SINGLE-PORT LAPAROSCOPIC CHOLECYSTECTOMY
USING X-CONE AND REUSABLE HAND INSTRUMENTS

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Max Institute of Minimal Access, Metabolic and Bariatric Surgery
Max Super Specialty Hospital, New Delhi, India
The Max Institute of Minimal Access, Metabolic and Bariatric Surgery (MAMBS), the first of its kind in the Asia-pacific subcontinent, has been expanding the horizons of Minimal Access Surgery for over two decades. The institute has been awarded the special title ‘Founder’ and accredited as an International Centre of Excellence for Bariatric Surgery by the Surgical Review Corporation (SRC), USA and for Endohernia Surgery by Asia Pacific Hernia Society (APHS), Singapore. The institute is equipped with state-of-the-art technology and infrastructure to provide quality services in Minimal Access, Metabolic and Bariatric Surgery. Academics and training programmes are one of the foremost priorities at the Institute.

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SINGLE-PORT LAPAROSCOPIC CHOLECYSTECTOMY

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Pradeep CHOWBEY, Director

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tation and/or peer-reviewed medical literature.
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**Patient Selection**

Since single-port laparoscopic cholecystectomy (SPLC) is a new variant of an established laparoscopic technique, careful patient selection is highly recommended in initial stages of the learning curve, which, based on our experience with SPLC, is short (about 20 patients).

**Indications**

- Patients between 16–80 years of age with uncomplicated cholelithiasis.
- ASA (American Society of Anaesthesiologists) Grades I and II.
- BMI < 35.

**Contraindications**

- Patients with acute cholecystitis, empyema and small contracted gallbladder (Relative).
- Patients with choledocholithiasis.
- Complex pathology like Mirizzi syndrome, perforation and cholecystoenteric fistula.
- Gallstone > 2.5 cm in size on ultrasonography.
- Morbidly obese patients (BMI > 35).
- Patients with previous abdominal surgery.
- Patients with ASA Grades IV and V.
- Coagulopathies.
- Cirrhosis.

**Introduction**

Minimal Access Surgery (MAS) has been established as a safe and feasible operating technique, that offers the benefit of less scarring, reduced trauma and early return to normal activity. At present, surgical techniques are aimed at reducing scars and trauma inherent in the type of surgical access. In the pursuit of performing “scarless surgery”, several advancements have been made in the field of MAS. NOTES (Natural Orifice Transluminal Endoscopic Surgery) and S-PORTAL (Single-Portal Access) are good examples of such techniques. In principle, Single-Port Surgery performs the same procedure as multiport MAS, using only one incision, mostly at the umbilicus. Use of this technique has spread rapidly over the last few years due its relative similarity with conventional MAS. Today, S-PORTAL is being performed for a wide spectrum of advanced laparoscopic procedures across surgical specialties: colorectal resections, bariatric operations, nephrectomies, cholecystectomies and splenectomies. There has been a remarkable thrust in medical engineering to make this access technique as safe and feasible as possible.

Also, there is ongoing evolution and improvement in the technology underlying S-PORTAL.

This encompasses different surgical techniques depending on the method of access, including single incision single-port surgery, single site multiple port surgery and single incision direct access surgery.

The instruments used for S-PORTAL have been continuously refined and improved in the past few years. The new design features included in the development of proximally curved coaxial instruments allow for limited triangulation and retraction without the need for suspension sutures or retractors. Single-Port Laparoscopic Cholecystectomy (SPLC) is one of the most commonly performed S-PORTAL procedures. It has increasingly gained in popularity due to its safety, feasibility and patient-friendly outcomes.
Equipment and Hand Instruments

The equipment and hand instruments used in Single Incision Laparoscopic Surgery (SILS) are essentially similar to those used in traditional multiport laparoscopic surgery. A port within the X-CONE is used to maintain pneumoperitoneum and a common passage allows both telescope and hand instruments to be inserted and changed. Instrument crowding outside a single-port may occasionally cause some ergonomic discomfort and limitation of movement. The use of streamlined laparoscopes with "chip-on-stick" technology, light cord adaptors, streamlined and lower profile hand instruments and different lengths of instruments are some measures that aid in reducing instrument crowding outside the port.

Access Device (X-CONE)

We use the X-CONE (KARL STORZ Tuttlingen, Germany) as an access device. X-CONE is a reusable access device for transumbilical laparoscopy (Fig. 1). The design offers high instrument mobility, stable instrument guidance and comfortable insertion technique. Three working channels permit the introduction of instruments up to 12.5 mm in size (clip applicator, stapler). Special curved instruments permit adequate triangulation, a good overview of the operative site and exact maneuvers to be performed both inside and outside the body. The use of a dedicated, extended-length telescope reduces the risk of instrument collision and creates the perfect conditions for optimal image quality. Among the main advantages of the X-CONE single-port device are its reusability and low recurring expenditures.

Telescope

A 5.5-mm extra-long telescope (KARL STORZ Tuttlingen, Germany) with a special right angled light cable adaptor is used (Figs. 2, 3). Use of the adaptor reduces the risk of instrument collisions and facilitates creating optimal ergonomic working conditions. It is compatible with high-resolution, truecolor 3-chip HD cameras IMAGE 1 HD.

1 X-CONE Single-Portal Surgery Access System (KARL STORZ Tuttlingen, Germany).

2 Telescope with freely rotatable light cord adaptor.

3 Extended-length telescope, diameter 5.5 mm, length 50 cm (KARL STORZ Tuttlingen, Germany).
Video Equipment

Standard high-definition technology is used for video equipment (Fig. 4), (Image 1 HD). The HD camera systems are equipped with three CCD chips that support the 16:9 input format and capture images with a resolution of 1920 x 1080 pixels (Fig. 5).

Hand Instruments

In our clinical practice, a pre-bent, curved, roticulating grasper is guided by the surgeon’s left hand to retract Hartmann’s pouch. A straight Maryland dissector, held in the right hand of the surgeon, is used for well-controlled and precise dissection (Fig. 6). The only different hand instrument used in SPLC is curved, roticulating Hartmann pouch grasper. The rest of the hand instruments are the same as those used for traditional multiport laparoscopic cholecystectomy (MPLC). The clip applier used for SPLC is the standard 10-mm clip applier, 36 cm in length, loaded with titanium clips (medium/large).

Operating Room Setup

The operating room setup for SPLC is depicted in Fig 7.
Patient Positioning

The patient is placed supine in modified lithotomy position (French position). The left arm is outstretched and the right arm is tucked to the side of the patient (Fig. 8). The patient is placed in the neutral position for initial peritoneal insufflation using a Veress needle that is inserted at the umbilicus. Once the X-CONE is in position, the patient is placed at 30° reverse Trendelenburg position and rotated to obtain a right-sided elevation.

Positioning of the Surgical Team

The operating surgeon stands between the legs of the patient. The first assistant stands to the left of the patient and the scrub nurse to the right. The video monitor is placed in front of the operating surgeon (Fig. 9).

Assembling the X-CONE

The sealing device of the X-CONE is assembled by fixing the reducer (11/5 mm) and the Luer-Lock connector with stopcock for insufflation (Fig. 10).
Initial Access

Surgical access is obtained through a periumbilical incision from 12° clock to 6° clock position on the left side (Figs. 11, 12). Pneumoperitoneum is created with a Veress needle and insufflation unit that allows to maintain an intrabdominal pressure of up to 15 mmHg (Fig. 13). A 10-mm standard laparoscopy port is inserted and a diagnostic laparoscopy is performed to confirm feasibility of performing SPLC (Figs. 14, 15). The 10-mm port is removed, the margins of the fascial defect are held with Allis forceps and the fascial incision extended to about 2 cm. Stay sutures are taken on either fascial margin to facilitate proper closure of the fascial defect at the end of surgery (Fig. 16).
Placement of X-CONE

The anterior abdominal wall is elevated with the help of stay sutures. The first half of the X-CONE is placed into the peritoneal cavity whilst maintaining upward traction on the anterior abdominal wall (Fig. 17). The second half is placed in a similar fashion (Figs. 18, 19). Both halves of the X-CONE are maneuvered into the correct alignment when the ball bearings click into place. The two halves of the outer working access of the X-CONE are coupled with each other to achieve a funnel-shaped working channel (Fig. 20). The insufflation stopcock should be located at 12 o’clock position. If there is difficulty in approximating the two halves of X-CONE together, the skin and fascial incisions should be extended. The sealing assembly is mounted to the top of the X-CONE such that the central larger port and the smaller ports on either side are positioned in a horizontal plane between 3 o’clock and 9 o’clock positions (Figs. 21, 22). Peritoneal insufflation is commenced using an abdominal pressure of 12 mmHg.
Utilization of Ports in X-CONE

The utilization of ports in X-CONE is depicted in Fig. 23.

1. X-CONE Single-Portal Surgery Access System
2. Surgeon’s right-hand instrument, Maryland dissector (KELLY).
3. Surgeon’s left-hand instrument (Hartmann pouch retractor).
5. 5-mm, 30° extended-length telescope with in-line light cord adaptor.

Operating Technique

The telescope is inserted through the right lateral port. A diagnostic laparoscopy is performed again to exclude bowel/omental injury during introduction of X-CONE. A 3-mm straight grasping forceps is inserted through the lower port to retract the gallbladder fundus (Fig. 24). The handle of the grasper is fixed near the flank so as to function as a self-retaining retractor (Fig. 25). Subsequently, the curved pre-bent grasper used for retraction of the Hartmann pouch is inserted through the left lateral port (Fig. 26). The Hartmann pouch is grasped and elevated upwards and medially. This brings the posterior aspect of Hartmann pouch with the posterior peritoneum in view. A straight Maryland dissector is inserted through the central port for dissection (Fig. 27). The posterior peritoneum over the Hartmann pouch is picked up with Maryland dissector and incised (Fig. 28).
Single-Port Laparoscopic Cholecystectomy Using X-CONE and Reusable Hand Instruments

Dissection is commenced posteriorly next to the wall of the gall bladder. Initial posterior dissection during cholecystectomy is safe as dissection separates the gallbladder from the porta hepatis. The cystic artery and cystic duct are dissected by a posterior approach. The entire triangle of Calot is dissected and exposed. This serves to obtain a “critical view of safety” by creating a large window up to high on the liver bed (Fig. 29). The anterior peritoneum is also dissected with the posterior approach. It is important to create a big window and obtain the “critical view of safety”.

Once the biliary anatomy has been delineated, clips are applied on the cystic artery and cystic duct. A standard 10-mm clip applier is used to deploy titanium clips (2 proximally, 1 distally) on cystic artery and cystic duct (Figs. 30–34). The gallbladder is removed from its bed with the help of a diathermy hook using monopolar cautery (Figs. 35, 36).
The gallbladder bed is inspected to ensure hemostasis and rule out bile leakage (Fig. 37). If required, the gallbladder is placed in an extraction bag for retrieval. The gallbladder is positioned within the X-CONE and extracted after removal of the sealing device (Fig. 38).

The X-CONE is disassembled and the two halves are removed from the umbilical wound (Fig. 39). The defect in the fascial sheath is closed by means of interrupted Vicryl sutures under direct vision (Figs. 40, 41). The skin is closed with a continuous subcuticular suture (3-0 monocryl) (Figs. 42, 43).
Discussion

In our experience, the main advantages of SPLC are improved cosmesis and greater patient satisfaction. The rationale of SPLC is to reduce the surgical access trauma and to provide nearly “scarless” surgery as the access wound is most often concealed in the natural umbilical scar. Based on the authors’ experience, SPLC is deemed safe and feasible. For SPLC to be considered a standard laparoscopic technique, it should provide a high safety profile and also afford additional benefits to the patient. The advantage of the X-CONE single-port device is that it is reusable and has low recurring expenditure. The use of X-CONE involves increased initial expenditures owing to the acquisition of an extended-length 5-mm telescope, a curved grasper and longer operating times during initial stages of the SPLC learning curve. It is expected that SPLC is gaining in acceptance among experts in the field, a tendency that could be even more enhanced by patient demand / expectation and propelled by medical industry seeking to introduce new equipment and technology.

The advantage of SPLC is that conversion to a standard laparoscopic procedure is always possible and can be readily performed. During SPLC, conversion may be performed to traditional MPLC or by placing one to two auxiliary rescue ports. On initial diagnostic laparoscopy, if the gallbladder is found to be unsuitable for SPLC, a traditional 4-port laparoscopic cholecystectomy may be performed. Alternatively, if an adverse event arises during the SPLC procedure (bleeding, unclear anatomy, inadequate retraction), one or more auxiliary rescue ports may be used. The rescue ports are most commonly sited on the right flank.

In view of the fact, that SPLC is a variation of an established surgical technique (laparoscopy), the procedure involves an initial learning curve. In our experience, the initial operating time was significantly higher in patients treated with SPLC. As the number of patients undergoing SPLC increased, a significant reduction in operating time was observed. In our experience, operating time considerably decreased after 20 SPLC procedures. This corroborates with the reported “learning curve” in literature.

During surgery, triangulation of instruments usually affords central vision while maneuvering one operating instrument on either side. Triangulation ensures the most comfortable working position for the surgeon in terms of ergonomics. Triangulation is a key principle of conventional surgery and is most often possible in traditional MPLC. However, it requires some practice and training to achieve a certain degree of triangulation in SPLC. In SPLC, the telescope and hand instruments are oriented almost parallel to each other. The distal curve of the grasper on the Hartmann pouch and the spatial alignment of the telescope provide a certain degree of triangulation at the site of surgery.

Instrument crowding outside the single-port may occasionally entail counterintuitive maneuvers and limitation of movement. In traditional multiport laparoscopic surgery, the port acts as a true fulcrum enabling a wide range of movements. However, in SPLC, the single port acts more like a piston wherein movements are restricted to “in-and-out” (without “side-to-side” movements). Some important measures need to be taken that aid in reducing instrument crowding outside the port. Some of these measures include: use of streamlined laparoscopes with “chip-on-stick” technology, use of light cord adaptors (so that the light cord is on-axis with the telescope), low-profile hand instruments and use of hand instruments of different lengths.

SPLC involves several technical challenges. During introduction and placement of the access port, there is a certain risk of injury to the underlying bowel. This can be avoided by placing stay sutures and elevating the abdominal wall while manipulating the port. During the initial phase of dissection while performing cholecystectomy, the duodenum forms a direct inferior relation. Therefore, all hand instruments have to be passed over the anterior wall of the duodenum to reach the gallbladder. This makes the anterior wall of duodenum prone to thermal injury while using diathermy. Also, there is loss of triangulation of instruments in SPLC. The approach for dissection in SPLC is necessarily from posterior. This may be an advantage as posterior dissection during cholecystectomy is safe in our experience. Since it is difficult to rotate the Hartmann pouch to provide an anterior view, the anterior peritoneum also needs to be divided from the posterior approach.

In SPLC, the telescope needs to be inserted from the right lateral port. The gallbladder fundus needs to be retracted using a 3-mm grasper that is inserted through the lower port. The handle of this grasper is fixed to make it self-retaining and thus reduce instrument crowding outside the X-CONE. A curved pre-bent roticulating grasper is used from the left lateral port. The distal curve of this grasper ensures that it does not obstruct the surgeon’s view of the operative field and also provides a certain degree of triangulation in the surgical field. In terms of ergonomics, it is easier to use a curved grasper because its position has to remain fixed and steady for a larger part of the operation. A straight Maryland dissector is used via the central working channel for controlled and precise dissection as it is important to use a familiar hand instrument here.

Single-port surgical procedures are based on the principle of minimizing access while using dedicated equipment and hand instruments for surgical intervention. It will require ongoing research and further developments to help us provide the “best” access that causes minimal inherent trauma. It can be expected that once this objective has been achieved, we shall then think in terms of devising instruments that allow to perform the surgical procedure under optimized ergonomic conditions. Further developments in robotics appear to be the next logical step forward.

Acknowledgement

Grateful acknowledgement to Dr Khoobsurat Najma, Medical writer, Max Institute of Minimal Access, Metabolic and Bariatric Surgery for compiling and editing the scientific content of this manuscript.

The authors are thankful to Ms. Tripta Sharma, Mr. Manish Kumar, Ms. Aenu Batra and Mr. Pankaj Gupta for technical assistance and secretarial support.
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

HOPKINS II® 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
**CLICK\linee Grasping Forceps**

35421 DFU

**CLICK\linee KELLY Dissecting and Grasping Forceps**

33321 MD

**CLICK\linee REDDICK-OLSEN Dissecting and Grasping Forceps**

30332 ULG
CLICKliné Hook Scissors

34321 EH  CLICKliné Hook Scissors, rotating, dismantling, with connector pin for unipolar coagulation, with irrigation connection for cleaning, single-action jaws, size 5 mm, length 36 cm, including:
Plastic Handle, insulated, without ratchet
Outer Sheath, insulated
Scissors Insert

Suction and Irrigation Tube

26173 BN  Suction and Irrigation Tube, anti-reflex surface, with two-way stopcock, for single hand control, size 5 mm, length 36 cm

Clip Applicator

26173 BN  Clip Applicator, rotating, dismantling, for ligating clips 26060 AL (medium-large), with ratchet to lock the jaw part holding the clip, including:
Metal Handle with ratchet
Metal Outer Tube
Insert for ligating clips 26060 AL

30460 AL  PILLING-WECK Titanium-Clips, medium-large, box with 16 sterile cartridges, 10 clips each, for use with applicators 30443 LR, 30444 LR and 26060 LR

Please note:
The use of other clips than indicated above can lead to damage of the mouthpiece.
Coagulating and Dissecting Electrode

26778 UF

Coagulating and Dissecting Electrode, L-shaped, insulated, with connector pin for unipolar coagulation, size 5 mm, length 43 cm

DESCHAMPS Ligature Needle

800001

DESCHAMPS Ligature Needle, curved to right, length 20 cm

Spare Part

23020 SA

X-CONE Sealing, including:
- 1 x sealing
- 1 x introducer sleeve
- 4 x introducer
- 4 x silicone leaflet washer
- 4 x seal bonnet (50/2,6)
- 4 x seal bonnet (50/4)
- 1 x silicone leaflet washer
- 1 x gaiter sealing cap, 5 mm
- 1 x gaiter sealing cap, 10 mm
- 1 x gaiter sealing cap, 12 mm
**IMAGE 1 HD**
FULL HD Camera Control Unit

**22 2020 11U110** IMAGE 1 HD Camera Control Unit SCB, with ICM module

for use with IMAGE 1 FULL HD three-chip camera heads, max. resolution 1920 x 1080 pixels, with integrated ICM (Image Capture Module), KARL STORZ-SCB and digital Image Processing Module, power supply 100 – 240 VAC, 50/60 Hz

including:
- Mains Cord
- 2x Connecting Cable, for controlling peripheral units
- DVI-D Connecting Cable
- SCB Connecting Cable
- Keyboard, with US English character set
- 2x KARL STORZ USB Stick, 4 GB

**22 2020 11U1** IMAGE 1 HD Camera Control Unit SCB

for use with IMAGE 1 FULL HD three-chip camera heads, max. resolution 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
- 2x SCB Connecting Cable
- DVI-D Connecting Cable
- Connecting Cable, for controlling peripheral units
- Keyboard, with US English character set

**Specifications:**

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**IMAGE1 HUB™ HD**
FULL HD Camera Head

- **IMAGE1 HUB™ HD**
- **H3-Z**

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For use with IMAGE 1 HUB™ HD Camera Control Unit SCB 22 2010 11U1xx and IMAGE1 HD Camera Control Unit SCB 22 2020 11U1xx
KARL STORZ FULL HD Monitors

KARL STORZ HD and FULL HD Monitors

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<td>RGB/VS/VGA</td>
<td>1x</td>
<td>1x</td>
<td>2x</td>
</tr>
<tr>
<td>S-Video</td>
<td>1x</td>
<td>1x</td>
<td>2x</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>1x</td>
<td>1x</td>
<td>2x</td>
</tr>
<tr>
<td>Outputs:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>S-Video</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
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</tr>
<tr>
<td>Signal Format Display:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4:3</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tbody>
</table>

The following accessories are included:

- Mains Cord
- External 24VDC Power Supply
- Signal cables: DVI-D, BNC

Optional accessories:

- 9626 SF Pedestal, for 96XX monitor series

Specifications:

<table>
<thead>
<tr>
<th>KARL STORZ 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>Wall-mounted with 100 adaption</td>
<td>9619 NB</td>
<td>9626 NB/NB-2</td>
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<tr>
<td>Brightness</td>
<td>280 cd/m²</td>
<td>400 cd/m²</td>
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<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
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<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.30 mm</td>
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<tr>
<td>Reaction time</td>
<td>12 ms</td>
<td>12 ms</td>
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<tr>
<td>Contrast ratio</td>
<td>700:1</td>
<td>700:1</td>
</tr>
<tr>
<td>Mount</td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td>Weight</td>
<td>10 kg</td>
<td>14 kg</td>
</tr>
<tr>
<td>Rated power</td>
<td>120 W</td>
<td>120 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>0–40°C</td>
<td>0–40°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. 80%</td>
<td>max. 80%</td>
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<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>699 x 445.6 x 87.5 mm</td>
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<tr>
<td>Power supply</td>
<td>85–264 VAC</td>
<td>85–264 VAC</td>
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</tbody>
</table>
Data Management and Documentation
KARL STORZ AIDA® compact NEO (HD/SD)
Brilliance in documentation continues!

AIDA® compact NEO from KARL STORZ combines all the required functions for integrated and precise documentation of endoscopic procedures and open surgeries in a single system.

Data Acquisition
Still images, video sequences and audio comments can be recorded easily during an examination or intervention on command by either pressing the on-screen button, via voice control, foot switch pedal or the camera head button. All captured images will be displayed on the right hand side as a “thumbnail” preview to confirm that the still image has been generated.

The patient data can be entered via the on-screen keyboard or a standard keyboard.

Flexible post editing and data storage
Captured still images or video files can be previewed before final storage or can be edited and deleted easily in the edit screen.

Reliable storage of data
- Digital storage of all image, video and audio files on DVD, CD-ROM, USB stick, external/internal hard-drive or by archiving data to the hospital server via DICOM/HL7
- Buffering ensures data backup if temporary storage is not possible
- Constant access to created image, video and audio files for medical documentation, patient records and for research and teaching purposes

Efficient data archiving
Once a procedure has been completed, KARL STORZ AIDA® compact HD/SD saves all captured data efficiently on DVD, CD-ROM, USB stick, external hard-drive, internal hard-drive and/or the respective network on the FTP server. Another interesting option is to store the data directly on the PACS/HIS server, using the interface package AIDA® communication HL7/DICOM.

Data that could not be archived successfully is maintained in a buffer memory until final storage. A two-line report header and a logo can be added to the default setting and thus tailored to the individual needs of the customer.

Multisession and Multipatient
Efficient storage of data collected from multiple patients/multiple treatment sessions via DVD, CD-ROM or a USB stick.
Single-Port Laparoscopic Cholecystectomy
Using X-CONE and Reusable Hand Instruments

**Functions and capabilities**

● Still images up to 1920 x 1080 can be taken with both systems (advanced/standard). Videos can be recorded at up to 1080p with the advanced version and up to 720p with the standard version (through HD-SDI)*

● Storage of audio files is available in both systems

● Includes DICOM/HL7 interface package

● Printing from the recording area (individual image with meta data)

● Burns DVDs, reads blue-ray

● AIDA Restore Configuration supports the simple import and export of system settings

● Reference screen with new QuickView (favorite folder)

● Video settings (contrast, etc.) can be made separately for all channels

● GUI adjustment options

● Compressed DICOM

● Support of OR1™ CHECKLIST V1.1

● Improved support of 15" screens with OR1™ CHECKLIST installation

● Scalable watermark

● High-quality function and switching of image and video quality without going to settings

● Sterile, ergonomic operation via touch screen, camera head buttons, and/or foot switch

● Data export on DVD, CD ROM, or USB stick, multi-session and multi-patient network storage option

● Automated generation of standard reports

● Systems approved for use in the OR environment according to EN 60601-1

● Compatible with the KARL STORZ Communication Bus (SCB) and with KARL STORZ OR1™ AV NEO

● KARL STORZ AIDA® compact advanced/standard represents an attractive, digital alternative to video printers, video recorders, and dictation devices

* A separate converter is required for DVI-IN use.

**200409 12** KARL STORZ AIDA® compact NEO standard, documentation system for digital storage of still images, video sequences and audio files, power supply: 115/230 VAC, 50/60 Hz

**200409 13** 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

---

**Specifications:**

<table>
<thead>
<tr>
<th>Video Systems</th>
<th>- PAL</th>
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<tbody>
<tr>
<td></td>
<td>- NTSC</td>
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<tr>
<td>Signal Inputs</td>
<td>- S-Video (Y/C)</td>
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<tr>
<td></td>
<td>- Composite</td>
</tr>
<tr>
<td></td>
<td>- RGBS – only in standard version</td>
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<tr>
<td></td>
<td>- SDI</td>
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<tr>
<td></td>
<td>- HD-SDI – only in standard version</td>
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<tr>
<td></td>
<td>- DVI – only in standard version</td>
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<tr>
<td>Image Formats</td>
<td>- JPG</td>
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<td>- BMP</td>
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<td>Video Formats</td>
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<td>Audio Formats</td>
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<td>Storage Media</td>
<td>- DVD+R</td>
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<td>- DVD+RW</td>
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<td>- DVD-R</td>
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<td>- CD-R</td>
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<td>- CD-RW</td>
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<tr>
<td></td>
<td>- USB stick</td>
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Notes:
Notes:
WITH COMPLIMENTS OF KARL STORZ — ENDOSKOPE