SINGLE-PORT ACCESS LAPAROSCOPY (SPAL)
FOR ADNEXAL PATHOLOGIES

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Single-Port Access Laparoscopy (SPAL) for Adnexal Pathologies

Introduction

Although laparoscopy has decreased morbidity directly related to the surgical approach, it is a well-known fact that each working port carries an inherent risk of bleeding, infection, concomitant iatrogenic visceral injury, hernia formation and less satisfactory cosmetic outcome. The latest advancements in terms of technical expertise and surgical instrumentation have allowed minimal access surgery to become even more minimal. This led to the development of a multitude of surgical approaches now collectively known as laparo-endoscopic single-site surgery (LESS) and involves more recently coined terminology including natural orifice transluminal endoscopic surgery (NOTES), single access laparoscopic surgery (SALS), single port access laparoscopy (SPAL) and one-port umbilical surgery (OPUS).

Initial trials, conducted in animal models, were accompanied by the development of dedicated, custom-made instrumentation. Based on advanced technical skills, it was finally possible to successfully translate LESS to humans. In this way, the new minilaparoscopic approach was shown to be a viable and feasible option, that can be widely used within the scope of minimally invasive procedures. Preliminary advances were made with the use of LESS in urologic and gastrointestinal surgery, and only recently, two reports addressing the application of SPAL also in gynecology, have been published. The data on which the reports are based, demonstrated that even though the SPAL approach was clearly feasible, the operating time was significantly longer as compared to conventional laparoscopy. In order to further evolve the concept of SPAL and to standardize its application in gynecology, the design of a set of specific laparoscopic instruments proved to be of key importance.

Indications

Despite the pioneering efforts in single-port gynecologic surgery, clinical application of such procedures gained little foothold.

Instrumentation suitable to perform complex surgical maneuvers intracorporeally did not exist. This fact is reflected in several publications on single-port surgery that can best regarded as hybrid reports, in which the target organ affected by the pathology, was exteriorized through the umbilicus and extracorporeal open surgery was performed. Several decades would go by before flexible instrumentation was able to make up the leeway with the surgical concept.

The actual indications of SPAL in gynecological surgery are increasing day by day. This booklet is intended to describe in particular the use of SPAL in patients with benign adnexal disease. At present, the general concept involves that functional integrity of the genital tract be preserved during the reproductive years and provides for its partial or complete removal after menopause. Given the confirmed absence of malignancy, SPAL can be performed for the treatment of benign ovarian tumors/cysts. Bilateral adnexitectomy is preferred after menopause. The enucleation of benign ovarian cysts (dermoid cysts, endometrioma, cystoadnexoma) and their removal with an endobag is indicated in reproductive-age women. Salpingectomy in cases of tubal pregnancy and bilateral hydrosalpinx in patients undergoing assisted reproductive technology (ART) techniques can be performed by single port.
Advantages and Disadvantages of Single-Port Access Laparoscopy (SPAL)

SPAL provides the option of further enhancing the cosmetic benefits of minimally invasive surgery while minimizing the potential morbidity associated with multiple incisions, as hernia, bleeding, wound infection, pain, gastrointestinal lesion, vascular lesion, extraperitoneal gas.

However consideration should be given to the intrinsic limitation of this new approach, which lies in the fact, that freedom of motion between the instruments is restricted, thus reducing surgical maneuverability and ergonomics while increasing operating time. In order to improve the performance of this surgical approach, the authors advocate using specialized instruments and a few ergonomic techniques.

The single-port approach should not be considered as a regular laparoscopic procedure because its successful implementation involves a significant learning curve. Stepwise practical training on simulators, animal models, and under supervision of an experienced staff member is mandatory before performing the technique in an operating theatre. The author's learning curve took approximately 10 cases to level out at a stable operating time.

The intrinsic limitations of this new approach are:

**Absence of triangulation.** Laparoscopic surgical techniques are based primarily on traction and countertraction forces that allow triangulation of forces applied from two different points. Inserting the laparoscopic instruments from a single-site port makes triangulation difficult when using standard laparoscopic instruments during in-line instrument deployment and visualization of the operating field. In this setting, parallel alignment of instruments reduces the range of motion between the instruments and is often associated with counterintuitive movements on the outside, where the distal ends of standard surgical instruments are prone to clash with each other. Although generally received with reluctance during standard laparoscopy, it can be necessary to cross instruments during single-port access surgery.

**Retraction.** With reduction of triangulation and limited degree of movement between instruments, retraction of the tissue becomes more difficult, and the surgeon has to adapt to new ergonomic operating principles quite different from those applied in standard laparoscopy.

**Instrument Crowding.** External crowding and clashing of instruments is the most distinct and awkward aspect of the learning curve for these procedures.
In **Inline Vision**. During standard laparoscopy, depth perception is lost when the camera orientation is on-axis with the shaft of a working instrument. This effect can manifest itself during single-port surgery. The surgeon should try to become accustomed to viewing angles that would otherwise be considered inappropriate during standard laparoscopy.

**Instrumentation**

**Design Features of the X-CONE**

X-CONE is a single-site trocar with five integrated access ports. This new device consists of two symmetric metal half shells of outward curved conical shape, that can be connected and sealed using one large silicone cap accommodating the ports. The lower part of the outward curved half shells can be used as retractors while the abdominal entrance is kept open, with the upper funnel-shaped part remaining extracorporeal. Once inserted in the peritoneal cavity, the two half shells fit together at their waistline to form an X-shape. By pushing the upper halves towards another the final access portal is created (**Fig. 2e**). The silicone cap, comprising four 6-mm and one 13-mm port, is connected on top of the X-CONE, forming an airtight seal. The external and internal diameters at the level of the X-CONE’s waistline are 25 mm and 20 mm, respectively.

**Assembly of the X-CONE**
Curved Instruments

Curved S-Portal instruments.
Endoscope

A 30° forward-oblique HOPKINS® laparoscope, 5 mm in diameter, is mandatory for proper visualization, which is a key factor that can prevent the operating instruments from constantly clashing with the scope. In our experience, the use of the 50 cm extended-length laparoscope has proven to be very useful during SPAL, because it allows the assistant to move the scope without impeding the surgeon's movements outside of the abdominal cavity.

To meet the demands of gynecological endoscopy, the basic equipment must comprise a powerful cold light source and endoscopes that are capable of providing high quality close-up views of the organs (Fig. 4).

Video Camera

In modern laparoscopy, a high-quality video camera should always be used. Surgeons must be adequately trained until they are proficient with the techniques of video laparoscopy usually performed in a comfortable standing position while watching the video screen.

A high definition three-chip video camera is preferred to provide a perfect vision, even when using a small-caliber scope (Fig. 5).

Cold Light Source

The quality level of a cold light source is determined by the quantity of light available at each step of the electro-optical system. The luminous efficacy of a lamp is expressed as the ratio of the total luminous flux emitted (light output) divided by the total lamp power input. However, increasing the power causes a real problem with regard to the generation of heat. At present, owing to the technical improvements made to video cameras, it is possible to return to reasonable power levels. 175–250 watts are generally sufficient for routine endoscopic procedures. For special applications, or when using miniature telescopes, a cold light source of 300 watts (Fig. 6) is recommended to maintain a sufficient level of illumination in the abdominal cavities. This is all the more true considering the fact that even minor bleeding can cause impaired vision due to significant light absorption.

CO₂-Endoflator

The main technical features include the unit’s capability to insufflate up to 15–20 L/min. (THERMOFLATOR® with a maximum of 30 L/min.) and to maintain a constant intra-abdominal pressure without exceeding the safety limit of 12–16 mmHg. Continuous control of intra-abdominal pressure helps prevent complications related to an incorrectly positioned Veress needle (pre-peritoneal emphysema, or puncture of the omentum, bowel and vessels). Patient safety is ensured by optical and acoustic alarms as well as several mutually independent safety circuits. The set-point values
for pressure and flow rate can be accurately preadjusted using jog keys and digital displays. For safety reasons, it is mandatory that the user have a sound understanding of the functions and quadro-manometric insufflation parameters. These four insufflation parameters are: preset insufflation pressure, actual intra-abdominal pressure, gas flow rate and total volume of gas inflow (Fig. 7).

**Electrosurgical Unit**

The AUTOCON® II 400 is a versatile, state-of-the-art high frequency electrosurgical unit designed for both unipolar and bipolar electrosurgical applications. The operational parameters of various cutting and coagulation settings can be preselected on the frontpanel display, thus providing the user with a highly accurate and reproducible method to obtain good results. Exact fine-tuning in 1 W-steps is enabled for procedures that require maximum precision at very low power. Up to 8 hemostatic effects for unipolar and bipolar cutting, each with up to 370 W output, permit optimal control of coagulation and the intended surgical effect (Fig. 8).

**Suction and Irrigation System**

Controlled suction and irrigation is of great importance because it provides the surgeon with a clear field of vision during laparoscopic surgery. For that reason, we suggest to have a suction-irrigation system on stand-by even in cases of diagnostic laparoscopy. The system may also be used for lavage of the abdominal cavity, control of bleeding and aspiration of clots, as required by the individual situation. In the authors’ experience, the use of a 5-mm suction cannula (Fig. 9) is recommended.
Operating Room Set-up

Patient Positioning

The patient is placed on the operating table in dorsal lithotomy position with both arms tucked close to the body with open legs and thighs flexed, allowing the assistant to handle the uterine manipulator. It is of key importance that the assistant can mobilize the uterus transvaginally, in order to help the surgeon by exposing the correct surgical planes of the operative field. In principle, many cases of adnexal pathology can be successfully managed by surgery without adjunctive use of an uterus manipulator, as required in virgo patients.

After preparation of the umbilicus, introduction of the X-CONE and accurate inspection of the abdomen, the patient is placed in Trendelenburg position. Because a steep head-down tilt is required during the operation, shoulder rests are placed on both sides of the table (Drawing 2).

Positioning of the Surgeon

The surgeon stands directly behind the patient’s head in order to allow improved hand-eye coordination and line-of-sight imaging. The assistant assumes a position on the right side, at the level of the patient’s right shoulder (Figs. 10a–b). For perfect ergonomics, the elbow should be flexed at an angle of more than 90° (Fig. 10a); both hands are pronated while the fingers are gently grasping the instrument handle to maintain a fatigue-free posture (Fig. 10b).

Positioning of the Equipment Cart

The monitor is placed in the middle of the patient’s legs to provide a good eyes-hands-monitor axis for the surgeon (Fig. 11).
Operating Technique

Establishing the Abdominal Entry

To enter the peritoneal cavity, the patient is initially put in a flat supine position, and a 1.5-mm to 2-cm full-thickness infraumbilical vertical skin incision is made with a pointed scalpel. (Figs. 12a, b). Occasionally, the natural course of the umbilical skin fold commences in a horizontal direction. In order to camouflage the scar and preserve the original umbilical shape, such variants require that an horizontal incision be made. Employing small retractors, the rectus fascia is identified and grasped with two Kocher clamps (Fig. 12c). The fascia is opened with a scalpel and the peritoneal opening is enlarged under direct vision with the surgeon’s finger or by use of blunt scissors (Fig. 12d) Finally, fascial sutures are placed at the cranial and caudal ends of the fascial incision.
Port Placement

Once the peritoneal cavity has been entered, the two half shells are fitted together to form an X-shape. Slight horizontal pressure is applied to approximate the two half-shells and establish the final access portal. The silicone cap, accommodating four 6-mm and one 13-mm port, is fitted over the top of the X-CONE to provide for an airtight seal. The sealing cap itself prevents the device from opening inadvertently. The single-port trocar device allows simultaneous passage of various laparoscopic instruments through one small opening and has the added advantage of being reusable. Introduction of the X-CONE is straightforward and safe; while inserting the device, care should be taken that the abdominal wall be lifted upward to prevent inadvertent entrapment of internal viscera. Port placement takes only little time if the surgeon is adequately trained in open access laparoscopy. In addition, the rigid, rounded design of the X-CONE is fitted to prevent iatrogenic lesions of the fascia during surgery and facilitates reintroduction through the abdominal wall opening, as required.
Intra-abdominal View

The endoscopic view confirms total patency of the trocar lumen.

Omentum trapped in the trocar.

Endoscopic view of upper abdomen.

Endoscopic view of the pelvis.
Technical Challenges

Wide spacing of trocars is considered a basic principle of multitrocar standard laparoscopy. Instrument triangulation allows proper tissue retraction, which is crucial for proper dissection along anatomical tissue planes. Placing several parallel instruments makes triangulation more difficult. Using at least one flexible or curved instrument moves the shaft’s axis out of the center sufficiently, thus allowing the surgeon to operate with some degree of triangulation.

The line of vision of the extended-length (50 cm) 30°-laparoscope can be directed toward the left side of the patient and by 90° rotation to the right side, it is possible to visualize the pelvis and prevent inadvertent contact with the operating instruments. The use of the video camera’s zoom function allows to keep the scope at adequate distance from the surgical target site.

The use of rigid, curved instruments is fundamental, because it helps minimizing extracorporeal clashing between instruments and video camera, and permits lateral insertion into the abdominal cavity. The use of dedicated, curved instruments (single- or double-curve) enables the mobilization and traction of organs by the combined application of twisting, advancing and retracting movements (Figs. 15a–c).

To reduce crowding of instruments, the shaft’s cross-section should be as slender as possible. Using instruments of varying overall lengths is also helpful. If the multichannel port is used for the camera and two instruments, different working lengths prevent the bulkiest part of each instrument (the external handle) from extracorporeal clashing. A straight handle design is particularly useful because it facilitates on-axis rotation and allows straightforward ergonomic control of the instrument.
To facilitate passage of the instrument through the port, some drops of vaseline can be applied to the shaft of the instrument.

In addition, multifunctional devices that feature grasping, dissecting, coagulating, and cutting properties, are suited to resolve limitations related to the reduced number of ports.

Using fixation sutures or sling sutures makes it possible to perform retraction maneuvers, that are usually accomplished by the assistant via an accessory trocar. The surgeon has the option of placing either fixed intra-abdominal sutures, anchored to the parietal peritoneum, or using percutaneous sutures, that are tied extracorporeally and, as dissection proceeds, allow variable traction forces to be applied.

**Surgical Procedures**

**Ovarian Cystectomy**

Through the left port, a curved, serrated grasping forceps (ME) is used to manipulate the ovary. Alternatively, an atraumatic forceps (DF) is inserted to handle the salpinx (working length 47 cm).

Occasionally, previous surface coagulation can facilitate grasping the smooth-walled cyst. Cold scissors are used through the central port for separating the ovarian cyst capsule from the ovarian cortex, followed by the use of bipolar forceps (ROBi® KELLY bipolar dissecting and grasping forceps) for dissection of the cyst wall and coagulation of small vascular bridges (Figs. 16a–d).
**Salpingectomy**

The scope is systematically positioned in the lateral right port and the rigid single-curved grasping forceps is inserted in the left port. Through the central port, either straight ROBi® bipolar dissecting and grasping forceps or straight cold scissors with curved blades are used (see Drawing 3).

After adhesiolysis (if needed), and determination of the boundaries of the Fallopian tube, particularly at the level of the ovarian vessels, the procedure is usually initiated at the isthmic tubal segment (Figs. 17a, b), proceeding in a retrograde fashion. Through the central port, either straight ROBi® bipolar dissecting and grasping forceps or straight cold scissors with curved blades are used (see Drawing 3). The fimbriated tubal end is grasped and placed on stretch by on-axis rotation of the curved grasping forceps.

**Adnexectomy**

The scope is systematically positioned in the lateral right port, and a rigid single-curved grasping forceps is inserted in the left port. Through the central port, either straight ROBi® bipolar dissecting and grasping forceps or straight cold scissors with curved blades are used (see Drawing 3).

After lysis of adhesions (as required), mobilization of the adnexa and identification of the ureter, grasping forceps are used to apply traction to the vascular pedicle, which is then coagulated and transected using the right-hand instruments. Section must be preceded by meticulous, step-by-step coagulation of the infundibulopelvic, mesosalpinx, meso-ovarian and utero-ovarian vessels (Figs. 18a–b).
Removal of the Surgical Specimen

Removal of the specimen is performed with an endobag, which is introduced through the 13-mm central port, and extracted via the umbilicus once the X-CONE has been removed (Figs. 19a–d).
Abdominal Wound Closure

Suture of the fascia should be performed routinely to prevent hernia formation. Closure of the cutaneous wound and reconstruction of the umbilical shape is performed with absorbable single stitches.

Intraoperative Umbilical Incision and Wound Closure

Cosmetic Outcome of the Umbilical Suture at 1 Month post-surgery
Conclusions

At present, although the cosmetic advantage is obvious, the true effects of embryonic natural orifice transumbilical endoscopic surgery (E-NOTES) on perioperative pain and morbidity are yet unknown. The patients’ views about scar-free surgery has also not been quantified. Indeed, recently, a prospective randomized trial (FAGOTTI A et al. 2011) provided evidence that SPAL is superior over a conventional multiaccess laparoscopic surgery approach in terms of postoperative pain and need for rescue analgesia, with a similar perioperative outcome for the treatment of benign adnexal disease.

Cost differences between single- and multiple-port laparoscopy is a topic that is subject to a number of yet unpublished studies. The anticipated decrease in morbidity rate is not likely to parallel the leap forward seen following the changeover from open to conventional laparoscopic surgery. This, however, is no justification for adapting a wait-and-see attitude.

Single-port access laparoscopy for the management of adnexal pathologies is a viable and feasible treatment option. Given a surgical team that is adequately trained and capable of meeting the objectives of standardized techniques while using specific dedicated instruments for each type of surgery will help decrease operative time, improve ergonomy and expand the range of indications.

Recent publications have reported on the use of single-portal access laparoscopy for the treatment of uterine pathology, such as LAVH, TLH and myomectomy. At first, careful case selection is of paramount importance to enable good endoscopic visualization, secondly, a low threshold should be maintained to convert to standard laparoscopy as indicated for reasons of safety and quality of care.

Flexible multichannel robotic systems and standalone deployable miniature robots are not far off. When these technologies become widely available, SPAL procedures will advance even further.
Recommended Literature


10. FADER AN, ESCOBAR PF: Laparoendoscopic single-site surgery (LESS) in gynecologic oncology: Technique and initial report. Gynecol Oncol 2009


Single Port Access Laparoscopy (SPAL) for Adnexal Pathologies

Instruments and Telescopes

23020 PA  X-CONE Single Portal Surgery Access System
size 25 mm, including:
- Port, consisting of two half cones (23020P1/ 23020P2)
- Sealing, with 4 x 5 mm and 1 x 5-13 mm ports
- Reducer, 13/5 mm and 11/5 mm
- LUER-Lock-conector with stopcock
for insufflation and desufflation

26031 SO  Retractors, s-shaped, 2 pieces, length 17 cm
26048 BSA  HOPIKINS® Forward-Oblique Telescope 30°,
diameter 5.5 mm, length 50 cm, autoclavable,
fiber optic light transmission incorporated,
light connection offset by 180° and angled 45°,
color code: red

Additional Instrumentation

26168 UN  COHEN Uterine Cannula, with 1 large 26168 UL
and 1 small 26168 US cone, spring-loaded fixation
for use with Uterine tenaculum forceps 26168 V,
with LUER-Lock adaptor for cleaning
26168 V  Uterine Tenaculum Forceps, length 22 cm

Ovarian Cystectomy

23451 AFU  ROTATIP® Forceps, dismantling, with connector
pin for unipolar coagulation,atraumatic, fenestrated,
double action jaws, jaws rotatable, sheath bending
according to CUSCHIERI O-CON, coaxial curved
down, size 5 mm, length 36 cm, including:
- Plastic Handle, without ratchet,
  with larger contact area at the finger ring
Outer Sheath, insulated
Forceps Insert

23451 ONU  ROTATIP® Forceps, dismantling, with connector pin
for unipolar coagulation, with LUER-Lock connector for
cleaning, single action jaws,atraumatic, fenestrated,
rotating jaws, CUSCHIERI O-CON sheath curve,
coaxially curved downwards, size 5 mm, length 36 cm,
including:
- Plastic Handle, without ratchet,
  with larger contact area
Outer Sheath, insulated
Forceps Insert

25451 MT  CLICKLINE® Scissors, cranked downwards, with
serrated jaws, single action jaws, rotating, size 5 mm,
length 43 cm.,
including:
- Plastic Handle, without ratchet,
  with larger contact area
Outer Sheath, insulated
Forceps Insert

38651 MA  MALZONI ROBI® Forceps,
double-action jaws, size 5 mm, length 36 cm,
including:
- RoBi® Plastic Handle, without ratchet,
  color code: light blue
Outer Sheath
Forceps Insert

38651 MD  RoBi® KELLY Grasping Forceps, CLERMONT-\nFERRAND model, rotating, dismantling, with connector
pin for bipolar coagulation, especially suitable for
dissection, double action jaws, size 5 mm, length 36 cm,
color code: light blue
including:
- RoBi® Plastic Handle, without ratchet
RoBi® Metal Outer Sheath
RoBi® Forceps Insert

Adnexectomy

23451 AFU  ROTATIP® Forceps, dismantling, with connector pin
for unipolar coagulation, atraumatic, fenestrated,
double action jaws, jaws rotatable, sheath bending
according to CUSCHIERI O-CON, coaxial curved
down, size 5 mm, length 36 cm, including:
- Plastic Handle, without ratchet,
  with larger contact area at the finger ring
Outer Sheath, insulated
Forceps Insert

25451 MT  CLICKLINE® Scissors, cranked downwards, with
serrated jaws, single action jaws, rotating, size 5 mm,
length 43 cm.,
including:
- Plastic Handle, without ratchet,
  with larger contact area
Outer Sheath, insulated
Forceps Insert

38651 MA  MALZONI ROBI® Forceps,
double-action jaws, size 5 mm, length 36 cm,
including:
- RoBi® Plastic Handle, without ratchet,
  color code: light blue
Outer Sheath
Forceps Insert

38651 MD  RoBi® KELLY Grasping Forceps, CLERMONT-\nFERRAND model, rotating, dismantling, with connector
pin for bipolar coagulation, especially suitable for
dissection, double action jaws, size 5 mm, length 36 cm,
color code: light blue
including:
- RoBi® Plastic Handle, without ratchet
RoBi® Metal Outer Sheath
RoBi® Forceps Insert

Suction and Irrigation

37112 A  Straight Grip Handle, for suction and irrigation,
autoclavable
to be used with:
- 37360 LH  Suction and Irrigation Cannula
  with lateral holes, size 5 mm, length 36 cm, for use with suction
  and irrigation handles
- 26175 P  Injection Needle, LUER-Lock,
diameter 1.2 mm, size 5 mm, length 36 cm
- 031133-10  Single-use tubing set, Sterile, 10 per pack
X-CONE Single Portal Surgery Access System

23020 PA  X-CONE Single Portal Surgery Access System
size 25 mm,

including:
Port, size 25 mm, consisting of two half cones
(23020P1/ 23020P2)
Sealing, with 4 x 5 mm and 1 x 5-13 mm ports
Reducer, 13/ 5 mm and 11/ 5 mm
LUER-Lock-connector with stopcock
for insufflation and desufflation

26031 SO  Retractors, s-shaped, 2 pieces, length 17 cm

HOPKINS® Forward-Oblique Telescope 30°

26048 BSA  HOPKINS® Forward-Oblique Telescope 30°,
diameter 5.5 mm, length 50 cm, autoclavable,
fiber optic light transmission incorporated,
light connection offset by 180° and angled 45°,
color code: red

It is recommended to check the suitability of the product for the intended procedure prior to use.
COHEN Uterine Cannula

26168 UN  COHEN Uterine Cannula, with 1 large 26168 UL and 1 small 26168 US cone, spring-loaded fixation for use with Uterine tenaculum forceps 26168 V, with Luer-Lock adaptor for cleaning

26168 V  Uterine Tenaculum Forceps, length 22 cm

ROTATIP™ Forceps

23451 AFU  ROTATIP™ Forceps, dismantling, with connector pin for unipolar coagulation, atraumatic, fenestrated, double action jaws, jaws rotatable, sheath bending according to CUSCHIERI O-CON, coaxially curved downwards, size 5 mm, length 36 cm, including:
- Plastic Handle, without ratchet, with larger contact area at the finger ring
- Outer Sheath, insulated
- Forceps Insert

23451 ONU  ROTATIP™ Forceps, dismantling, with connector pin for unipolar coagulation, with Luer-Lock connector for cleaning, single action jaws, atraumatic, fenestrated, rotating jaws, CUSCHIERI O-CON sheath curve, coaxially curved downwards, size 5 mm, length 36 cm, including:
- Plastic Handle, without ratchet, with larger contact area
- Outer Sheath, insulated
- Forceps Insert
CLICKLINE® METZENBAUM Scissors

25451 MT

CLICKLINE® Scissors, cranked downwards, with serrated jaws, single action jaws, rotating, size 5 mm, length 43 cm, including:
- Plastic Handle, without ratchet, with larger contact area
- Outer Tube, insulated
- Scissors Insert

MALZONI ROBI® Forceps and ROBI® KELLY Grasping Forceps

38651 MA

MALZONI ROBI® Forceps, double-action jaws, size 5 mm, length 36 cm, including:
- ROBI® Plastic Handle, without ratchet
- Outer Sheath
- Forceps Insert

38651 MD

ROBI® KELLY Grasping Forceps, CLERMONT-FERRAND model, rotating, dismantling, with connector pin for bipolar coagulation, especially suitable for dissection, double action jaws, size 5 mm, length 36 cm, color code: light blue, including:
- ROBI® Plastic Handle, without ratchet
- ROBI® Metal Outer Sheath
- ROBI® Forceps Insert
Single Port Access Laparoscopy (SPAL) for Adnexal Pathologies

**Straight Grip Handle**

37112 A  **Straight Grip Handle**, for suction and irrigation, *autoclavable*

**to be used with:**

37360 LH  **Suction and Irrigation Cannula with lateral holes**, size 5 mm, length 36 cm, for use with suction and irrigation handles

26175 P  **Injection Needle**, LUER-Lock, diameter 1.2 mm, size 5 mm, length 36 cm

031133-10 **Single-use tubing set**, Sterile, 10 per pack
IMAGE1 S Camera System

Economical and future-proof
- Modular concept for flexible, rigid and 3D endoscopy as well as new technologies
- Forward and backward compatibility with video endoscopes and FULL HD camera heads
- Sustainable investment
- Compatible with all light sources

Innovative Design
- Dashboard: Complete overview with intuitive menu guidance
- Live menu: User-friendly and customizable
- Intelligent icons: Graphic representation changes when settings of connected devices or the entire system are adjusted
- Automatic light source control
- Side-by-side view: Parallel display of standard image and the Visualization mode
- Multiple source control: IMAGE1 S allows the simultaneous display, processing and documentation of image information from two connected image sources, e.g., for hybrid operations

Dashboard
Live menu
Intelligent icons
Side-by-side view: Parallel display of standard image and Visualization mode
IMAGE1 S Camera System

Brilliant Imaging

- Clear and razor-sharp endoscopic images in FULL HD
- Natural color rendition

Reflection is minimized
- Multiple IMAGE1 S technologies for homogeneous illumination, contrast enhancement and color shifting

FULL HD image

CLARA

FULL HD image

CHROMA

FULL HD image

SPECTRA A*

FULL HD image

SPECTRA B**

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

**TC 200EN**

**TC 200EN**

**IMAGE1 S CONNECT**, connect module, for use with up to 3 link modules, resolution 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital Image Processing Module, power supply 100–120 VAC/200–240 VAC, 50/60 Hz

- **Mains Cord**, length 300 cm
- **DVI-D Connecting Cable**, length 300 cm
- **SCB Connecting Cable**, length 100 cm
- **USB Flash Drive**, 32 GB, USB silicone keyboard, with touchpad, US

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

**Specifications:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>TC 200EN</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD video outputs</td>
<td>2x DVI-D, 1x 3G-SDI</td>
</tr>
<tr>
<td>Format signal outputs</td>
<td>1920 x 1080, 50/60 Hz</td>
</tr>
<tr>
<td>LINK video inputs</td>
<td>3x</td>
</tr>
<tr>
<td>USB interface</td>
<td>4x USB, (2x front, 2x rear)</td>
</tr>
<tr>
<td>SCB interface</td>
<td>2x 6-pin mini-DIN</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>2.1 kg</td>
</tr>
</tbody>
</table>

**For use with IMAGE1 S**

**IMAGE1 S CONNECT Module TC 200EN**

**TC 300**

**TC 300**

**IMAGE1 S H3-LINK**, link module, for use with IMAGE1 FULL HD three-chip camera heads, power supply 100–120 VAC/200–240 VAC, 50/60 Hz, for use with **IMAGE1 S CONNECT TC 200EN**

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

**Specifications:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>TC 300 (H3-Link)</th>
</tr>
</thead>
</table>
| Supported camera heads/video endoscopes | TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S)
|                               | 22220055-3, 22220056-3, 22220057-3, 22220058-3, 22220060-3, 22220061-3, 22220064-3, 22220065-3 (compatible without IMAGE1 S technologies CLARA, CHROMA, SPECTRA*) |
| LINK video outputs            | 1x               |
| Power supply                  | 100–120 VAC/200–240 VAC |
| Power frequency               | 50/60 Hz         |
| Protection class              | I, CF-Defib      |
| Dimensions w x h x d          | 305 x 54 x 320 mm |
| Weight                        | 1.86 kg          |

* SPECTRA A: Not for sale in the U.S.
** SPECTRA B: Not for sale in the U.S.
IMAGE1 S Camera Heads

For use with IMAGE1 S Camera System
IMAGE1 S CONNECT Module TC 200EN, IMAGE1 S H3-LINK Module TC 300
and with all IMAGE1 HUB™ HD Camera Control Units

TH 100

IMAGE1 S H3-Z Three-Chip FULL HD Camera Head,
50/60 Hz, IMAGE1 S compatible, progressive scan,
sinkable, gas- and plasma-sterilizable, with integrated
Parfocal Zoom Lens, focal length f = 15–31 mm (2x),
2 freely programmable camera head buttons,
for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

Specifications:

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 100</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 114 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, f = 15–31 mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>

TH 104

IMAGE1 S H3-ZA Three-Chip FULL HD Camera Head,
50/60 Hz, IMAGE1 S compatible, autoclavable,
progressive scan, sinkable, gas- and plasma-sterilizable,
with integrated Parfocal Zoom Lens, focal length
f = 15–31 mm (2x), 2 freely programmable camera head buttons,
for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

Specifications:

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-ZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 104</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>299 g</td>
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<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, f = 15–31 mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>
Monitors

9619 NB  
19" HD Monitor,  
color systems PAL/NTSC, max. screen resolution 1280 x 1024, image format 4:3,  
power supply 100–240 VAC, 50/60 Hz,  
wall-mounted with VESA 100 adaption,  
including:  
External 24 VDC Power Supply  
Mains Cord

9826 NB  
26" FULL HD Monitor,  
wall-mounted with VESA 100 adaption,  
color systems PAL/NTSC,  
max. screen resolution 1920 x 1080, image format 16:9,  
power supply 100–240 VAC, 50/60 Hz  
including:  
External 24 VDC Power Supply  
Mains Cord
Monitors

KARL STORZ HD and FULL HD Monitors

<table>
<thead>
<tr>
<th>Input Name</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output Name</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
</tbody>
</table>

Signal Format Display:
- 4:3
- 5:4
- 16:9
- Picture-in-Picture
- PAL/NTSC compatible

Optional accessories:
- 9826 SF: Pedestal, for monitor 9826 NB
- 9619 SF: Pedestal, for monitor 9619 NB

Specifications:

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop with pedestal</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Product no.</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td>Brightness</td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td>Reaction time</td>
<td>5 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td>Mount</td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td>Weight</td>
<td>7.6 kg</td>
<td>7.7 kg</td>
</tr>
<tr>
<td>Rated power</td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td>Certified to</td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>
**AUTOCON® II 400 SCB**

**20535201-125** AUTOCON® II 400 High End, Set SCB

- power supply 220 - 240 VAC, 50/60 Hz,
- HF connecting sockets:
  - Bipolar combination, Multifunction,
  - Unipolar 3-pin + Erbe Neutral electrode combination 6.3 mm, jack and 2-pin,
- System requirements: SCB R-UI Software Release 20090001-43 or higher

including:

- **AUTOCON® II 400**, with KARL STORZ SCB
- Mains Cord
- SCB Connecting Cable, length 100 cm

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**Cold Light Fountain XENON 300 SCB**

**20133101-1** Cold Light Fountain XENON 300 SCB

- with built-in antifog air-pump, and integrated KARL STORZ Communication Bus System SCB
- power supply: 100 – 125 VAC/220 – 240 VAC, 50/60 Hz

including:

- Mains Cord
- Silicone Tubing Set, autoclavable, length 250 cm
- SCB Connecting Cord, length 100 cm

**20133027** Spare Lamp Module XENON

- with heat sink, 300 watt, 15 volt

**20133028** XENON Spare Lamp, only,

- 300 watt, 15 volt

---

**Fiber Optic Light Cable**

**495 NCS** Fiber Optic Light Cable,

- with straight connector, extremely heat-resistant, diameter 4.8 mm, length 250 cm

**495 NA** Fiber Optic Light Cable,

- with straight connector, diameter 3.5 mm, length 230 cm
**ENDOFLATOR® 40 with KARL STORZ SCB**

with High Flow Insufflation (40 l/min.)

**UI400S1**

**ENDOFLATOR® 40 SCB,**
Set, with integrated SCB module,
power supply 100 - 240 VAC, 50/60 Hz
including:
**ENDOFLATOR® 40**
Mains Cord, length 300 cm
SCB Connecting Cable, length 100 cm
Universal Wrench
Insufflation Tubing Set, with gas filter, sterile,
for single use, package of 5*

Subject to the customer’s application-specific requirements additional accessories must be ordered separately.

* This product is marketed by mtp.
For additional information, please apply to:

mtp medical technical promotion gmbh,
Take-Off Gewerbepark 46,
D-78579 Neuhausen ob Eck, Germany

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**HAMOU® ENDOMAT® with KARL STORZ SCB**

Suction and Irrigation System

**26331101-1**

**HAMOU® ENDOMAT® SCB,**
power supply 100 – 240 VAC, 50/60 Hz
including:
Mains Cord
5x HYST Tubing Set*, for single use
5x LAP Tubing Set*, for single use
SCB Connecting Cable, length 100 cm
VACUsafe Promotion Pack Suction*, 2 l

Subject to the customer’s application-specific requirements additional accessories must be ordered separately.

* This product is marketed by mtp.
For additional information, please apply to:

mtp medical technical promotion gmbh,
Take-Off Gewerbepark 46,
D-78579 Neuhausen ob Eck, Germany
Single Port Access Laparoscopy (SPAL) for Adnexal Pathologies

KARL STORZ AIDA® compact NEO advanced

Brilliance in documentation

Data Acquisition

Still images, video sequences and audio comments can easily be recorded during an examination or intervention by pressing the on-screen button, activating the footswitch, or pressing the camera head button.

All captured data are displayed on the right-hand side as a thumbnail preview to ensure the data have been generated. Patient data can be entered via an onscreen or standard keyboard. The system also offers the possibility to transfer all relevant patient data via a DICOM worklist or a link to the hospital information system (HIS) without requiring manual entry in the patient entry screen.

Flexible Review, Data Storage and Efficient Data Export

Captured still images or video files can easily be viewed, edited, or deleted on-screen before final storage. KARL STORZ AIDA® compact NEO efficiently stores all recorded data on DVD, CD, USB stick, external/internal drive, the relevant network and/or on a FTP server. It is also possible to save the data directly on the PACS and/or HIS servers via HL7/DICOM. Data that cannot be stored successfully remains in a cache until final archiving is possible.

Special Features:

- SD and HD signal support:
  - Y/C (S-Video)
  - Composite input
  - DVI-D input
- Picture-in-Picture function:
  Display of channel 2 (SD) in channel 1 (FULL HD)
- Resolution:
  - Still images 1920 x 1080 and SD
  - Videos 1080p, 720p and SD
- Interface package (DICOM/H7) included
- NEO Secure security software
- Recommended applications:
  - Universal (cart or OR1™) installation

20040913-EN* KARL STORZ AIDA® compact NEO advanced

Documentation system for digital storage of still images, video sequences and audio files, power supply 115/230 VAC, 50/60 Hz

* Available in the following languages:
DE, ES, FR, IT, PT, PL, RU, DK, SE, JP, CN

AIDA compact NEO: Recording screen

AIDA compact NEO: Patient data

AIDA compact NEO: Review screen
Equipment Cart

**Equipment Cart**
wide, high, rides on 4 antistatic dual wheels equipped with locking brakes 3 shelves, mains switch on top cover, central beam with integrated electrical subdistributors with 12 sockets, holder for power supplies, potential earth connectors and cable winding on the outside,

*Dimensions:*
- Equipment cart: 830 x 1474 x 730 mm (w x h x d),
- shelf: 630 x 510 mm (w x d),
- caster diameter: 150 mm

including:
- **Base module equipment cart,** wide
- **Cover equipment,** equipment cart wide
- **Beam package equipment,** equipment cart high
- 3x **Shelf,** wide
- **Drawer unit with lock,** wide
- 2x **Equipment rail,** long
- **Camera holder**

**Monitor Swivel Arm,**
height and side adjustable, can be turned to the left or the right side, swivel range 180°, overhang 780 mm, overhang from centre 1170 mm, load capacity max. 15 kg, with monitor fixation VESA 5/100, for usage with equipment carts UG xxx
Recommended Accessories for Equipment Cart

**UG 310**

**Isolation Transformer,**
200 V–240 V; 2000 VA with 3 special mains socket, expulsion fuses, 3 grounding plugs, dimensions: 330 x 90 x 495 mm (w x h x d), for usage with equipment carts UG xxx

**UG 410**

**Earth Leakage Monitor,**
200 V–240 V, for mounting at equipment cart, control panel dimensions: 44 x 80 x 29 mm (w x h x d), for usage with isolation transformer UG 310

**UG 510**

**Monitor Holding Arm,**
height adjustable, inclinable, mountable on left or right, turning radius approx. 320°, overhang 530 mm, load capacity max. 15 kg, monitor fixation VESA 75/100, for usage with equipment carts UG xxx