigation is carried out while observing the entire peritoneal cavity below the right diaphragm from the pouch of Douglas to the ileocecal region and the region extending from the lower surface of the liver to below the left diaphragm. Residual abscess formation commonly occurs in the pouch

of Douglas and ileocecal area; thus, these regions must be thoroughly checked.

In cases involving peritonitis, drainage can be carried out in the pouch of Douglas.

#### **36.2.2.5 Wound Closure**

The laparoscope and trocars are removed, and the umbilicus is closed with fascial sutures.

#### **36.2.2.6 Postoperative Management**

The preoperative care strategy employed after laparoscopic appendectomy is the same as that used after open appendectomy.