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ACHIEVING EXCELLENCE IN LAPAROSCOPIC ABDOMINAL WALL HERNIA REPAIR
Achieving excellence in laparoscopic abdominal wall hernia repair

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Table of Contents

1  Anatomy of Anterior Abdominal Wall .......... 8
  1.1 Rectus Abdominis Muscle ................. 8
  1.2 External Oblique Muscle ................. 8
  1.3 Internal Oblique Muscle ................. 9
  1.4 Transverse Abdominal Muscle .......... 9
  1.5 Rectus Sheath .......................... 9
  1.6 Transversalis Fascia .................... 9
  1.7 Blood Supply of the Anterolateral Abdominal Wall ................. 10
  1.7.1 Superficial Vessels .................... 10
  1.7.2 Deep Vessels ........................ 10
  1.8 Nerve Supply of the Anterolateral Abdominal Wall ................. 10

2  Endoscopic Inguinal Anatomy .......... 11
  2.1 Fruchaud's Myopectineal Orifice .... 11
  2.2 The Preperitoneal Space – Space of Nyhus ................. 11
  2.2.1 The Recti Abdomini Muscles and the Pubic Arch ................. 11
  2.2.2 Cooper's and Lacunar Ligament and Iliopubic Tract .......... 12
  2.2.3 Inferior Epigastric Vessels .......... 12
  2.2.4 Retro-Inguinal Space of Bogros .......... 12
  2.2.5 Spermatic Cord Structures .......... 12
  2.2.6 Deep Inguinal Ring .......... 12
  2.2.7 Psoas Major Muscle ................. 12
  2.2.8 Triangle of Doom .................... 12
  2.2.9 Triangle of Pain .................... 12
  2.3 Laparoscopic View of the Anterior Abdominal Wall ................. 12
  2.4 References ................................ 12

3  Instruments and Equipment for Laparoscopic Hernia Repair ................. 13
  3.1 Instruments and Videoendoscopic Equipment ................. 13
  3.2 Instruments and Accessories for Surgical Access ................. 13
  3.3 Trocars ....................... 14
  3.4 Laparoscopic Hand Instruments .......... 14
  3.5 Prosthesis .......................... 14
  3.6 Fixation Device and Suture Material .. 14

4  Laparoscopic Ventral Hernia Repair ................. 15
  4.1 Patient Selection ................. 15
  4.2 Operating Room Setup and Port Placement ................. 15
  4.3 Operative Technique ................. 16
  4.3.1 Initial Intraoperative Access .......... 16
  4.3.2 Adhesiolysis .................... 16
  4.3.3 Port Placement .................... 16
  4.3.4 Reduction of Hernia Sac Contents .......... 17
  4.3.5 Closure of Hernia Defect .......... 17
  4.4 Examination of Ventral Abdominal Wall for Occult Hernias .......... 17
  4.4.1 Placement of Intraperitoneal Mesh .......... 17
  4.4.2 Mesh Fixation .................... 18
  4.4.3 Omental Coverage .................. 19
  4.5 Technical Vignettes .................. 19

5  Inguinal Hernia Repair – Transabdominal Preperitoneal Approach (TAPP) ................. 20
  5.1 Patient Selection ................. 20
  5.2 Operating Room Setup ................. 20
  5.3 Initial Intraperitoneal Access and Port Placement ................. 21
  5.4 Surgical Technique .................. 21
  5.5 Mesh Preparation and Fixation ................. 22
  5.6 Technical Vignettes .................. 23

6  Inguinal Hernia Repair – Total Extra-peritoneal Approach (TEP) ................. 24
  6.1 Patient Selection ................. 24
  6.2 Operating Room Setup ................. 24
  6.3 Operative Technique ................. 24
  6.3.1 Preperitoneal Access ................. 24
  6.3.2 Balloon Dissection of the Preperitoneal Space ................. 24
  6.3.3 Trocar Placement ................. 25
  6.3.4 Preperitoneal Dissection and Reduction of the Hernia Sac ................. 25
  6.4 Mesh Preparation and Placement ................. 26
  6.4.1 Mesh Fixation .................... 27
  6.5 Technical Vignettes .................. 27
  6.6 General Postoperative Considerations ................. 27

Recommended Instrument Set, Units and Accessories ................. 28
The anterolateral abdominal wall is a musculofascial structure, devoid of any skeletal support, encasing the abdominal contents. It is a dynamic structure that works constantly against internal and external forces and provides protection to the intra-abdominal organs. The anterolateral abdominal wall extends from the costal margins and xiphoid process up to the iliac crests, os pubis and pubic symphysis. The boundary between the anterior and lateral walls is indefinite and overlapping. In its most lateral aspects, the wall is connected to both the posterior abdominal wall and paravertebral tissues, thereby forming a continuous and flexible sheet. The anterolateral abdominal wall is made up of skin, a superficial fatty layer of subcutaneous tissue (Camper’s fascia), a deep membranous layer of subcutaneous tissue (Scarpa fascia), investing (deep) fascia, trilaminar abdominal muscles, endoabdominal (transversalis) fascia, extraperitoneal fat, and the parietal peritoneum. The supportive structures of the anterolateral abdominal wall are three bilaterally paired flat muscles (external oblique muscles, internal oblique muscles and transverse abdominal muscles) with their aponeuroses, the two recti abdomini muscles in the midline with their sheath, and the linea alba in the midline.

### 1.1 Rectus Abdominis Muscle

A long and bilaterally paired muscle, the rectus abdominis (Fig. 1.1a, b), is found on either side of the midline in the anterior abdominal wall. The lateral margins of the paired muscles are formed by a surface marking called the linea semilunaris, extending from the inferior costal margin near the 9th costal cartilages to the pubic tubercles. The rectus abdominis originates from the pubic crest and is inserted into the xiphoid process of the sternum and the 5th–7th costal cartilages.

![Fig. 1.1](image1.png) Structure of the anterolateral abdominal wall (a). Transverse section of the wall (b) showing the rectus abdominis muscle with sheath.

### 1.2 External Oblique Muscle

The external oblique muscle (Fig. 1.1c) is the most superficial and largest flat muscle in the abdominal wall. Its fibers run inferomedially. This muscle originates from the 5th to 12th ribs and is inserted into the iliac crest and pubic tubercle. In the midline, the aponeurosis of all flat muscles become entwined, forming a midline raphe termed the linea alba – a fibrous structure that extends from the xiphoid process of the sternum to the pubic symphysis.
**1.3 Internal Oblique Muscle**

The internal oblique muscle (Fig. 1.1 d) lies deep to the external oblique muscle, is smaller and thinner, with fibers running superomedially. The internal oblique muscle originates from the inguinal ligament, iliac crest and lumbodorsal fascia. In the midline, it forms aponeurotic fibers contributing to the linea alba. It is inserted into the 10th to 12th ribs, and forms the conjoint tendon.

**1.4 Transverse Abdominal Muscle**

The transverse abdominal muscle (Fig. 1.1e) is the deepest muscle with fibers running transversely. It originates from the inguinal ligament, 7th to 12th costal cartilages, the iliac crest and thoracolumbar fascia and is inserted into the conjoint tendon, xiphoid process, linea alba and the pubic crest.

![Fig. 1.1 Schematic drawing showing the muscles of the anterolateral abdominal wall: external oblique muscle (c), internal oblique muscle (d) and transverse abdominal muscle (e).](image)

**1.5 Rectus Sheath**

It is a long fibrous sheath formed mainly by aponeurosis of 3 lateral abdominal muscles: external oblique, internal oblique and transversus abdominis. These muscles form the anterior wall between the level of the anterior superior iliac spine and pubis. The rectus abdominis muscle lies in contact with the fascia transversalis. The aponeurosis of the internal oblique muscle at the lateral margin divides into the anterior lamina and posterior lamina. The anterior lamina passes in front of the rectus which also blends with the aponeurosis of the external oblique muscle. The posterior lamina of the rectus sheath is absent below the arcuate line (semicircular line of Douglas) where the muscle is covered only by the fascia transversalis.

**1.6 Transversalis Fascia**

The transversalis fascia is a thin aponeurotic membrane which lies between the inner surface of the transverse abdominal muscle and the parietal peritoneum. It covers the inner surface of the abdominal muscle wall laterally and anteriorly. It becomes the quadratus lumborum fascia and psoas fascia where it passes over these muscles posteriorly and it is termed the iliac fascia and superior fascia of the pelvic diaphragm when passing inferiorly into the pelvic region.
1.7 Blood Supply of the Anterolateral Abdominal Wall

1.7.1 Superficial Vessels
These include the superficial epigastric, the superficial circumflex iliac and the superficial external pudendal arteries, all arising from the femoral artery, and superficial branches from the lower three or four intercostal vessels (Fig. 1.1f).

These vessels form a network in the subcutaneous fat (Panniculus adiposus). Surgical trauma to these vessels leads to formation of hematomas.

1.7.2 Deep Vessels
These include the following vessels: The circumflex iliac, lumbar and intercostal vessels supply the flat muscles of the abdomen. The recti are supplied by the superior and inferior epigastric arteries that anastomose around the umbilicus, and intercostal vessels that pierce the rectus sheath laterally before supplying the muscle.

1.8 Nerve Supply of the Anterolateral Abdominal Wall

The nerve supply of the anterior abdominal wall is from the lower intercostal (D7–D12) and the upper lumbar (L1–L2) nerves (Fig. 1.1g). The nerves traverse between the transversus and internal oblique muscles, and pierce the lateral border of rectus sheath to supply the rectus abdominis. The intercostal nerves supply the abdominal muscles and their anterior branches form the cutaneous nerves that supply the overlying skin. The lumbar nerves from L1 root form the ilioinguinal and iliohypogastric nerves which supply the skin around the genital area, and the genitofemoral nerve supplies the cremaster muscle.
Achieving Excellence in Laparoscopic Abdominal Wall Hernia Repair

Endoscopic Inguinal Anatomy

A thorough knowledge of groin anatomy is a sine qua non to any hernia repair. Unlike the anatomical view offered in the course of an anterior surgical approach, the endoscopic technique enables visualization of the internal aspects of groin anatomy. Endoscopic hernia repair is performed in the preperitoneal space, which is a potential space created between the rectus abdominis muscle with the fascia transversalis and peritoneum. The lateral extent is from one anterior superior iliac spine to the other. The region that delineates the potential site of femoral and inguinal hernias lies within a quadrangle known as the myopectineal orifice (also termed Fruchaud’s myopectineal orifice).

2.1 Fruchaud’s Myopectineal Orifice

Described in 1956 by Fruchaud,²,³ the myopectineal orifice (Fig. 2.1 a) is bounded by the following structures:

- Medially by the lateral border of the rectus abdominis
- Laterally by the iliopsoas
- Superiorly by the conjoint tendon
- Inferiorly by the pecten pubis

The iliopubic tract – a fibrous band running parallel and posterior (deep) to the inguinal ligament – extends from Cooper’s ligament to the anterior superior iliac spine and divides this space into a superior and an inferior compartment.

The superior compartment has the inferior epigastric artery, which demarcates the medial from the lateral compartment. The former is the site of direct inguinal hernia. Lying just laterally to the inferior epigastric artery, the deep inguinal ring is the site for indirect inguinal hernia. Below the iliopubic tract, the external iliac vessels exit the abdominal cavity to enter the thigh. The most medial compartment of this space is the femoral canal, which is bounded by the femoral vein laterally, the iliopubic tract superiorly, the pectin pubis (pectineal line of pubis) inferiorly and the lacunar ligament medially. The femoral canal contains the deep inguinal lymph node (also termed Cloquet’s node) which is the potential site for femoral hernias.

2.2 The Preperitoneal Space – Space of Nyhus

The anatomical working space of Nyhus includes the space of Bogros laterally and space of Retzius medially.

2.2.1 The Recti Abdomini Muscles and the Pubic Arch

The posterior surface of the rectus abdominis in the midline forms the roof of the cavity. The pubic bone forms an arc in the centre at the distal end. The lateral boundary of the visible pubic bone marks the site of Cooper’s ligament (pectineal ligament).

Fig. 2.1 Myopectineal orifice (right side) (a), Triangle of Doom (b) and Triangle of Pain (c). Psoas ①; iliacus m. ②; transverse abdominis m. ③; rectus abdominis muscle ④; pectineal line of the pubis ⑤; pubic bone ⑥; femoral ring ⑦; external iliac vein ⑧; external iliac artery ⑨; deep inguinal ring ⑩; iliopubic tract ⑪; vas deferens ⑫; aberrant obturator vessel ⑬; obturator foramen ⑭; obturator nerve ⑮; inferior epigastric vessels ⑯ ⑰; Cooper’s ligament ⑱.
2.2.2 Cooper’s and Lacunar Ligament and Iliopubic Tract

Cooper’s ligament (pectineal ligament) is a shiny, fibrous structure covering the superior pubic ramus. It forms the inferomedial margin of the femoral ring. The superior margin of the femoral ring is formed by the iliopubic tract. The medial margin is formed by the lacunar ligament. The lateral margin is formed by the external iliac vein. The iliopubic tract is a fascial condensation of the fascia transversalis connected laterally with the inner lip of the iliac crest and the anterior superior iliac spine.*

2.2.3 Inferior Epigastric Vessels

The inferior epigastric artery originates from the external iliac artery. It ascends obliquely along the medial margin of the deep inguinal ring between the fascia transversalis and peritoneum.

2.2.4 Retro-Inguinal Space of Bogros

The retro-inguinal space of Bogros is a lateral extension of the retropubic space of Retzius. Bendavid reported that a venous network is frequently located at the lower anterior portion of the space of Bogros. The Bendavid ‘venous circle’ is composed of the inferior epigastric vein, the iliopubic vein, the rectusial vein, the retropubic vein, and the communicating rectusio-epigastric vein. Familiarity with this venous circle is critical for ensuring safe fixation of a prosthetic mesh.

2.2.5 Spermatic Cord Structures

The spermatic cord emerges from the deep inguinal ring and consists of the ductus deferens, testicular artery and testicular vein. The ductus deferens courses medially towards the urinary bladder base and the testicular vessels traverse laterally in a cranial direction.

2.2.6 Deep Inguinal Ring

This ring is the internal opening of the inguinal canal, allowing for passage of the vasa deferentia, testicular vessels and the genital branch of the genitofemoral nerve.

2.2.7 Psoas Major Muscle

The floor of the space of Bogros is formed by the psoas muscle.

2.2.8 Triangle of Doom

At the level of the deep ring, the testicular vessels exit the retroperitoneum to enter the inguinal canal. The vasa deferentia emerge from the inguinal canal through the deep inguinal ring and traverse over the external iliac vessels for a short distance before turning medially towards the urinary bladder. This anatomical relationship of the vasa deferentia medially, the testicular vessels laterally and the peritoneal reflection inferiorly forms a triangle with the apex at the deep inguinal ring. This is known as the Triangle of Doom (Fig. 2.1b), as the external iliac vessels lying within this triangle are vulnerable to trauma during dissection.

2.2.9 Triangle of Pain

Lateral to the Triangle of Doom, in the space of Bogros, lies the Triangle of Pain (Fig. 2.1c). It is bounded medially by the spermatic vessels; the iliopubic tract forms the superolateral border of the triangle. Mesh fixation should be avoided in this area because of the risk of injury to the femoral branch of the genitofemoral nerve or the lateral femoral cutaneous nerve.

2.3 Laparoscopic View of the Anterior Abdominal Wall

Viewed laparoscopically, the peritoneum is thrown into specific folds that form anatomical landmarks for locating hernia defects. Infraumbilically, in the midline, lies the median umbilical fold formed by the urachus, which extends from the umbilicus to the apex of the bladder. Lateral to the midline are the umbilical folds (medial umbilical ligament), which are formed by the obliterated umbilical arteries. Further laterally are the lateral umbilical folds (lateral umbilical ligament) marking the site of the inferior epigastric vessels. The peritoneal fossae lying between these folds from medial to lateral are the supravesical fossa, medial inguinal fossa and lateral inguinal fossa. Direct (acquired) inguinal hernias arise in the supravesical and medial inguinal fossa, and indirect (congenital) inguinal hernias lie in the lateral inguinal fossae.

2.4 References

Laparoscopic groin hernia repair is an advanced laparoscopic procedure which essentially involves creation of a space at the myopectineal orifice, wide enough to accommodate a large-sized mesh to bridge the hernial breach. The surgical procedure requires the creation of a wide working space and the instrumentation conforms to this need.

3.1 Instruments and Videoendoscopic Equipment

Fig. 3.1a High-resolution IMAGE™ camera system ①; 4K Video Screen ②; Xenon cold light source ③; high-flow insufflator (ENDOFLATOR® 50 SCB) ④.

Fig. 3.1b–d IMAGE™ 4U One-Chip 4K UHD Camera Head (b) and Fiber Optic Light Cable (c), KARL STORZ laparoscope with 30° angle of view and 10 mm in diameter, which is used for TEP (d).

3.2 Instruments and Accessories for Surgical Access

Fig. 3.2 Surgical scalpel no. 11 ①; dressing forceps ②; tissue scissors ⑦; S-shaped retractors ⑥; spacemaker surgical balloon ⑧ – custom-made from 2 fingerstalls of a size-8 latex surgical glove – is mounted on a suction cannula ⑨ which can be connected to a 50 cc syringe comfortably ⑩.
3.3 Trocars

Fig. 3.3 Two 6-mm trocars and one 11-mm trocar Hasson trocar with a conical sleeve. The trocars for TEP should be non-metallic and preferably ribbed to prevent slippage through the port incision. Non-metallic trocars prevent conduction of current to surrounding tissues. This must be avoided under any circumstances taking into account that – owing to the limited working space – the instrument tip can accidentally come into contact with the trocar while using electrocautery.

3.4 Laparoscopic Hand Instruments

Fig. 3.4 CLICKLINE dissecting and grasping forceps; CLICKLINE grasping forceps; CLICKLINE scissors; needle holder; suction cannula.

3.5 Prosthesis

Fig. 3.5 Light-weight coated mesh with non-adhesive barrier. Medium- or light-weight polypropylene mesh. Prostheses for hernia repair vary in size, texture, tensile strength and coating. They should be chosen according to the size of defect and the anticipated anatomical plane of mesh placement.

3.6 Fixation Device and Suture Material

Fig. 3.6 ProTack™ fixation device using metallic tacks. Additional items recommended for use in hernia surgery (not depicted) are absorbable sutures (2-0 Vicryl), unidirectional barbed sutures (V-Loc), needle for fascial closure, (2-0 ethilon) suture on a straight needle.
4.1 Patient Selection

Indications
- Incisional and ventral abdominal wall hernia with symptoms of pain and disfigurement from the hernia.
- Prevention of complications like incarceration and bowel obstruction.

Contraindications

Absolute Contraindications:
- Medically unfit for general anesthesia.
- Uncontrollable coagulopathy.
- Giant hernia with major ‘loss of domain’ of the abdominal contents.
- Major abdominal sepsis.
- Strangulated bowel as hernial content.
- Abdominal wall hernia in children (less than 12 years of age).
- Acute abdominal distension and gross bowel dilatation.
- Enterocutaneous fistula.

Relative Contraindications:
- Excessive redundant abdominal wall and tissue.
- Considerable variation in the anatomy of rectus abdominis muscles from xiphoid process to pubis.
- Large defect of the abdominal wall hernia.

4.2 Operating Room Setup and Port Placement

Ergonomically, the most comfortable working position is to have the operating surgeon, the camera port, the surgical field and the primary monitor in the same straight line. The room setup is such that it is flexible and convenient to allow change in positions of operating personnel, operating table and the primary monitor. To facilitate unimpeded movability of the operating surgeon on either side of the patient, both arms should be tucked alongside the body. This aids in the management of patients with a large longitudinal incision.

In the case of midline hernias, the operating team can stand on either side of the patient. For unilateral hernias, the surgeon stands on the contralateral side of the hernia. Increasing the distance between the hernia and port sites makes surgical manipulation easier.

Figs. 4.1a–e show various types of OR setup, which is chosen according to hernia site, such as left subcostal (a), paraumbilical (b), right iliac fossa (c), epigastric (d) and suprapubic hernia (e).
4.3 Operative Technique

4.3.1 Initial Intraoperative Access
Establishing a safe intraperitoneal access is important for laparoscopic ventral hernia repair. Abdominal access can be achieved by closed technique (also termed Veress needle technique) and direct open access. The absence of a palpable spleen is confirmed before introducing a Veress needle. It is imperative that the stomach be decompressed with an orogastric tube prior to Veress needle puncture, especially when insufflation is initiated from the left hypochondrial region. The Palmer’s point, located one finger space below the left subcostal region (in the midclavicular line) is the preferred location to gain initial intraperitoneal access using a Veress needle technique.

4.3.2 Adhesiolysis
Adhesiolysis is performed in an area 5 cm around the hernia defect and the previous scar using cold scissors (Fig. 4.2a). An avascular plane exists between the abdominal wall and viscera, which is accessed and developed for adhesiolysis (Fig. 4.2b).

In patients with dense bowel adhesions to the anterior abdominal wall, the parietal peritoneum may be incised well away from the bowel, and the adherent bowel reduced along with the peritoneum and sheath. (Fig. 4.2c, d)

4.3.3 Port Placement
The arrangement of the trocar ports for laparoscopic ventral incisional hernia repair should be in the form of an arc of a circle, the centre of which is the hernia defect. With this arrangement, a good triangulation of trocars is obtained, which is essential for optimal ergonomics.
Laparoscopic Ventral Hernia Repair

To avoid chopstick effect (clashing of instruments), the intertrocar distance should not be less than 3 cm. All trocars should be located at least 10 cm away from the nearest margin of the hernia defect.

The port setup varies according to the site of the hernia on the abdominal wall. Some of the more commonly used port positions are shown in Fig. 4.3 a–e.

### 4.3.4 Reduction of Hernia Sac Contents

The contents of the sac are completely reduced, especially omentum and extraperitoneal fat in the case of epigastric hernia. Complete reduction of contents is confirmed by external palpation of the hernia sac on the anterior abdominal wall for residual content.

The omentum is reduced in continuity and any free omental fragments are removed through the 11/12-mm port. Atraumatic bowel forceps are used to mobilize and manipulate the bowel. The direction of pull on the bowel needs to vary to achieve atraumatic reduction of the bowel when incarcerated.

### 4.3.5 Closure of Hernia Defect

The hernia defect is approximated with either percutaneous transabdominal or by intracorporeal sutures.

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**Fig. 4.3** Left subcostal hernia (a); paraumbilical hernia (b); right iliac fossa hernia (c); epigastric hernia (d); suprapubic hernia (e).

---

**4.4 Examination of Ventral Abdominal Wall for Occult Hernias**

Laparoscopy has the added advantage of detecting occult hernias along weak areas of the abdominal wall especially at previous incision sites.

#### 4.4.1 Placement of Intraperitoneal Mesh

The diameter of the hernia defect is directly measured intraperitoneally. The surgeon should be alerted to the possible presence of occult hernias and their location on the abdominal wall while assessing the size of the defect.

For multiple hernias, as shown in Fig. 4.5 a (Swiss cheese hernias; see overleaf), the size of the entire defect can be determined by measuring the maximal distance between the outermost hernias of the same scar. The anticipated size of the mesh is determined by adding at least 10 cm to the height/width of the defect, which ensures that a circumferential margin of at least 5 cm is available on all sides of the hernia defect. Larger hernias require greater mesh cover. The size of the mesh is calculated prior to defect closure.
The placement of a central suture, transfascial sutures and marking of the mesh on the abdominal wall facilitates optimal positioning of the mesh. The central suture orients the centre of the mesh to the centre of the defect. The transfascial sutures fix the mesh to the abdominal wall at predetermined locations. (Fig. 4.5b)

A percutaneous suture to centre the mesh is passed intra-abdominally through the midpoint of the hernia defect and is retrieved through the 11/12 mm port which is used for insertion of the mesh. The suture is then tied to the centre of the mesh and, subsequently, the mesh is rolled and inserted through the same 11/12 mm port. The four transfascial sutures are placed on the mesh at 12, 3, 6 and 9 o’clock positions to preclude the risk of injury to inferior epigastric vessels while retrieving the long ends of transfascial sutures with the fascial closure needle. The mesh is unrolled and properly positioned first on the floor of the abdominal cavity.

### 4.4.2 Mesh Fixation

The fascial closure needle is passed through the same skin incision but at different points 1 cm apart through the peritoneum. The fascial closure needle thus retrieves the 2 long ends of each transfascial suture through the same skin incision. All 4 transfascial sutures are retrieved percutaneously. The central suture and transfascial sutures are pulled taut so that the mesh abuts snugly to the abdominal wall. There is a wide variety of fixation methods available to anchor the mesh.

The tacks/anchors are applied at intervals of 2.5–3 cm circumferentially along the mesh. In addition, a second row of tacks is applied circumferentially around the hernia defect (‘double crown’ technique of mesh fixation, see Fig. 4.6a, b).

Overhanging margins of mesh are avoided to prevent incarceration of bowel. The two long ends of the transfascial sutures are tied loosely to prevent strangulation of intervening tissue and entrapment of nerves.

---

**Fig. 4.4** Reduction of hernia contents.

**Fig. 4.5a** Swiss cheese hernias.

**Fig. 4.5b** Mesh placement by using central and transfascial sutures.

**Fig. 4.6** ‘Double crown’ technique (a, b); omental coverage (c).
4.4.3 Omental Coverage
Once fixation of the mesh is complete, the patient is positioned in a reverse Trendelenburg position and the available omentum is spread out on the surface of the bowel to provide a barrier between the mesh and the underlying bowel. This method of omental coverage prevents the formation of bowel adhesions (Fig. 4.6c).

4.5 Technical Vignettes

- Laparoscopic Ventral Hernia Repair (LVHR) is not a suitable option for patients with a large apron of fat and redundant tissue requiring abdominoplasty, and in patients with a densely scarred abdomen.
- LVHR requires strict adherence to the principle of tensionless closure of the hernia defect with a prosthetic reinforcement that extends up to 5 cm beyond the hernia defect.
- The port arrangement is in the form of an arc, the centre of which is the hernia defect.
- Cold scissors are the best means of performing adhesiolysis and precautions should be taken to avoid an inadvertent enterotomy.
- Complete reduction of the hernia sac contents should be ensured, especially of the omentum and extraperitoneal fat.
- The mesh should be placed such that there is an overlap of at least 5 cm along the outer margin of the defect, especially in larger hernias.
- Optimal positioning of the mesh is critical, with use of central and transfascial sutures.
- The best mesh fixation appears to be a combination of transabdominal sutures and metallic fixation devices.
- The patient should be counselled about the likelihood of formation of seromas postoperatively.
- Various laparoscopic techniques have been introduced recently – including abdominal wall repair – in which mesh is placed outside the peritoneal cavity. Long-term results are awaited.
The transabdominal preperitoneal (TAPP) repair is another modality for endoscopic repair for groin hernias. The emergence of both techniques—the total extraperitoneal repair (TEP) and TAPP—has gained worldwide popularity in the management of inguinal hernia repair. TAPP is a technically less demanding procedure and has a short learning curve. The short learning curve is consequent to a large working space with well-defined anatomical landmarks which is helpful in maintaining anatomical orientation during dissection.

The advantages of the TAPP approach are balanced by the need to breach the peritoneal cavity with its related complications and prolonged operation time due to the need for closure of the peritoneal flap. However, the decision over TAPP or TEP ultimately lies in the surgical expertise and clinical presentation of the hernia. It is best to strategize the approach congruous to clinical situations to deliver the best postoperative outcomes.

### 5.1 Patient Selection

#### Indications
- Uncomplicated inguinal hernia.
- Patients with a large, irreducible or partially reducible sliding inguinal hernia.
- Cases of obstructed or incarcerated inguinal hernia.

#### Contraindications

**Absolute Contraindications**
- Pregnancy.
- Coagulopathy.
- All patients unfit for general anesthesia.
- Intra-abdominal sepsis.

**Relative Contraindications**
- Patients with a history of previous surgery in the space of Retzius are avoided to prevent the risk of bladder injury.
- Situations where placement of a mesh is not recommended.
- Patients with recurrence after TEP / TAPP repair in high-volume centres of excellence.

### 5.2 Operating Room Setup

The monitor with the entire video-endoscopic equipment is positioned at the foot end of the patient.

The operating surgeon and the camera assistant stand on opposite sides of the patient.

The operating surgeon stands on the side opposite to the hernia with the scrub nurse next to the surgeon.

The anesthesiologist and anesthesia monitors are positioned at the head end of the patient.
5.3 Initial Intraperitoneal Access and Port Placement

The site of intraperitoneal access in patients undergoing TAPP is supraumbilical in the midline. Alternatively, if there is a midline surgical scar, the initial access is gained at the Palmer’s point. Abdominal access can be achieved by using a closed technique (also termed ‘Veress Needle Technique’) or by open access or visiport. The intra-abdominal pressure is maintained at 12–14 mmHg. A diagnostic laparoscopy is performed first to assess the hernia and check for the occurrence of iatrogenic access-related injuries.

The added advantage of this approach is diagnosis of a hernia on the contralateral side. However, the presence of a cord lipoma may be missed in the absence of an overt hernia.

The two working ports are placed about a centimeter distal and on either side of the camera port at the lateral margin of the rectus abdominis muscle. (Fig. 5.2) The patient is then positioned in a 15° Trendelenburg position to help retract the bowel away from the surgical field.

5.4 Surgical Technique

The incision in the peritoneum begins at 2 cm above and medial to the ipsilateral anterior superior iliac spine (ASIS) on the affected side and is extended medially and proximally towards the midline up to the medial umbilical ligament. (Fig. 5.3 a)

The avascular preperitoneal space is the plane of dissection to raise the peritoneal flap and to expose the entire myopectineal orifice. (Fig. 5.3b) The dissection comprises mainly of stripping the peritoneum gently away from the anterior abdominal wall.

Unlike the TEP repair, dissection in TAPP begins laterally. The space lateral to the inferior epigastric vessels is dissected out first, exposing the transversus abdominis muscle superiorly and the iliopsoas muscle inferiorly. The inferior epigastric vessels are visible through the peritoneum in thin patients, whereas in obese patients the deep ring acts as the landmark for orientation.

Medial to the inferior epigastric vessels lies the rectus abdominis muscle which can be traced distally. The pubic bone with Cooper’s ligament is visualised at the distal end of the rectus abdominis muscle.

The space behind the pubic bone is dissected to provide a niche for the inferior margin of the mesh. In case of a direct hernia, the sac is completely dissected off and inverted along with the peritoneal flap which is used to cover the mesh at the end of the procedure.

Fig. 5.2 Port placement for the TAPP repair.

Fig. 5.3 Incision in the peritoneum (a). Avascular peritoneal space for exposure of the myopectineal orifice (b).
Anterior superior iliac spine (ASIS); medial umbilical ligament (MUL); direct hernia (DH).
An indirect sac may be dealt with in more than one way depending on the clinical situation. An incomplete sac may be completely dissected off the cord structures and inverted as a direct sac.

The dissection of an inguino-scrotal or congenital sac from the cord structures is performed at the level of the deep inguinal ring, the sac is then ligated and divided. This approach avoids unnecessary dissection of the cord structures and is a safer approach as opposed to complete dissection of the sac.

A direct sac is reduced by gentle traction from the transversalis fascia. In case of a large direct hernia, the stretched transversalis fascia (pseudosac) can be inverted and tacked to Cooper’s ligament or the anterior abdominal wall to prevent seroma formation.

The exposure of the myopectineal orifice of Fruchaud extending from the pubic symphysis medially to the iliopsoas laterally and from the arcuate line proximally to the dissected space of Retzius and Bogros distally, marks completion of the dissection. (Fig. 5.3c)

5.5 Mesh Preparation and Fixation

A mesh of 15 x 12 cm² in the horizontal and vertical axis respectively is rolled up and introduced through the 11-mm trocar. The use of a medium to lightweight polypropylene mesh is recommended (Fig. 3.5).

The mesh is placed, so as to cross the midline to the opposite side medially and to lie over the psoas muscle laterally. Care should be taken that 2–3 cm of the inferior margin of the mesh lie in the retropubic space medially.

The mesh is fixed at two points to Cooper’s ligament medially and to the anterior abdominal wall above the iliopubic tract laterally. Extra fixation at 2 or 3 sites may also be added to the superior margin of the unrolled mesh up to the midline.

The mesh is fixed using partial thickness metallic/absorbable tacks or with sutures depending on the surgeon’s preferences (Fig. 5.4a)

The peritoneal flap is closed using a running suture to avoid any defects from forming between the fixation points as shown in Fig. 5.4b. These defects have been reported to be a cause for bowel incarceration and obstruction in the postoperative period.

The procedure concludes with the transversus abdominis plane block (TAP), under ultrasound guidance for postoperative analgesia.
5.6 Technical Vignettes

- The TAPP approach offers the advantage of a shorter learning curve on account of a large working space and defined anatomical landmarks.
- Incision beyond the medial umbilical fold should be avoided or performed with care to avoid bladder injury.
- Once the inferior boundary of dissection has been reached, the psoas muscle should be demonstrated laterally, at least 5 cm of the cord structures with the Triangle of Doom and the retropubic space medially.
- Particular care must be taken to preserve integrity of the inferior epigastric vessels (IEV). In order to prevent iatrogenic injury from occurring in the course of dissection, the vessels can be identified transperitoneally or traced at a location medial to the deep inguinal ring.
- The size of the mesh plays an important role in a durable repair and should measure at least 15 x 12 cm².
- The mesh should not be fixed below the iliopubic tract to avoid injury to the lateral cutaneous nerve of the thigh.
- Meticulous hemostasis and scrotal support especially in complete indirect inguinal hernias decreases seroma formation.
6.1 Patient Selection

During their early experience, surgeons should preferably operate on the following patients:

- Small, direct, uncomplicated hernias.
- Incomplete, indirect reducible hernias.
- Thin patients.
- Patients who are fit for general anesthesia.

6.2 Operating Room Setup

The patient is placed in the Trendelenburg position with both the arms secured by the sides.

The monitor is positioned at the foot end of the patient. The surgeon stands on the side opposite the hernia with the assistant (camera operator) on the same side as the hernia.

In bilateral repairs, the positions are switched between the surgeon and assistant to repair the contralateral side.

6.3 Operative Technique

6.3.1 Preperitoneal Access

An infraumbilical, transverse 12-mm incision is made just lateral to the midline to expose the anterior rectus sheath (Fig. 6.2a).

To avoid inadvertent opening of the peritoneum, a transverse incision is made on the anterior rectus sheath to one side of midline (Fig. 6.2b).

The margins of the incised sheath are held with stay sutures using vicryl 1-0 (Fig. 6.2c).

6.3.2 Balloon Dissection of the Preperitoneal Space

Two fingerstalls of a size-8 latex surgical glove are tied one on top of the other on the tip of a 5-mm laparoscopic suction cannula to make an indigenous balloon. Commercially available balloons may also be used for creating the preperitoneal space (Fig. 6.3).

The balloon is inserted into the preperitoneal space and inflated with 100–150 ml of saline for 2–3 minutes. It aids in creating the initial working space while at the same time providing hemostasis.
6.3.3 Trocar Placement
An 11-mm Hasson cannula with a conical sleeve (blunt tip) is introduced into the preperitoneal tunnel through the infraumbilical incision and secured with stay sutures. (Fig. 6.4a) Insufflation is begun with the pressure setting at 12–15 mmHg.

A 30°-laparoscope, diameter 10 mm, is mounted on the camera head and introduced through the subumbilical port. A 6-mm port is placed about 2 cm above the pubic symphysis in the midline and, subsequently, a 6-mm port is placed midway between the two ports (subumbilical and suprapubic) in the midline (Fig. 6.4b).

6.3.4 Preperitoneal Dissection and Reduction of the Hernia Sac
The preperitoneal space is developed by dissecting the loose areolar tissue in the midline using sharp and blunt dissection. The space below the pubic bone, i.e., space of Retzius, is exposed for 2–3 cm to accommodate the lower margin of the mesh (Fig. 6.5a).

The first anatomical landmark is the pubic bone identified in the midline which is traced laterally to expose the Cooper’s ligament and iliopubic tract. In a direct hernia, the Cooper’s ligament is obscured due to the hernia sac. The direct defect can be seen in the abdominal wall once the sac is reduced by the traction on the peritoneal extrusion and countertraction on the transversalis fascia (pseudosac). (Fig. 6.5b). The key anatomical landmarks visualized following reduction of a direct sac are (Fig. 6.5c):

- Cooper’s ligament.
- Iliopubic tract.
- Femoral ring.
- Inferior epigastric vessels.

Fig. 6.3 A custom-made surgical balloon is inserted in the peritoneal space.

Fig. 6.4 Hasson trocar introduced in the subumbilical port (a); port placement for TEP (b).

Fig. 6.5 Shown are the first anatomic landmarks: pubic bone and space of Retzius (a); Direct defect after countertraction on the transversalis fascia (b); Anatomical landmarks after reduction of a direct sac (c): pubic bone (PB); Cooper’s ligament (CL); vas deferens (VD); testicular vessel (TV); direct hernia (DH); inferior epigastric vessel (IEV); deep inguinal ring (DIR); iliopubic tract (IPT); femoral ring (FR).
Lateral to the inferior epigastric vessels, an indirect hernia sac is identified as a white glistening structure lying anterolateral to the spermatic cord, entering the deep inguinal ring. (Fig. 6.5d) An incomplete sac is dissected off the cord and completely reduced. No attempt should be made to reduce a complete sac, as extensive dissection may result in severe postoperative testicular oedema and pain. The cord structures are separated from the complete hernia sac which is ligated and divided distal to the ligature, leaving the distal end of the sac open in situ. (Fig. 6.5e)

The cord should be completely parietalized up to the point where the vas deferens turns medially. Adequate space has to be created lateral to the cord structures to accommodate the lateral part of mesh. This space of Bogros comprises only loose areolar tissue, which is completely divided using sharp and blunt dissection. The inferior extent of dissection in this space is the iliopsoas muscle, whereas the lateral limit is the anterior superior iliac spine. (Fig. 6.5f)

The fascia over the psoas muscle is preserved and diathermy is avoided to prevent injury to cutaneous nerves. The preperitoneal space is now fully prepared which facilitates mesh placement. In the case of bilateral hernias, the surgeon and camera assistant change sides and a similar dissection is performed on the opposite side.

**6.4 Mesh Preparation and Placement**

The size of the polypropylene mesh to cover the myopectineal orifice is 15 x 13 cm. (Fig. 6.6a) An innovative technique has been developed by our team in which the rolled mesh is introduced in this space for easy handling and accurate fixation. The mesh is rolled like a carpet to two-thirds of its length, leaving 5 cm free. Two stay sutures are placed on the roll using an absorbable suture (Vicryl 2-0), 3 cm away from the margins to keep the rolled mesh in position. (Fig. 6.6b) The rolled mesh is then held with a 5-mm grasper and introduced into the preperitoneal space through the 11 mm subumbilical trocar.

![Fig. 6.5d Indirect hernia sac seen entering the deep ring (d).](image)  
![Fig. 6.5 Transected complete indirect sac (e). Inferior extent of dissection (f).](image)

![Fig. 6.6 Unrolled mesh (a); Rolled mesh (b).](image)
6.4.1 Mesh Fixation
The mesh is placed such that the medial margin extends for 2–3 cm beyond the midline on the opposite side and 2–3 cm below the pubic bone inferomedially. Laterally, the inferior margin of the mesh should lie over the psoas muscle. It should be ensured that no extraperitoneal fat lies beneath the lower margin of the mesh. The fold of the peritoneum should lie below the inferior margin of the mesh. The mesh is fixed at two places on the Cooper's ligament using a 5 mm fixation device. No fixation should be done laterally to avoid cutaneous nerve entrapment.
In the case of bilateral hernias, a similar fixation of the mesh is done on the opposite side with a 2–3 cm overlap in the midline. (Fig. 6.7)

After removing the stay sutures, the mesh is unrolled on the floor following which CO₂ is exsufflated and trocars are removed. It is vital to ensure the mesh lies flat at the time of exsufflation (Fig. 6.8).

6.5 Technical Vignettes

- The proper access between the fascia transversalis and peritoneum is important.
- The pubic bone is the first landmark in the midline which needs to be identified at the start of dissection.
- As the dissection proceeds laterally to the pubic bone, one should be aware of the presence of ‘corona mortis’.
- Inferior epigastric vessels should be identified on the roof when creating lateral space.
- Dissect laterally until the lateral border of the psoas muscle to create adequate space.
- While parietalization, caution should be exercised while dissecting the Triangle of Doom and Bendavid’s venous circle.

6.6 General Postoperative Considerations
The incidence of postoperative nausea and vomiting (PONV) has significantly reduced with the newer anesthetic agents. Ondansetron is the preferred antiemetic if required.

The patient is encouraged to ambulate after 4 hours of surgery and resume oral intake. Injectable analgesics coupled with the intraoperative TAP block provides good control of postoperative pain.

To avoid the incidence of seroma formation and to minimize postoperative swelling, the patient is provided with a scrotal support or advised to wear an accurately fitting undergarment in the case of groin hernia.

Patients are advised to resume their routine daily activities according to their physical comfort. Extreme body postures like bending down should be avoided for approximately two weeks with no restrictions on weight-bearing activities.
Basic Set for Laparoscopy

26003 BA  HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 10 mm, length 31 cm, autoclavable, fiber optic light transmission incorporated, color code: red

Optional: 26003 BCA  HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 10 mm, length 31 cm, autoclavable, for indocyanine green (ICG), fiber optic light transmission incorporated, for use with Fiber Optic Light Cable 495 NCSC, Fluid Light Cable 495 FQ/FR and Cold Light Fountain D-LIGHT P SCB 20133701-1, color code: red

Optional: 26003 EC  ENDOCA MELEON® HOPKINS® Telescope, diameter 10 mm, length 31 cm, autoclavable, variable direction of view from 0° - 90°, adjustment knob with fin for selecting the desired direction of view, fiber optic light transmission incorporated, color code: gold

2x 30160 GYG  Trocar, with conical tip, with Luer-Lock connector for insufflation, size 6 mm, working length 10 cm, color code: black, including:
- Cannula
- Trocar only
- Valve Seal

30103 AO  Trocar, size 11 mm, color code: green, including:
- Cannula, with 2 flanges for fixation of sutures, adjustable cone, with insufflation stopcock, working length 13 cm
- Trocar only, with blunt tip
- Automatic Valve, Cone

30140 DB  Reduction Sleeve, reusable, instrument diameter 5 mm, trocar cannula outer diameter 11 mm, color code: green

33351 MD  CLICKLINE KELLY Dissecting and Grasping Forceps, rotating, with connector pin for unipolar coagulation, size 5 mm, length 36 cm, double action jaws, including:
- Plastic Handle, without ratchet, with larger contact area
- Outer Tube, insulated
- Forceps Insert

33351 ML  CLICKLINE KELLY Dissecting and Grasping Forceps, rotating, dismantling, insulated, with connector pin for unipolar coagulation, Luer-Lock connector for cleaning, double action jaws, long, size 5 mm, length 36 cm

26173 AM  BERCI Fascial Closure Instrument, for subcutaneous ligature of trocar incisions, size 2.8 mm, length 17 cm, for closure of trocar incision wounds
HOPKINS® Telescopes

26003 BA  **HOPKINS® Forward-Oblique Telescope 30°**, enlarged view, diameter 10 mm, length 31 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red

26003 BCA  **HOPKINS® Forward-Oblique Telescope 30°**, enlarged view, diameter 10 mm, length 31 cm, **autoclavable**, for indocyanine green (ICG), fiber optic light transmission incorporated, for use with Fiber Optic Light Cable 495 NCSC, Fluid Light Cable 495 FQ / FR and Cold Light Fountain D-LIGHT P SCB 20133701-1, color code: red

26003 EC  **ENDOCAMELEON® HOPKINS® Telescope**, diameter 10 mm, length 31 cm, **autoclavable**, variable direction of view from 0° – 90°, adjustment knob with fin for selecting the desired direction of view, fiber optic light transmission incorporated, color code: gold

39501 BEC  **Wire Tray**, for Cleaning, Sterilization and Storage of **ENDOCAMELEON®**, length 32 cm and one light cable, including holder for light post adaptor, silicone telescope holder and lid, external dimensions (w x d x h): 480 x 125 x 54 mm

It is recommended to check the suitability of the product for the intended procedure prior to use.
Trocars and Accessories
size 6 and 11 mm

30160 GYG  Trocar, with conical tip, with Luer-Lock connector for insufflation, size 6 mm, working length 10 cm, color code: black, including:
- Cannula
- Trocar only
- Valve Seal

30103 AO  Trocar, size 11 mm, color code: green, including:
- Trocar only, with blunt tip
- Cannula without valve, with insufflation stop-cock, length 10.5 cm
- Multifunctional valve, size 11 mm

30103 C3  Cone, ribbed, for trocars size 11 mm, with 2 discs for fixation of suture, color code: green

30140 DB  Reduction Sleeve, reusable, instrument diameter 5 mm, trocar cannula outer diameter 11 mm, color code: green
Dissecting and Grasping Forceps

**CLICKLINE** – rotating, dismantling, insulated, with connector pin for unipolar coagulation
For use with trocars, size 6 mm

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**Double-action jaws**

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In the tables above, the item numbers shown against a **GREEN** background indicate the CLICKLINE insert only. The item numbers of the complete **CLICKLINE** instrument – consisting of:
- insulated plastic handle, with connector pin for unipolar coagulation,
- insulated metal outer sheath and
- **CLICKLINE** insert
are shown against a **RED** background.
Dissecting and Grasping Forceps
**CLICKLINE** – rotating, dismantling, **without** connector pin for unipolar coagulation
For use with trocars, size 6 mm

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- insulated metal outer sheath and
- **CLICKLINE** insert
are shown against a **BLUE** background.
Grasping Forceps
CLICKLINE – rotating, dismantling, insulated, with connector pin for unipolar coagulation
For use with trocars, size 6 mm

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**CLICKLINE CROCE-OLMI Grasping Forceps,**
atraumatic, fenestrated, curved

**CLICKLINE Grasping Forceps,**
with especially fine atraumatic serration, fenestrated

**CLICKLINE INAKI Dissecting and Grasping Forceps,**
slender, atraumatic, fenestrated, curved

**Please note**
In the tables above, the item numbers shown against a **GREEN** background indicate the CLICKLINE insert only.
The item numbers of the complete **CLICKLINE** instrument – consisting of:
- insulated plastic handle, with connector pin for unipolar coagulation,
- insulated metal outer sheath and
- **CLICKLINE** insert
are shown against a **RED** background.
Grasping Forceps

CLICKLINE – rotating, dismantling, **without** connector pin for unipolar coagulation,
For use with trocars, size 6 mm

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<tr>
<td>33310 CC</td>
<td>CLICKLINE CROCE-OLMI Grasping Forceps,atraumatic, fenestrated, curved</td>
</tr>
<tr>
<td>33310 ON</td>
<td>CLICKLINE Grasping Forceps,with especially fine atraumatic serration, fenestrated</td>
</tr>
<tr>
<td>33310 IN</td>
<td>CLICKLINE INAKI Dissecting and Grasping Forceps,slender, atraumatic, fenestrated, curved</td>
</tr>
</tbody>
</table>

**Please note**
In the tables above, the item numbers shown against a **GREEN** background indicate the CLICKLINE insert only. The item numbers of the complete CLICKLINE instrument – consisting of:
- metal handle, **without** connector pin for unipolar coagulation,
- insulated metal outer sheath and
- CLICKLINE insert
are shown against a **BLUE** background.
Scissors

CLICKLINE – rotating, dismantling, with and without connector pin for unipolar coagulation, For use with trocars, size 6 mm

<table>
<thead>
<tr>
<th>Working Length</th>
<th>Plastic Handle</th>
<th>Metal Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td>33151</td>
<td>33161</td>
</tr>
</tbody>
</table>

Single-action jaws

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>34310 MS</td>
<td>CLICKLINE METZENBAUM Scissors, curved, length of blades 12 mm</td>
</tr>
<tr>
<td>34310 MA</td>
<td>CLICKLINE Scissors, with serrated jaws, curved, spoon blades, length of blades 17 mm</td>
</tr>
<tr>
<td>34310 EH</td>
<td>CLICKLINE Hook Scissors, length of blades 10 mm</td>
</tr>
</tbody>
</table>

Please note

In the tables above, the item numbers shown against a **GREEN** background indicate the CLICKLINE insert only. The item numbers of the complete CLICKLINE instrument – consisting of:
- insulated plastic handle, with connector pin for unipolar coagulation,
- insulated metal outer sheath and
- CLICKLINE insert
are shown against a **RED** background.

The item numbers of the complete CLICKLINE instrument consisting of:
- metal handle, without connector pin for unipolar coagulation,
- insulated metal outer sheath and
- CLICKLINE insert
are shown against a **BLUE** background.
ROBI® Bipolar Grasping Forceps and Scissors

ROBI® – rotating, dismantling, with connector pin for bipolar coagulation,
CLERMONT-FERRAND Model
For use with trocars, size 6 mm

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>38610 ON</td>
<td>ROBI® Grasping Forceps, CLERMONT-FERRAND Model, fenestrated, with especially fine atraumatic serration</td>
</tr>
<tr>
<td>38610 MD</td>
<td>KELLY ROBI® Grasping Forceps, CLERMONT-FERRAND Model, especially suitable for dissection</td>
</tr>
<tr>
<td>38610 MW</td>
<td>METZENBAUM, ROBI® Scissors CLERMONT-FERRAND Model, curved jaws, double-action jaws, thinner scissor blades</td>
</tr>
</tbody>
</table>

Please note
In the tables above, the item numbers shown against a GREEN background indicate the CLICKLINE insert only. The item numbers of the complete CLICKLINE instrument – consisting of:
- insulated plastic handle, with connector pin for unipolar coagulation,
- insulated metal outer sheath and
- CLICKLINE insert
are shown against a RED background.
Achieving Excellence in Laparoscopic Abdominal Hernia Repair

Surgical Sponge Holder
size 5 mm, trocar size 6 mm

Surgical Sponge Holder, self-retaining, length 30 cm including:
Handle
Outer Sheath, insulated
Sponge Holder Insert

Suction and Irrigation Tubes*
size 5 mm, trocar size 6 mm

Cannula, with lateral holes, length 36 cm

Cannula, length 36 cm

Handle with Two-Way Stopcock, for suction and irrigation, autoclavable, for use with suction and irrigation cannulas, size 5 mm

* Additional handles and cannulas for suction and irrigation, see catalog LAPAROSCOPY.
KOH Macro Needle Holder

dismantling

Cleaning and sterilization are gaining increasing importance for KARL STORZ as a manufacturer of surgical instruments. Similar to all our surgical instruments, the cleaning and hygiene of our needle holders also play an important role.

Our KOH macro needle holders feature consistent effectiveness and precision, with significantly improved cleaning results achieved by dismantling the instrument. The handle, outer sheath and inner part can be cleaned and sterilized separately for perfect results.

<table>
<thead>
<tr>
<th>Benefits of the unique reusable three-piece design:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Can be disassembled into three separate components.</td>
</tr>
<tr>
<td>• Fully autoclavable.</td>
</tr>
<tr>
<td>• Cleaning adaptor.</td>
</tr>
<tr>
<td>• Choice of six different handles and three different working inserts.</td>
</tr>
<tr>
<td>• With tungsten carbide inserts.</td>
</tr>
<tr>
<td>• Environmentally correct:</td>
</tr>
<tr>
<td>In the event of damage, only the component with the defect needs to be replaced.</td>
</tr>
<tr>
<td>• User-friendly and ergonomic handling.</td>
</tr>
</tbody>
</table>
Handles and Outer Tubes
KOH Macro Needle Holders, dismantling

Axial and pistol grip handles with disengageable ratchet

30173 AR Handle, axial, with disengageable ratchet, ratchet release on the right side

30173 AL Handle, axial, with disengageable ratchet, ratchet release on the left side

30173 AO Handle, axial, with disengageable ratchet, ratchet release on top

30173 PR Handle, pistol grip, with disengageable ratchet, ratchet release on the right side

30173 PL Handle, pistol grip, with disengageable ratchet, ratchet release on the left side

30173 PO Handle, pistol grip, with disengageable ratchet, ratchet release on top

Metal Outer Sheath
size 5 mm

30173 A Outer tube for dismantling KOH needle holder, size 5 mm, length 33 cm
KOH Macro Needle Holder
dismantling, size 5 mm

<table>
<thead>
<tr>
<th>Working Length</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 cm</td>
<td>30173 AR</td>
</tr>
<tr>
<td></td>
<td>30173 AL</td>
</tr>
<tr>
<td></td>
<td>30173 AO</td>
</tr>
</tbody>
</table>

**Single-action jaws:**

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30173 R</td>
<td>30173 RAR 30173 RAL 30173 RAO</td>
</tr>
<tr>
<td>30173 L</td>
<td>30173 LAR 30173 LAL 30173 LAO</td>
</tr>
<tr>
<td>30173 F</td>
<td>30173 FAR 30173 FAL 30173 FAO</td>
</tr>
<tr>
<td>30173 G</td>
<td>30173 GAR 30173 GAL 30173 GAO</td>
</tr>
</tbody>
</table>

KOH Macro Needle Holder,
jaws curved to right, with tungsten carbide inserts

KOH Macro Needle Holder,
dismantling, jaws curved to left, with tungsten carbide inserts

KOH Macro Needle Holder,
dismantling, straight jaws, with tungsten carbide inserts

KOH Macro Assistant Needle Holder,
straight jaws

Please note
In the tables above and on the next page, the item numbers shown against a GREEN background indicate the needle holder insert only. The item numbers of the complete instrument are shown against a GREY background.
KOH **Macro Needle Holder**
dismantling, size 5 mm

<table>
<thead>
<tr>
<th>Working Length</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 cm</td>
<td>30173 PR 30173 PL 30173 PO</td>
</tr>
</tbody>
</table>

**Single-action jaws:**

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30173 R</td>
<td>30173 RPR 30173 RPL 30173 RPO</td>
</tr>
<tr>
<td>KOH Macro Needle Holder, jaws curved to right, with tungsten carbide inserts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30173 L</td>
<td>30173 LPR 30173 LPL 30173 LPO</td>
</tr>
<tr>
<td>KOH Macro Needle Holder, jaws curved to left, with tungsten carbide inserts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30173 F</td>
<td>30173 FPR 30173 FPL 30173 FPO</td>
</tr>
<tr>
<td>KOH Macro Needle Holder, straight jaws, with tungsten carbide inserts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insert No.</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30173 G</td>
<td>30173 GPR 30173 GPL 30173 GPO</td>
</tr>
<tr>
<td>KOH Macro Assistant Needle Holder, straight jaws</td>
<td></td>
</tr>
</tbody>
</table>

**BERCI Fascial Closure Instrument**

BERCI Fascial Closure Instrument,
for subcutaneous ligature of trocar incisions, size 2.8 mm, length 17 cm, for closure of trocar incision wounds
Achieving Excellence in Laparoscopic Abdominal Hernia Repair

Equipment Cart

Monitor:
TM 220 27" FULL HD Monitor
20090621 21.5" Touch Screen, 24 V
Optional:
TM 342 31" 4K Monitor

Camera System:
TC 201 XX** IMAGE1 S CONNECT® II,
4K Technology, basic module
TC 300 IMAGE1 S™ H3-LINK,
module for rigid endoscopy, FULL HD
TH 102 IMAGE1 S™ H3-Z FI Three-Chip
FULL HD Camera Head
Optional:
TC 304 IMAGE1 S™ 4U-LINK, module for
rigid endoscopy, 4K technology
TH 120 IMAGE1 S™ 4U,
One-Chip 4K UHD Camera Head

Light Source:
201337 01-1 Cold Light Fountain D-LIGHT P SCB
495 NCSC Fiber Optic Light Cable, with safety lock
Optional:
TL 300 Cold Light Fountain POWER LED
300 SCB

Pump System:
UP 210 ENDOMAT® SELECT, roller pump
UP 601 SURGERY Software, license
031524-10* Tubing Set

Insufflation:
UI 500S1 ENDOFLATOR® 50 SCB
031210-10* Insufflation Tubing Set, ENDOFLATOR® 50
UP 501 S1 S-PILOT®, for smoke evacuation
031447-10* Tubing Set
031111-10* Smoke Evacuation Filter

Documentation:
WD 300-XX*** AIDA®
TC 009 USB Adaptor, for ACC 1 and ACC 2
TC 010 Two-Pedal Footswitch USB

HF-Unit:
UH 400 AUTOCON® III 400 High-End
27805 Neutral Electrode
27806 UR Neutral Electrode Connecting Cable
UF 902 Two-Pedal Footswitch

Equipment Cart:
UG 220 Equipment Cart, wide
UG 500 Monitor Holder
UG 501 Monitor Holder Adaptor
UG 520 Monitor Holding Arm
UG 609 Bottle Holder, for CO2 bottles
UG 902 Footswitch Holder, for two-pedal
HF footswitch
UG 310 Isolation Transformer
UG 410 Earth Leakage Monitor

**XX Please indicate the relevant country code (DE, EN, ES, FR, IT, PT, RU) when placing your order.
*** Also available in the following languages: DE, EN, ES, FR, IT, PT, RU
**IMAGE1 S™**
As individual as your requirements

**Innovative Design**
- Side-by-side View: Parallel display of standard image and visualization mode possible
- Multiple source management: Simultaneous control, display and documentation of two image sources possible (e.g., hybrid procedures)
- Intuitive user guidance (dashboard, live menu and setup menu)
- Intelligent icons display settings and status
- Individual presets possible
- 50 patient data records can be archived

**Side-by-side View:**
Parallel display of standard image and "SPECTRA B"

**Dashboard**

**Status indication icons**

**Economical and futureproof**
- Modular platform: Rigid, flexible and 3D technology can be selected according to individual preferences
- Easy integration of new technologies
- Forward and backward compatibility
- No additional equipment (e.g., special light sources) required for S-Technologies
**IMAGE1 S™**

As individual as your requirements

With the IMAGE1 S™ camera platform, KARL STORZ once again sets a new milestone in endoscopic imaging, consolidating their reputation as an innovative leader in minimally invasive surgery.

The IMAGE1 S™ camera platform offers surgeons a single system for all applications. As a modular camera platform, IMAGE1 S™ combines various technologies (e.g., rigid, flexible and 3D endoscopy) in one system and can therefore be adapted to individual customer needs. Furthermore, the camera platform offers expanded compatibility and connectivity for NIR/ICG fluorescence imaging, integration of operating microscopes and the use of VITOM® 3D exoscopes.

**Brilliant imaging**

- Versatile visualization options for diagnosis and therapy
- Innovative S-Technologies for easy differentiation of tissue structures
- Clear and razor-sharp imaging
- Natural color rendition
- Automatic light source control

<table>
<thead>
<tr>
<th><strong>CLARA</strong>: Homogeneous illumination</th>
<th><strong>SPECTRA A</strong>: Color hue shift and exchange (filtering reds)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Standard Image" /></td>
<td><img src="#" alt="Standard Image" /></td>
</tr>
<tr>
<td><img src="#" alt="CLARA" /></td>
<td><img src="#" alt="SPECTRA A" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CHROMA</strong>: Contrast enhancement</th>
<th><strong>SPECTRA B</strong>: Spectral color shift (intensification of greens and blues)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Standard Image" /></td>
<td><img src="#" alt="Standard Image" /></td>
</tr>
<tr>
<td><img src="#" alt="CHROMA" /></td>
<td><img src="#" alt="SPECTRA B" /></td>
</tr>
</tbody>
</table>

*SPECTRA A / SPECTRA B: Not available for sale in the U.S.A.*
IMAGE1 S™ Camera System

TC 201EN* 

**IMAGE1 S CONNECT® II**, connect module, for use with up to 3 link modules, resolution 3840 x 2160 and 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital Image Processing Module, power supply 100-240 VAC, 50/60 Hz, including:

**Mains Cord**, length 300 cm
**DVI-D Connecting Cable**, length 300 cm
**DisplayPort Cable**, length 300 cm
**SDI-Cable**, length 300 cm
**SCB Connecting Cable**, length 100 cm
**USB Flash Drive**, 32 GB

**Specifications:**

| Video outputs | 2 x DisplayPort 1.2, 1 x 12G/3G-SDI, 1 x DVI-D |
| Format signal outputs | 3840 x 2160 p and 1920 x 1080 p, 50/60 Hz |
| LINK video inputs | 3x |
| USB interface | 4 x USB, (2 x front, 2 x rear) |
| SCB interface | 1 x 6-pin mini-DIN |
| Power supply | 100-240 VAC |
| Power frequency | 50/60 Hz |
| Protection class | 1, CF-Defib |
| Dimensions w x h x d | 305 x 54 x 320 mm |
| Weight | 3.1 kg |

For use with **IMAGE1 S CONNECT® II TC 201EN**

TC 304

**IMAGE1 S 4U-LINK**, link module, for use with **IMAGE1 S CONNECT® II TC 201EN**, power supply 100–120 VAC / 200–240 VAC, 50/60 Hz, for use with **IMAGE1 S CONNECT® II TC 201EN**, including:

**Mains Cord**, length 300 cm
**Link Cable**, length 20 cm

**Specifications:**

| Camera System | **TC 304 (IMAGE1 S™ 4U-LINK)** |
| Supported camera heads/video endoscopes | TH 120 |
| LINK video outputs | 1 x |
| Power supply; Power frequency | 100-240 VAC; 50/60 Hz |
| Protection class | 1, CF-Defib |
| Dimensions w x h x d | 305 x 54 x 320 mm |
| Weight | 1.86 kg |

TC 300

**IMAGE1 S™ H3-LINK**, link module, for use with **IMAGE1 S CONNECT® II TC 201EN**, power supply 100–120 VAC / 200–240 VAC, 50/60 Hz, for use with **IMAGE1 S CONNECT® II TC 201EN**, including:

**Mains Cord**, length 300 cm
**Link Cable**, length 20 cm

**Specifications:**

| Camera System | **TC 300 (IMAGE1 S™ H3-LINK)** |
| Supported camera heads/video endoscopes | TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 |
| LINK video outputs | 1 x |
| Power supply; Power frequency | 100-120 VAC/200-240 VAC; 50/60 Hz |
| Protection class | 1, CF-Defib |
| Dimensions w x h x d | 305 x 54 x 320 mm |
| Weight | 1.86 kg |

*Also available in the following languages: DE, ES, FR, IT, PT, RU.*

Please indicate the required language code when placing your order.
IMAGE1 S™
One-Chip 4K UHD Camera Head and Three-Chip FULL HD Camera Heads

IMAGE1 S 4U, One-Chip 4K UHD Camera Head, for use with TC 304, IMAGE1 S 4U-LINK, module for 4K endoscopy

**Specifications**

<table>
<thead>
<tr>
<th>Frame rate</th>
<th>50 / 60 Hz</th>
<th>Cable length</th>
<th>300 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image sensor</td>
<td>1-chip</td>
<td>Cable routing</td>
<td>angled</td>
</tr>
<tr>
<td>Resolution</td>
<td>3840 x 2160 pixels</td>
<td>Camera head buttons</td>
<td>freely programmable</td>
</tr>
<tr>
<td>Scanning method</td>
<td>progressive scan</td>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Lens</td>
<td>fixed focus</td>
<td>Reprocessing</td>
<td>soakable, sterilizable with EtO gas and H₂O₂ plasma</td>
</tr>
<tr>
<td>Focal length</td>
<td>f = 18 mm</td>
<td>S-Technologies</td>
<td>CLARA, CHROMA, SPECTRA*</td>
</tr>
<tr>
<td>Dimensions (w x h x l)</td>
<td>46 x 37 x 133 mm</td>
<td>Degree of protection</td>
<td>in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib</td>
</tr>
<tr>
<td>Weight</td>
<td>210 g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* SPECTRA A / SPECTRA B: Not for sale in the U.S.A.

**IMAGE1 S™ Three-Chip FULL HD Camera Heads**

**IMAGE1 S™ FULL HD three-chip camera heads for use with TC 300, IMAGE1 S™ H3-LINK, link module for rigid endoscopy**

<table>
<thead>
<tr>
<th>TH 100</th>
<th>IMAGE1 S™ H3-Z Three-Chip FULL HD Camera Head</th>
<th>TH 102</th>
<th>IMAGE1 S™ H3-Z FL Three-Chip FULL HD Camera Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame rate</td>
<td>50 / 60 Hz</td>
<td>Cable length</td>
<td>300 cm</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3-chip</td>
<td>Cable routing</td>
<td>angled</td>
</tr>
<tr>
<td>Resolution</td>
<td>1920 x 1080 pixels</td>
<td>Camera head buttons</td>
<td>freely programmable</td>
</tr>
<tr>
<td>Scanning method</td>
<td>progressive scan</td>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens</td>
</tr>
<tr>
<td>Focal length</td>
<td>f = 15 – 31 mm (2x)</td>
<td>Focal length</td>
<td>f = 15 – 31 mm (2x)</td>
</tr>
<tr>
<td>Dimensions (w x h x d)</td>
<td>39 x 49 x 114 mm</td>
<td>Degree of protection</td>
<td>in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib</td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
<td>Weight</td>
<td>246 g</td>
</tr>
</tbody>
</table>

| Reprocessing | soakable, sterilizable with EtO gas and H₂O₂ plasma | Reprocessing | soakable, autoclavable, sterilizable with EtO gas and H₂O₂ plasma |
| S-Technologies | CLARA, CHROMA, SPECTRA* | S-Technologies | CLARA, CHROMA, SPECTRA* |
| Degree of protection | in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib | Degree of protection | in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib |
| Molecular imaging | near-infrared imaging using indocyanine green (ICG) | Molecular imaging | near-infrared imaging using indocyanine green (ICG) |

* SPECTRA A / SPECTRA B: Not for sale in the U.S.A.
Monitors

**TM 342 31" 4K Monitor**, screen resolution 3840 x 2160, image format 16:9, video inputs: DP 1.2a, 2x DVI-D, 12G-SDI, 3G-SDI, USB Typ-B, RS-232C, GPI, video outputs: DVI-D, 12G-SDI, 3G-SDI, power supply 100 – 240 VAC, 50/60 Hz, with VESA 100 and VESA 200 adaption including:

- 1x **External 48 VDC Power Supply**
- 1x **Mains Cord**
- 1x **Cable Cover**
- 2x **Screws** for cable cover
- 4x **Mounting Screws M4**
- 4x **Mounting Screws M6**
- 1x **Instruction Manual**

**TM 220 27" FULL HD Monitor**, screen resolution 1920 x 1080, image format 16:9, video inputs: 2x DVI, 3G-SDI, VGA, S-Video, Composite, video outputs: DVI, 3G-SDI, Composite, power supply 100 – 240 VAC, 50/60 Hz, 5 V DC output (1 A), wall mount with VESA 100 adaption including:

- 1x **External 24 VDC Power Supply**
- 1x **Mains Cord**
- 1x **Cable Cover**
- 4x **Mounting Screws M4**
## Monitors

### 31" 4K and 27" FULL HD Monitor

### Specifications

<table>
<thead>
<tr>
<th></th>
<th>TM 342</th>
<th>TM 220</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen diagonal</strong></td>
<td>31.1&quot;</td>
<td>27&quot;</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>3840 x 2160 pixels</td>
<td>1920 x 1080 pixels</td>
</tr>
<tr>
<td><strong>Aspect ratio</strong></td>
<td>16:9</td>
<td></td>
</tr>
<tr>
<td><strong>Contrast ratio</strong></td>
<td>1500:1</td>
<td>1000:1</td>
</tr>
<tr>
<td><strong>Brightness</strong></td>
<td>350 cd/m² (type)</td>
<td>900 cd/m² (type)</td>
</tr>
<tr>
<td><strong>Max. viewing angle</strong></td>
<td>178° vertical / horizontal</td>
<td></td>
</tr>
<tr>
<td><strong>Video inputs</strong></td>
<td>1 x DisplayPort, 1 x 12G-SDI, 2 x DVI-D, 1 x 3G-SDI</td>
<td>2 x DVI-D, 1 x 3G-SDI, 1 x RGBS (VGA), 1 x S-Video, 1 x Composite</td>
</tr>
<tr>
<td><strong>Video outputs</strong></td>
<td>1 x DVI-D, 1 x 12G-SDI, 1 x 3G-SDI</td>
<td>1 x DVI-D, 1 x 3G-SDI, 1 x Composite, 1 x S-Video</td>
</tr>
<tr>
<td><strong>RS-232C connector</strong></td>
<td>1 x</td>
<td>1 x</td>
</tr>
<tr>
<td><strong>USB output</strong></td>
<td>5V / 1A</td>
<td></td>
</tr>
<tr>
<td><strong>Mount</strong></td>
<td>100/200 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>external, DC 48V</td>
<td>external</td>
</tr>
<tr>
<td><strong>Unit properties</strong></td>
<td>Picture in/out Picture, zoom function</td>
<td>Picture-in-Picture</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>139.2 W</td>
<td>72 W</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td><strong>Power frequency</strong></td>
<td>50/60 Hz</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td><strong>Dimensions (w x h x d)</strong></td>
<td>760 x 444 x 87 mm</td>
<td>660 x 400 x 87 mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>11.2 kg</td>
<td>8.5 kg</td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
<td>wipe disinfection</td>
<td></td>
</tr>
<tr>
<td><strong>Degree of ingress protection</strong></td>
<td>IP45 front, IP32 rear</td>
<td>IP32</td>
</tr>
</tbody>
</table>

**Optional accessories:**

**9832 SFH** - **Monitor Stand**, for professional use, height-adjustable, tiltable, rotation +/-30°, disinfectable, color white, VESA 200 adaptor, for use with 32" Monitors up to 15 kg

**9826 SF** - **Monitor Stand**, basic monitor stand, tiltable, rotation +/-30, disinfectable, color white, VESA 100 adaptor, for use with all monitors with VESA 100 adaptor up to 12 kg
Fiber Optic Light Cable

495 NCSC  **Fiber Optic Light Cable**, with straight connector, extremely heat-resistant, with safety lock, diameter 4.8 mm, length 250 cm

Cold Light Fountain Power LED 300

TL 300  **Cold Light Fountain Power LED 300**, with integrated KARL STORZ-SCB, high-performance LED module and one KARL STORZ light outlet, power supply 100–240 VAC, 50/60 Hz including: Mains Cord

Cold Light Fountain D-LIGHT P SCB

20 1337 01-1  **Cold Light Fountain D-LIGHT P SCB**, with integrated KARL STORZ-SCB, high-performance light unit for perfusion assessment, autofluorescence and standard endoscopic diagnosis, including a 300 Watt Xenon bulb and KARL STORZ light cable connection, power supply 100–125/220–240 VAC, 50/60 Hz including: Mains Cord SCB Connecting Cable One-Pedal Footswitch, one-stage, for switch function Democard Fluorescence Imaging
ENDOFLATOR® 50 SCB

Special features:
- Ease of use due to large 7" color touch screen: Simultaneous display of set values and actual values facilitate monitoring of the insufflation process.
- Automatic adjustment of insufflation rate to diverse instrument resistance values ensures the fastest possible insufflation.
- Fully automatic, electronically controlled gas refill (e.g. in case of gas loss when changing instruments).
- SECUVENT® safety system: Constant monitoring of intraabdominal pressure.
- High gas flow particularly helpful to maintain pressure while using a suction unit for evacuation of smoke.
- Powerful HIGH FLOW mode for fast insufflation of large gas volumes up to 50 l/min.
- A high-capability trocar (HICAP® trocar) that allows ideal flow conditions is included in the set.
- Tubing set with integrated heating element for preheating gas to body temperature to prevent telescope from fogging and peritoneum from cooling down.
- Connectability option to KARL STORZ Communication Bus (KARL STORZ-SCB) for unit integration.

ENDOMAT® Select

Suction or Irrigation System

UI 500 S1

ENDOFLATOR® 50 SCB, with integrated SCB module, power supply 100–240 VAC, 50/60 Hz including:
ENDOFLATOR® 50 SCB
SCB Connecting Cable, length 100 cm
Universal Wrench
Heated Insufflation Tubing Set, with gas filter, sterile, for single use, package of 3
HICAP® Trocar, size 11 mm

UP 501 S1

S-PILOT®, including footswitch, power supply 100–240 VAC, 50/60 Hz including:
S-PILOT®
One-Pedal Footswitch
Tubing Set Suction, sterile, for single use, package of 5
SCB Connecting Cable, length 100 cm

UP 210

ENDOMAT® SELECT, suction or irrigation pump, including mains cord, power supply 100–240 VAC, 50/60 Hz

UP 601

Surgery Software, License, allows selection of the procedures “LAP”, “THOR” and “PROCTO”, for use with ENDOMAT® SELECT UP 210

031524-10*

Tubing Set, Irrigation, FC, sterile, for single use, package of 10, for use with KARL STORZ HAMOU® ENDOMAT® 26331120-1 and ENDOMAT® SELECT UP 210
Documentation
AIDA® – Exceptional documentation

The name AIDA® stands for the comprehensive implementation of all documentation requirements arising in surgical procedures: A tailored solution that flexibly adapts to the needs of every specialty and thereby allows for the greatest degree of customization.

This customization is achieved in accordance with existing clinical standards to guarantee a reliable and safe solution. Proven functionalities merge with the latest trends and developments in medicine to create a fully new documentation experience – AIDA®.

AIDA® seamlessly integrates into existing infrastructures and exchanges data with other systems using common standard interfaces.

WD 300-EN*
AIDA®, Documentation System Set,
for recording still images and videos,
dual channel up to FULL HD, 4K, 2D/3D,
power supply 100 – 240 VAC, 50/60 Hz,
including:
AIDA®
USB Silicone Keyboard, with US English character set, with touchpad

WD 350-EN*
AIDA® with SMARTSCREEN®,
Documentation System Set, for recording still images and videos, dual channel up to 4K, 2D/3D,
power supply 100 – 240 VAC, 50/60 Hz,
including:
AIDA®
OR1™ SMARTSCREEN®,
USB Silicone Keyboard, with US English character set, with touchpad

* Please, specify the language code when placing your order. Available in English (EN), German (DE), Spanish (ES), French (FR), Italian (IT), Portuguese (PT) and Russian (RU).
Workflow-oriented use

**Patient**
The procedure data input can be done manually or via a DICOM worklist.

**Checklist**
You have the option of digitizing a wide range of OR safety checklists.

**Record**
Still images and video sequences can be recorded in Full HD, 4K and 3D quality.

**Edit**
Simple adjustments to recorded still images and videos can be very rapidly completed with the Edit module.

**Complete**
A procedure can be completed with just one click. The Intelligent Export Manager (IEM) allows the automatic transmission of all data to configured storage locations in the background.

**Reference**
Allows you direct and easy access to previously recorded data at all times.
SCENARA®
Data Management

Documentation of endoscopic examinations and surgical procedures has become part of the standard protocol employed in many hospitals and practices today. It requires the team members to cope with an increasingly complex digital environment and to handle large volumes of data. Continuous advancements in medical science and technology have resulted in a growing need for, and interest in solutions which facilitate the transfer and management of data. Data records must be stored in a clearly structured manner to make them readily accessible when needed later, such as for instance for patient follow-up or for studies and research. Apart from that, medical professionals are always interested in simplified processes, increased efficiency, and patient satisfaction.

SCENARA® offers a new, platform-independent and modular software solution that meets these requirements and currently consists of two modules.

Functions and Capabilities:

SCENARA®.STORE
Image and video data storage and management.
- Endoscopic data from various systems at a central location with fast and mobile data access.

SCENARA®.CONNECT
Centralized communication interface.
- Interoperability between documentation solutions from KARL STORZ and other information and archiving systems already existing at the institution.

SCENARA®.STORE and SCENARA®.CONNECT
- Scalable solutions for facilities of all sizes.
- Software updates and upgrades.
- Service contract for software maintenance, troubleshooting and software updates without additional costs.
Intelligent Data Storage and Management
Data Management
Based on a scientifically tested set of rules, image and video data can be compressed or even deleted after a defined time period.

Support in Finding Information
Fast Data Access
SCENARA® .STORE provides flexible and easy access to endoscopic image and video data. As a result, productivity and patient care can be improved, time saved, costs reduced, and patient satisfaction increased.

Smart Function and Intuitive Use
View and Edit
SCENARA® .STORE features a virtual examination concept and additional navigation tools that ensure excellent user orientation at any time, even during long recordings. Image and video data can be directly and quickly edited for further use. Videos can be cut and still images generated from videos with just a few clicks.

Compare and Share
SCENARA® .STORE allows users to compare the recordings of patients from the same procedure or from several procedures to access the patient follow-up. In addition, patient data can be made available to other users in a controlled and documented manner.

Export
SCENARA® .STORE allows the easy and rapid export of all image and video data, optionally in anonymized form. These are then available for immediate use, e.g., for forwarding to the patient or for presentation purposes.

Interfaces
SCENARA® .CONNECT offers a centralized communication interface to existing information systems, which leads to considerable savings.

Reduced Complexity
SCENARA® .CONNECT reduces the complexity of the workflow by ensuring optimal interoperability between the KARL STORZ documentation solutions and existing information and archiving systems from different manufacturers.

Efficiency
SCENARA® .CONNECT increases efficiency as manual data transfer is no longer necessary.

Safety
SCENARA® .CONNECT improves the safety of patient data by preventing wrong save destinations and data loss.

Clinical Integration
SCENARA® .CONNECT permits easy integration and seamlessly fits into existing clinical infrastructures.
SCENARA®

Overview

Sources

TELE PACK X Series

AIDA® with SMARTSCREEN®

KARL STORZ OR1 FUSION®

Storage Location

SCENARA® .STORE

SCENARA® .CONNECT

Hospital Network (LAN / WLAN)

Communication Interface

WS 100-S

WS 100-C

Medical Information, Archiving or Practice System (HIS / PACS)

End Devices

This graphic presents a possible scenario.

* Also available in the following languages: DE, ES, FR, IT, PT, RU

| WS100-S | Software and modality license (per KARL STORZ documentation unit – KARL STORZ OR1 FUSION®, KARL STORZ AIDA® and TELE PACK X Series). Please note the installation requirements. |
| WS100-C | Software and modality license (per KARL STORZ documentation unit – KARL STORZ OR1 FUSION®, KARL STORZ AIDA® and TELE PACK X Series). Please note the installation requirements. |

| WSOFTINSTALL | WSLABASIC |
| Software Installation and Configuration | Software support contract basic |
| WMaintenance | WSLAPREMIUM |
| Software Maintenance Contract | Software support contract premium |