MINILAPAROSCOPY
Cholecystectomy and Hernia Repair

Gustavo L. CARVALHO
Eduardo BONIN
Marcelo LOUREIRO
Flavio MALCHER
MINILAPAROSCOPY
Cholecystectomy and Hernia Repair

Part I: Minilaparoscopic Cholecystectomy (MLC)
— The Clipless Technique —
Gustavo L. CARVALHO, MD, PhD
Eduardo BONIN, MD, MSc

Part II: Minilaparoscopic Hernioplasty
Using Both TAPP and TEP
— The Combined Technique —
Gustavo L. CARVALHO, MD, PhD
Marcelo LOUREIRO, MD, PhD
Flavio MALCHER, MD

1 Oswaldo Cruz University Hospital and UNIPECLIN
Faculty of Medical Sciences, University of Pernambuco
Recife, Brazil
2 Jacques Perissat Institute (IJP) and Positivo University
Curitiba, Brazil
3 Federal University of the State of Rio de Janeiro
Unirio Gaffree Guinle University Hospital
Rio de Janeiro, Brazil

Acknowledgements
A special word of gratitude goes to
Eduardo MORENO PAQUENTIN (MD, FACS) and
Jorge LAZO DE LA VEGA ESPINOZA (MD, FACS)
for helping us with the translation
and revision of the Spanish edition.
Important notes:
Medical knowledge is ever changing. As new research and clinical experience broaden our knowledge, changes in treatment and therapy may be required. The authors and editors of the material herein have consulted sources believed to be reliable in their efforts to provide information that is complete and in accord with the standards accepted at the time of publication. However, in view of the possibility of human error by the authors, editors, or publisher, or changes in medical knowledge, neither the authors, editors, publisher, nor any other party who has been involved in the preparation of this work warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for the results obtained from use of such information. The information contained within this booklet is intended for use by doctors and other health care professionals. This material is not intended for use as a basis for treatment decisions, and is not a substitute for professional consultation and/or use of peer-reviewed medical literature.

Some of the product names, patents, and registered designs referred to in this booklet are in fact registered trademarks or proprietary names even though specific reference to this fact is not always made in the text. Therefore, the appearance of a name without designation as proprietary is not to be construed as a representation by the publisher that it is in the public domain. The use of this booklet as well as any implementation of the information contained within explicitly takes place at the reader’s own risk. No liability shall be accepted and no guarantee is given for the work neither from the publisher or the editor nor from the author or any other party who has been involved in the preparation of this work. This particularly applies to the content, the timeliness, the correctness, the completeness as well as to the quality. Printing errors and omissions cannot be completely excluded. The publisher as well as the author or other copyright holders of this work disclaim any liability, particularly for any damages arising out of or associated with the use of the medical procedures mentioned within this booklet. Any legal claims or claims for damages are excluded.

In case any references are made in this booklet to any 3rd party publication(s) or links to任何3rd party websites are mentioned, it is made clear that neither the publisher nor the author or other copyright holders of this booklet endorse in any way the content of said publication(s) and/or web sites referred to or linked from this booklet and do not assume any form of liability for any factual inaccuracies or breaches of law which may occur therein. Thus, no liability shall be accepted for content within the 3rd party publication(s) or 3rd party websites and no guarantee is given for any other work or any other websites at all.

Minilaparoscopy – Cholecystectomy and Hernia Repair
Part I: Minilaparoscopic Cholecystectomy (MLC) – The Clipped Technique
Gustavo L. Carvalho, MD, PhD
Eduardo Bonin, MD, MSc

Part II: Minilaparoscopic Hernioplasty Using Both TAPP and TEP – The Combined Technique
Gustavo L. Carvalho, MD, PhD
Marcelo Loureiro, MD, PhD
Flavio Malcher, MD

1) Oswaldo Cruz University Hospital and UNIPECLIN,
Faculty of Medical Sciences, University of Pernambuco,
Recife, Brazil
2) Jacques Perissat Institute (IJP) and Positivo University, Curitiba, Brazil
3) Federal University of the State of Rio de Janeiro – Unirio Gaffree Guinle
University Hospital, Rio de Janeiro, Brazil

Correspondence address of the author:
Gustavo L. Carvalho, MD, PhD
UNIPECLIN e Departamento de Cirurgia, Hospital Universitário Oswaldo Cruz (HUOC), Faculdade de Ciências Médicas (FCM), Universidade de Pernambuco (UEPE), Recife, Brazil
Clinica Cirurgica Videolaparoscopica Gustavo Carvalho
Av. Visconde de Jequitinhonha, 1.144, 9º andar, Sala 910 – Boa Viagem – Recife/PE
CEP: 51030-020, Brazil
Telephone: +55 (81) 2129 1910 / 3462 4162
Cell phone: +55 (81) 99908 1060 / +55 (81) 99705 6342
E-mail: atendimento@gustavocarvalho.med.br
www.gustavocarvalho.med.br

All rights reserved.
1st edition 2013
© 2015 Endo Press GmbH
P.O. Box, 78503 Tuttlingen, Germany
Phone: +49 (0) 74 61/1 45 90
Fax: +49 (0) 74 61/708-529
E-mail: Endopress@t-online.de

No part of this publication may be translated, reprinted or reproduced, transmitted in any form or by any means, electronic or mechanical, now known or hereafter invented, including photocopying and recording, or utilized in any information storage or retrieval system without the prior written permission of the copyright holder.
Editions in languages other than English and German are in preparation. For up-to-date information, please contact Endo Press GmbH at the address shown above.

Design and Composing:
Endo Press GmbH, Germany

Printing and Binding:
Staubb Druck + Medien AG
Max-Planck-Straße 17, 78713 Schramberg, Germany

ISBN 978-3-89756-545-6
## Contents

Part I: Minilaparoscopic Cholecystectomy (MLC) – The Clipless Technique  
1.0 Introduction  .................................................... 6  
1.1 The New Low-Friction Mini Trocar System  ....................... 6  
1.2 Why Minilaparoscopy?  ........................................ 9  
2.0 Minilaparoscopic Cholecystectomy (MLC)  .......................... 11  
2.1 Surgical Technique  ........................................... 12  
2.2 Results  ............................................................ 18  
2.3 Conclusions  ..................................................... 21  
2.4 References  ..................................................... 22  

Part II: Minilaparoscopic Hernioplasty Using Both TAPP and TEP –  
The Combined Technique  ............................................ 23  
3.0 Minilaparoscopic Hernioplasty  .................................... 23  
3.1 Why Combine TAPP and TEP for Minilaparoscopic Hernioplasty?  ............................. 23  
3.2 Room Setup and Trocar Positions  ................................ 24  
3.3 Surgical Technique  ........................................... 25  
3.4 Casuistics and Results  ........................................ 30  
3.5 Use of ENDOCAMELEON® in MLC and Hernia Repair  .............. 31  
3.6 Conclusions  ..................................................... 31  
3.7 References  ..................................................... 32  

Recommended Sets for  
Minilaparoscopic Clipless Cholecystectomy  
and Minilaparoscopic Inguinal Hernia Repair  
IMAGE1 S™ Camera System and KARL STORZ Monitors  .............. 33
Part I: Minilaparoscopic Cholecystectomy (MLC)  
The Clipless Technique

1.0 Introduction

Minimal access surgery is an improved surgical technique enabling surgeons to perform complex procedures causing less surgical trauma and consequently less pain, leading to a faster recovery. Other benefits are improved cosmetics from diminished or hidden marks of the surgical procedure.

Minilaparoscopy (in the following termed as ‘Mini’) has emerged as a natural advancement of laparoscopy and was first presented in 1996 with a proposal to diminish surgical trauma by reducing the diameter of standard laparoscopic instruments. Using the minilaparoscopic cholecystectomy procedure as a model, the first instruments designed for that purpose, were not cost-effective because they involved the use of expensive, fragile miniature scopes and a lot of disposable items. This surgical instrument setup made mini unpopular and applicable to only a minority of laparoscopic surgeons. At this time, claimed advantages of this technique were less parietal damage, less pain, faster recovery, shorter hospitalization, early return to daily activities and even better cosmetic results when compared to laparoscopy.

Ten years later, with the advent of Natural Orifice Translumenal Endoscopic Surgery (NOTES) and more recently, Single Incision Laparoscopic Surgery (SILS), reduced trauma and better cosmetic outcomes where accomplished by eliminating or reducing the number of operative ports. Novel access sites (i.e. transvaginal) and novel instruments allowed transvisceral and transumbilical procedures utilizing only one port for inserting all surgical instruments, thus inaugurating the ‘reduced portal surgery era’. Although conceptually ideal for achieving a no-scar surgery, these techniques are currently mostly performed using at least one extra surgical (mini-)port that allows to maneuver laparoscopic instruments for organ retraction. As some of these techniques became feasible, there are still concerns regarding costs and safety for its widespread use.

Meanwhile, and aside from this trend, minilaparoscopy have been used over the years around the world for performing a variety of surgical procedures in a safe and consistent fashion. Currently, minilaparoscopic cholecystectomy (MLC) is the procedure where the mini technique is most often used. Mini has also been used in a series of procedures, such as appendectomy, liver, kidney and mesenteric cysts, inguinal hernia repair, lumbar sympathectomy and reflux disease, among others. Mini instruments have also been widely used in gynecology. For thoracic procedures, where it should be termed minithoracoscopy, mini enables thorax sympathectomy and biopsies for example. The employment of mini in pediatric surgery has been accepted with enthusiasm, a fact that is reflected in many different procedures.

Interestingly, with the advent of the reduced port surgery era, minilaparoscopy regained attention as an attractive option for improving cosmetics while preserving some valuable laparoscopic principles such as instrument triangulation. Despite its advantages, for some surgeons already performing minilaparoscopy for years, minilaparoscopic instruments could be improved for better performance at low cost, thus allowing minilaparoscopy to be an even more attractive technique.

1.1 The New Low-Friction Mini Trocar System

Current minilaparoscopic instrumentation comprises instruments sized 2.5–3.5 mm in diameter. The mini trocars currently available on the market, are a miniaturization of the traditional laparoscopic trocars typically incorporating a double tier sealing set up that is composed of a proximal rubber sealing and an internal mechanical valve. These trocars have always been perceived as troublesome for the practicing minilaparoscopic surgeon, since they are easily dislocated from the surgical site during procedures. Moreover, variable force is needed for overcoming the considerable trocar-instrument friction. Most of the friction force is attributed to the sealing and valve mechanism. In order to increase the precision of movement and decrease surgical stress during mini procedures, the new low-friction KARL STORZ mini trocar has been developed. No valve and no seal is used minimizing usual friction forces between trocar and instruments. This special trocar was designed to resemble a long needle, and to precisely fit the corresponding 3-mm diameter instruments. The low-friction trocar system features a cannula longer than that of traditional mini trocars.
Minilaparoscopic Cholecystectomy (MLC) – The Clipless Technique

Unlike traditional trocar systems, a precisely diameter-adjusted conic blunt-tip insert has been found to produce less trauma while passing through muscle layers and skin. In the new mini trocar system, the remaining instrument-trocar lumen is minimal (Fig. 1), therefore eliminating the need for an additional sealing mechanism to prevent gas loss (measured as < 0.15 l/min per trocar) (Figs. 2, 3).

The long tapered-tip trocars prevent its dislocation even in thin patients and are well-suited to the idea of a less-scar, less-trauma approach. To facilitate insertion, the stylet is locked using a Luer-lock connector that may also be used for suction or gas insufflation, which is particularly useful for creating operating fields such as required for preperitoneal endoscopic hernia repair and lumbar sympathectomies. A funnel cap, included in the scope of supply, can be attached to the Luer-lock in order to facilitate exchange of instruments (Fig. 2).

Mini trocar insertion (Low-friction mini trocar with dilating tip). A pinpoint skin incision is made with a scalpel (a). Skin incision dilation and insertion of the trocar (b). With the funnel cap being attached to the trocar inlet, forceps insertion is facilitated (c, d). The trocar may alternatively be used without the cap, however forceps exchange may then be more difficult (e). (f) Mini trocars and forceps in action during a routine cholecystectomy.
The novel mini trocar is precisely engineered for reducing the friction forces between the trocar and the mini instruments, thus significantly diminishing trocar movement, dislocation and reinsertions, consequently reducing skin trauma and thus improving cosmetics results (Figs. 3, 4). Moreover, a great improvement has also been realized with regard to precision of surgical gestures during dynamic surgical tasks (e.g. suturing) resulting in reduced stress and higher effectivity.

The use of a low-friction trocar eliminates the need for preventing inadvertent trocar dislocation (a), as undesired movements during surgery are minimal, increasing the safety of the procedure.
1.2 Why Minilaparoscopy?

Lessons learned from laparoscopy over the past 30 years have shown that minimal access surgery is of benefit to patients in that it produces less tissue damage and consequently causes a reduced metabolic response to trauma.

Recently Thane Blinman (2010) has described a theoretical mathematical model to evaluate the amount of tissue damage using incisions of different sizes. The author concluded that the sum of several small incisions is not equivalent to a single linear incision, which involves that there is at least an advantage in using trocars of the smallest possible effective size. We managed to corroborate that concept by using another model involving the geometrical (cylindrical) measurement of trauma volume. According to our concept, the injury caused by different trocar sizes is directly proportional to the square radius of the trocar, given a similar thickness of the abdominal wall (Table 1). For example, an 11-mm trocar generates approximately 5 times more tissue damage than a 6-mm trocar and twenty-five times more than a 2-mm trocar (Fig. 5, Table 1). This occurs because the tissue injury is not of linear, but rather of cylindrical shape.

Table 1: Parietal Injury Versus Somatic Pain (h = 31.85 mm)

<table>
<thead>
<tr>
<th>Technique</th>
<th>Incisions</th>
<th>Volume (π · R² · h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.O.T.E.S.</td>
<td>Pure – no skin incision</td>
<td>~0</td>
</tr>
<tr>
<td>Hybrid N.O.T.E.S.</td>
<td>(3.5 mm x 2)</td>
<td>612</td>
</tr>
<tr>
<td>Hybrid N.O.T.E.S.</td>
<td>(6 mm x 1)</td>
<td>900</td>
</tr>
<tr>
<td>L.E.S.S. (Single-Port)</td>
<td>(28 mm)</td>
<td>19600</td>
</tr>
<tr>
<td>L.E.S.S. (Single-Port)</td>
<td>(36 mm)</td>
<td>32419</td>
</tr>
<tr>
<td>Minilaparoscopy</td>
<td>(11 mm x 1 + 3.5 mm x 3)</td>
<td>3945</td>
</tr>
<tr>
<td>Laparoscopy</td>
<td>(11 mm x 2 + 6 mm x 2)</td>
<td>7854</td>
</tr>
</tbody>
</table>

Table 1: Parietal Injury Versus Somatic Pain (h = 31.85 mm)

Volume of trauma: a comparative representation based on the trocar size.
Minilaparoscopy has been developed since the time laparoscopic cholecystectomy was established as a gold standard in the surgical treatment of cholecystolithiasis during the early 1990s. By miniaturizing instruments from 10 and 5 mm to 3.5 and 2.5 mm, the basis was laid for another crucial step forward in the evolution of minimal access cholecystectomy.

Miniaturization of port size is advantageous from the financial standpoint in that it allows the use of permanent rather than expensive disposable material as seen with novel access technologies. Maintenance and handling are also similar to laparoscopic surgical instruments, being advantageous for other professionals involved in the routine surgical environment. For the practicing surgeon who has already acquired a good level of familiarity with laparoscopic surgery, minilaparoscopy provides a smooth and easier transition involving a shorter learning curve. However, the inherent greater fragility of small-caliber instruments can precipitate an increase in costs compared to those involved in the use of standard laparoscopic instruments.

The objection that ‘minilaparoscopic’ instruments would necessarily have much shorter lifetime compared to 5-mm instruments, has proved not to be true. Except for the 3-mm scope, the other items have been shown to be as durable and reliable as the 5-mm ones. However, even experienced surgeons may need time to train and adapt, once they decide to use minilaparoscopic instruments.

As a conclusion, by decreasing parietal damage while using a technology adapted from laparoscopy, minilaparoscopy is considered an easy-to-learn procedure and a cost-effective solution that is suited to cope with increasing cosmetic demands in today’s society for small-scar or hidden-scar surgery (Fig. 6).
2.0 Minilaparoscopic Cholecystectomy (MLC)

Unlike conventional laparoscopic cholecystectomy, MLC features a few aspects that will be described below. Surgical gestures in minilaparoscopy require a considerably higher degree of sensitivity and accuracy because more delicate and fragile instruments are used. The literature on mini shows great heterogeneity in the technique. The size of mini trocars varies among different companies ranging from 2.8 mm to 4.2 mm in diameter. The pneumoperitoneum technique can be variable and is applied according to surgeon’s preference. Most surgeons establish an umbilical port ranging from 11 to 13 mm, for placing the laparoscope as well as for the use of endoclips. A 3-mm 0°-laparoscope may also be used via the umbilical port, however this is fraught with reduced image quality and the drawback of considerable fragility.

Dissection of the gallbladder is performed by monopolar electrocautery. Dissectors, hooks, scissors and suction instruments ranging in diameter from 2–3 mm are used in the epigastrium port (Fig. 7). Usually, the cystic duct and artery are clipped using a 5- or 10-mm clip applier entering through the umbilical port or the epigastrium. For this approach, a 3-mm laparoscope is usually employed for guidance. There are only a few reports that address ligation of the cystic duct and artery using intracorporeal knots. Removal of the gallbladder is always done at the umbilicus by using a plastic bag to retrieve the organ.6

We have developed a modification of the minilaparoscopic technique (the clipless technique) and used it in more than 1,500 cases over the last 12 years with good results. Based on this series, we report the benefits of using a 10-mm laparoscope instead of minilaparoscopes. In our experience, this has been associated with a considerable reduction in costs and has given the added option of applying this technique in almost any surgical environment allowing the use of mini instruments. This technique involves that no clips are used to ligate the cystic duct or artery, which is why it has been called the clipless technique (summarized below).3, 6
2.1 Surgical Technique

Surgical team positioning and port placement are established according to the schematic drawings below (Fig. 8). According to the protocol established at our institution, minilaparoscopic cholecystectomy is usually performed under general anesthesia. Following intraumbilical administration of local anesthesia with bupivacaine for the purpose of postoperative pain relief, pneumoperitoneum is created via the open insertion technique through the umbilicus by placing a hidden intra-umbilical incision, through which a blunt 11-mm trocar is introduced (Figs. 9 and 10).

Sequence showing the administration of intraumbilical anesthesia (a–c). The intraumbilical area is exposed and an incision is made at a hidden umbilical fold (d). Blunt initial dilation of aponeurosis with a needle holder (e, f).
Minilaparoscopic Cholecystectomy (MLC) – The Clipless Technique

Sequence showing how dilation of the umbilical orifice is achieved by inserting a blunt tip trocar (a–c). Through the incision previously placed in a hidden umbilical fold (see 9d), a blunt tip trocar is inserted into the peritoneal cavity in an atraumatic manner (d–f). No veress needle is used.

The pneumoperitoneum is created by using a CO₂ pressure ranging from 8–12 mmHg. Then, a 30°-laparoscope, 10 mm in diameter, is used for the entire procedure. Another 3 trocars of 3.5 mm are used; for improved performance, we prefer to use the new low-friction trocars. One 3.5-mm trocar is placed in the epigastrium for dissection, cutting, coagulation, irrigation and aspiration. Two other additional mini trocars are inserted at the right subcostal margin; the most lateral trocar is used to retract the gallbladder fundus toward the diaphragm and the most medial trocar is used for grasping and exposing the area of the Hartmann pouch (Fig. 11).

Sequence demonstrating insertion of the epigastrium trocar (a, b). The gallbladder fundus is grasped (c, d), and dissection of Calot triangle is initiated, provided adequate exposure has been obtained (e, f).
Most importantly, the positioning of trocars should be slightly below the costal margin to avoid bending and damaging of instruments.

After completing the initial setup, an endoscopic inspection of the abdominal cavity should be carried out prior to initiating the cholecystectomy procedure. Potentially complicated cases are immediately converted to conventional laparoscopy by replacing the mini trocars with 6-mm conventional laparoscopic trocars.

The procedure usually begins with dissection of the peritoneum close to the gallbladder infundibulum and Callot triangle (Fig. 12). The cystic artery is identified and carefully cauterized at approximately 3–5 mm of its length using monopolar electrocautery (Fig. 13) or bipolar forceps, if available (Fig. 14).

Sequence of peritoneal dissection enlarging Callot triangle and improving the “Critical View of Safety” (a–c). Great care is paid during dissection of the cystic artery, keeping a safe distance from the common bile duct and other vital structures.
Cystic artery cauterization is always performed in close proximity to the gallbladder infundibulum, thus avoiding the risk of inadvertent thermal injury to the bile ducts. For a safe cystic artery cauterization, we observe very strict rules, such as correct identification of structures, no use of metal clips when using cautery close to them, because they may transfer energy and thereby cause damage to surrounding structures (Table 2). Cystic artery cauterization near the gallbladder neck by monopolar cautery (Figs. 13, 14) proved to be safe and effective. In the authors’ experience, there was no case of internal bleeding during surgery or in the postoperative period. Strict observance of the safety rule to coagulate near the gallbladder neck and far from the bile ducts has prevented the occurrence of thermal injuries.6

**Table 2: Primary Principles for Safe Use of Electrocautery in Minilaparoscopic Cholecystectomy**

<table>
<thead>
<tr>
<th>Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrocautery mandates the use of a return electrode monitor;</td>
</tr>
<tr>
<td>Use bipolar or monopolar energy with blend mode (30 w cut, 40 w coagulation, or less);</td>
</tr>
<tr>
<td>Never – BUT REALLY NEVER – use a metal clip, if use of electrocautery is intended close to the clipped structure;</td>
</tr>
<tr>
<td>Short pulses should always be used, never exceeding more than 1 second;</td>
</tr>
<tr>
<td>To avoid damage, electrocautery must be used at least 10 mm away from vital structures (pedicle, duodenum, colon, etc);</td>
</tr>
<tr>
<td>Use dissecting forceps to coagulate, if artery diameter is greater then 2 mm</td>
</tr>
</tbody>
</table>

**Hint:** Compare with 3-mm forceps.
The cystic duct is **not** clipped (as usual), but ligated with intracorporeal surgical knots using polyester or polyglactin 2-0 (Vicryl or Ethibond®) (Figs. 15 and 16).

Replacing the clips by using surgical knots (Fig. 16) significantly helps in reducing equipment costs. Furthermore, in this way, certain complications can be avoided that are inherent to clip application, such as clip migration off the cystic artery, causing hemorrhage or, if the cystic duct is involved, causing bile leakage. In addition, clips that moved to the duodenum or the hepatic duct causing duct obstruction have been described.1, 16, 25

Sequence of intracorporeal knot tying performed manually to ligate the cystic duct.
Liver bed dissection and hemostasis are accomplished using a monopolar hook electrode. In difficult cases, especially in patients with a fatty or cirrhotic liver, the gallbladder dissection starts from the fundus and is carried towards the infundibulum (antegrade ‘fundus-first’ dissection (Fig. 17)) to improve proper visualization of the Callot triangle, thus increasing safety. When necessary, intraoperative cholangiography is performed, introducing an extra mini trocar or a large needle at the right subcostal region; this port is then used for inserting a 4- or 6-Fr. catheter into the cystic duct.

Sequence showing an antegrade fundus-first cholecystectomy. Once adequate fundus dissection is complete, the infundibulum is grasped and retracted allowing the gallbladder pedicle to be dissected with safety (a–f).
Removal of the gallbladder should always be accomplished by using an extraction bag. A bag made from a sterile glove initially introduced via the umbilical port may be strategically used to remove the gallbladder, avoiding the use of expensive, specially manufactured retrieval bags. Once the bag has been blindly inserted into the abdominal cavity via the umbilical 11-mm port, the 10-mm laparoscope is re-inserted and the gallbladder is placed into the bag. A mini forceps is used to get hold of the outer edge of the extraction bag, which is delivered into the umbilical trocar in a retrograde fashion. Next, the bag is externally grasped and retrieved under direct vision (Figs. 18, 19).

This maneuver is essential to avoid the use of a 3-mm minilaparoscope and provide a safe removal of the gallbladder. In addition, it allows to enlarge the umbilical aponeurotic incision with minimal aesthetic compromise in the presence of cholecystitis or large stones (Figs. 18a–c).

The procedure is finished by closure of the aponeurotic defect at the umbilicus using purse string suture (Figs. 18d–f). All other 3.5-mm ports usually heal without suture.

### 2.2 Results

In a recent publication (Carvalho et al. 2009), results from our first 1,500 cases (now exceeding 1,543), were impressive: Postoperatively, patients reported little pain and great satisfaction with cosmetic results of surgery (Figs. 19, 20). The average hospital stay was 16 h, and 96% of patients were discharged within 24 hours. The mean operative time was 43 minutes (25–127 min). In 2.8% of patients conversion to conventional laparoscopic cholecystectomy (5 mm) was required. There was no need for conversion to laparotomy in any patient.
Minilaparoscopic Cholecystectomy (MLC) – The Clipless Technique

Image sequence showing gallbladder removal. The wound is kept protected by the bag (a–c), larger stones are crushed prior to retrieval to avoid the need for enlarging the umbilical incision (c). Wound closure is performed under direct vision, taking care that each margin of aponeurosis is grasped while using proper skin retraction (d–f).

Image sequence showing how the gallbladder is placed in a sterile “hand-made” bag. Here, the outer edge of the bag is grasped to facilitate insertion of the gallbladder. The bag which is loaded with the gallbladder is again grasped and delivered inside the trocar to be removed (a–f).
The main complications were minor infection of the umbilical incision (1.9%) and umbilical hernia (1%). In the authors’ experience, it was necessary to perform only one laparoscopic reintervention (bile leakage due to a Luschka accessory duct, which was sutured). In this series, there were no deaths, no post-operative bleeding, no damage to the intestines or main bile ducts, and no conversion to open surgery.

Based on our current experience with more than 1,500 minilaparoscopic cholecystectomies performed with clipless technique, the use of intracorporeal surgical knots has proved to be even safer, showing a much lower complication rate as compared to the one involving the use of clips. Other authors have confirmed that safety of the procedure is enhanced by using suture ligation instead of clips for sealing the cystic duct. Indeed, the use of clips for cystic duct ligation has been found to be associated with complications, such as migration into bile duct and stone formation.
By training in a lap trainer, surgical dexterity can be enhanced reducing the time involved in ligation. In our clinical experience, because no optics exchange we even managed to match the time spent for suture ligation with the time needed to apply laparoscopic clips. This may be important to reduce the overall operative time usually reported for minilaparoscopic cholecystectomy. Another interesting aspect is the increased operative time attributable to placing laparoscopic clips under direct vision of the 3-mm minilaparoscope. On account of unavailability of 3-mm clip applicators, some surgeons need to exchange ports for visualization in order to place clips from the umbilical incision. For this maneuver, the 11-mm umbilical trocar receives the clip applier, while the 3-mm minilaparoscope is placed in a trocar located at the epigastrium. By not using clip applicators, this maneuver is spared, thus reducing operative time.

2.3 Conclusions

Currently, minilaparoscopy can be regarded as a refinement of laparoscopy, which is due to the fact that both procedures share the same principles of instrument triangulation and access to anatomical structures while offering the same ergonomics and benefits in terms of safety. By using the new low-friction mini trocars, the surgeon is given the added benefit of increased surgical precision, which is another step forward in the development of modern minilaparoscopic surgery.

It may also be concluded that clipless minilaparoscopic cholecystectomy is as safe and effective as the 5-mm/10-mm laparoscopic procedure, but with clearly better aesthetic outcomes. The technique presented in this booklet does not show any difference regarding the operative risk when compared with the usual needlescopic procedure or the already established 5-mm/10-mm laparoscopy approach.

It also entails a considerable reduction in cost, and, as it does not use the 3-mm laparoscope or disposable materials, it is possible to perform minilaparoscopic cholecystectomy (MLC) on a larger number of patients. Owing to the near invisibility of scars, MLC may also be considered as cosmetically effective as NOTES and SILS.
2.4 References


Part II: Minilaparoscopic Hernioplasty Using Both TAPP and TEP – The Combined Technique

3.0 Minilaparoscopic Hernioplasty

3.1 Why Combine TAPP and TEP for Minilaparoscopic Hernioplasty?

For surgical repair of inguinal hernias, two main laparoscopic techniques are currently employed; the totally extraperitoneal hernioplasty (TEP) and transabdominal preperitoneal (TAPP) technique with mesh fixation. Both are of proven efficacy and safety. The decision as to which approach should be adopted is subject to the surgeon’s personal experience and preference.

Using the TAPP procedure in the intraabdominal cavity allows the surgeon to operate on a larger working area as compared to the extraperitoneal space offered by TEP. TAPP repair involves routine evaluation of intraabdominal organs and permits both diagnosis and treatment of incidentally detected bilateral hernia (occurring in up to 25% of clinically suspected unilateral hernias and other intraabdominal diseases). Laparoscopy allows to treat incarcerated and strangulated hernias, with evaluation of the ischemic bowel viability. However, despite these advantages, TAPP has the drawback of increased costs and long duration of the procedure, since it usually requires mesh fixation either by use of staples or sutures, and closure of the mandatory peritoneum flap. Conversely, the TEP procedure, particularly in its variation without mesh fixation, is attractive for its simplicity, speed of execution, low cost, and the fact that it eliminates the need for elaborate opening and consequent peritoneum closure. On the other hand, TEP can be technically more demanding to perform in view of its small working space and increased level of difficulty with regard to proper identification of anatomical landmarks.

Over the years, TEP has shown to be slightly ahead of TAPP, with outcomes at least approximately equal to the best results yielded via open techniques. Its key benefits lie in the fact that there is no need for creating a peritoneal flap and no need for mesh fixation, resulting in less postoperative pain and faster recovery. Although advantageous in several ways, TEP has not been widely adopted on account of its inherent complexity, particularly due to issues related to creation of the preperitoneal space and understanding its anatomy. Apart from that, TEP does not provide the option of intraperitoneal inspection, which is crucial for treating incarcerated hernias. By combining the established advantages of TEP with those of TAPP, along with the precision and cosmetics of minilaparoscopy, the authors describe a technique that stands a good chance of becoming the new gold standard of minilaparoscopic inguinal hernia surgery.

In the combined technique proposed below, laparoscopy works as a TEP access accelerator. As described in the section on surgical technique, TAPP is immediately followed by TEP, but in this particular method, it is not only used for treating incarcerated hernias, but also on a routine basis, because of the advantages involved in the combined approach. The added use of mini laparoscopy allows easy exchange of trocar positions between the intra- and extraperitoneal spaces, which improves versatility of the surgical technique during laparoscopic hernioplasty.

Apart from facilitating creation of the preperitoneal space under direct laparoscopic vision, the combined approach also offers several benefits over TEP. Laparoscopy allows adequate evaluation of the key anatomical structures involved in hernia repair, which is mandatory in the planning of all surgical steps performed in the preperitoneal space. Thus, laparoscopy has shown to be very useful in uncommon situations, such as underestimated hernia size, direct coalescing bilateral hernias with displaced epigastric vessels and abdominal contents within the hernia sac. Using a laparoscope for meticulous anatomical inspection can help to reduce perioperative complications, which, though of rare occurrence, may entail potentially serious consequences. By facilitating TEP, the combined technique can have a positive impact on the learning curve.
3.2 Room Setup and Trocar Positions

Surgical team positioning and port placement are established as shown in the schematic drawings below (Fig. 1). According to the protocol employed at the author’s institution, minilaparoscopic hernioplasty is usually performed under general anesthesia. Following intraumbilical administration of local anesthesia with bupivacaine for the purpose of postoperative pain relief, pneumoperitoneum is created via the open insertion technique through the umbilicus by placing a hidden intra-umbilical incision, through which a blunt-tipped 11-mm trocar is introduced.

Operating room setup and trocar positions for right and left minilaparoscopic hernioplasty.
3.3 Surgical Technique

The procedure starts laparoscopically with open pneumoperitoneum creation (see Figs. 9, 10, pages 12–13). Following infiltration of local anesthesia (bupivacaine; 0.25%, 20 ml), a vertical transumbilical incision, more prominent for the infraumbilical direction, is made. Care is taken while dilating the aponeurotic umbilical orifice with the tip of a needle holder.

A blunt-tipped 11-mm trocar is gently inserted after preliminary dilation of the aponeurotic umbilical orifice. The pneumoperitoneum is established using CO\textsubscript{2} insufflation at a pressure ranging from 8–12 mmHg. Then, a 30°-laparoscope, 10 mm in diameter, is used for the entire procedure. Neither a Veress needle nor a 3-mm scope are used at this stage of the procedure.

After completing the initial pneumoperitoneum setup, inspection of the abdominal cavity is carried out prior to starting with the herniorraphy procedure. At this point, intraabdominal inspection may elicit findings that trigger the need to immediately convert to conventional laparoscopy, which should be performed using the 6-mm standard laparoscopic trocars instead of the mini trocars. Following adequate laparoscopic assessment, incarcerated hernias can be reduced at this stage of the procedure. Usually, there is no need to resort to conversion, if reduction is performed according to the rules of good clinical practice (Fig. 2).
Following laparoscopic inspection of the abdominal cavity, the first 3.5-mm mini trocar is inserted under transperitoneal vision, at a site medial to the epigastric vessels, performing preliminary dilation with a blunt-tipped, atraumatic 3-mm laparoscopic instrument, carefully avoiding iatrogenic peritoneum perforation. Through the mini trocar preliminary dissection is performed under direct laparoscopic vision, employing sweeping movements that are carried out between the peritoneum and the muscular-aponeurotic planes. The CO₂ tubing is disconnected from the umbilical port and attached to the CO₂ LUER connector of the mini trocar. At this stage, a second 3.5-mm trocar may be inserted to facilitate dissection of the preperitoneal space using a bimanual technique, or after preperitoneal insufflation, under direct visualization. Preperitoneal insufflation can be initiated as soon as the 11-mm intraperitoneal umbilical trocar valve has been opened halfway. At this point, it is possible to directly visualize CO₂ insufflation and gradual build-up of the preperitoneal space, as previously described (Fig. 3).⁸

Once the preperitoneal space has been established sufficiently by CO₂ insufflation, the 11-mm trocar is removed to permit insertion of an 18-Fr. Foley catheter in the abdomen via the umbilicus to evacuate the CO₂ which occasionally is found to escape from the preperitoneal space, either by diffusion or accidental damage of the peritoneum during hernia sac dissection. The catheter serves to prevent narrowing of preperitoneal spaces, which may occur when CO₂ leaks transperitoneally into the peritoneal cavity, resulting in competitive spaces.

The 11-mm trocar, one with a pyramidal tip, not the blunt-tipped trocar previously used, is re-introduced through the already created umbilical skin incision, and advanced in a 45° angle toward the preperitoneal space, which has already been fashioned to a size sufficient for starting dissection. It is not necessary to use a balloon dissector because the proper workspace is gradually established with the aid of the tip of the scope and 3-mm dissection instruments passed through the 3.5-mm mini trocars.

At the end of this stage of the procedure, there is

- a transperitoneal opening, which is kept open by an 18-Fr. Foley catheter,
- an aponeurotic opening with an 11-mm trocar providing the optical pathway to the preperitoneal space, and
- two other 3.5-mm mini working trocars.
The second aponeurotic orifice is essential in that it provides an independent pathway to the preperitoneal space. For this purpose, a Z-shaped insertion maneuver is carried out with the pyramidal-tipped trocar, eliminating the need to close the second (infraumbilical) aponeurotic opening at the end of the procedure.

The TEP part of the procedure is now commenced under direct preperitoneal vision. Provided adequate preperitoneal space has been created by bimanual dissection to determine the relevant landmarks of inguinal anatomy, proper dissection of the hernia sac follows and the preperitoneal space is enlarged to a size that matches the 13 x 15 cm polypropylene mesh with rounded edges.

At this point, care must be taken to make sure that the hernia orifice as well as the inguinal anatomic landmarks including at least the iliopubic tract, the vas deferens, the gonadal vessels and epigastric vessels are clearly identified (Figs. 4–6).

Following insertion of the 11-mm trocar in the preperitoneal space, dissection for enlargement of this space continues, now under direct preperitoneal vision. The image sequence shows adequate exposure of the preperitoneal space, which is performed by bimanual dissection.

Following proper identification of the hernial sac, it is progressively separated from the spermatic cord structures by blunt dissection and cautious use of electrocautery.
Prior to mesh insertion, make sure dissection of the preperitoneal space is developed such that it allows to localize and determine all relevant inguinal anatomic landmarks. Shown on the left are the dissected right (a) and left (b) inguinal regions of the hernia orifice (O), the iliopubic tract (1), pectineal ligament (2), vas deferens (3), gonadal (4), epigastric (5) and iliac (6) vessels, which can be clearly visualized.

**Endoscopic abdominal aspect of the right posterior inguinal region.** Preperitoneal fatty tissue and parietal peritoneum are left out.

**Hernial orifices:** suprapubic (a), direct (b), and indirect (c) inguinal hernia.

- **Light green area** “Trapezoid of Disaster”
- **Dark green area** “Doom Triangle”

① Inferior epigastric vessels
② Interfoveolar ligament of Hesselbach
③ Plica umbilicalis medialis
④ Pubic branch of inferior epigastric vessels
⑤ Pectineal ligament
⑥ Obturator nerve
⑦ M. transversus abdominis with fascia transversalis
⑧ Iliopubic tract
⑨ Lateral femoral cutaneous nerve
⑩ Testicular vessels
⑪ Femoral nerve
⑫ Genital branch of genitofemoral nerve
⑬ Femoral artery / vein
⑭ Deferent canal
⑮ M. rectus abdominis with fascia
The polypropylene mesh is blindly inserted through the 11-mm trocar and usually not fixed. Make sure, that it completely covers the entire inguinal-crural region and snugly fits the anatomy (Fig. 8). In the presence of a large direct hernia defect, one should consider the need for mesh fixation. Preperitoneal CO₂ is released allowing the peritoneum to compress the mesh and keep it in place, which obviates the need for mesh fixation. Once the mesh has been placed properly, the 11-mm trocar is removed and reintroduced again into the abdominal cavity, using the access opening that is kept open by the 18-Fr. Foley catheter. This step serves to visually control the inner aspect of the mesh, which should give a smooth appearance without any signs of wrinkles. If the need arises to readjust the implanted mesh, this can be obtained with the aid of the tip of the 30°-scope. As an alternative option, a laparoscopic instrument may be introduced, using one or two 3.5-mm mini trocars through the skin openings already created in the peritoneal cavity (Fig. 9).

The rolled up polypropylene mesh is blindly inserted through the 11-mm trocar. Care is taken while spreading out the mesh completely until it covers the entire inguinal-crural region and snugly fits the individual anatomy. Preperitoneal CO₂ is gradually released allowing the peritoneum to compress the mesh and keep it in place.

Laparoscopic image sequence, taken while inspecting the inner aspect of mesh. The surface of the mesh should give a smooth appearance without any signs of wrinkles (b). Note the floppiness of the hernia sac (c). Proper implantation of the mesh is confirmed after some minor wrinkles have been smoothed out with the aid of a 3-mm forceps introduced into the peritoneal cavity for this purpose (d).
Subsequently, CO\(_2\) is fully evacuated. The procedure is finished by closure of the aponeurotic defects at the umbilicus using purse string sutures (see Figs. 20d–f, page 19). The remaining 3.5-mm port incisions will heal without suture and are covered with a surgical tape.\(^\text{10}\)

### 3.4 Casuistics and Results

Between January 2011 and March 2012, an overall number of 41 male and 3 female patients were operated using the combined TAPP-TEP technique. Nine patients had bilateral hernias, three of which were discovered intraoperatively. Overall, 29 hernias were on the right side and 24 on the left. In the group of patients with unilateral hernias, 14 were found to have both direct and indirect defects, 8 had recurrent defects, and 3 had incarcerated hernias. Small umbilical hernias were found in 29 patients, with symptoms in 6 cases.\(^\text{1,10}\)

Our preliminary results show a mean operative time of 41 min. Accidental peritoneum perforations added difficulty to the procedure, and in the end, 3 peritoneal perforations and 9 transected inguinal scrotal hernia sacs were sutured laparoscopically after repositioning the 3.5-mm trocars intraperitoneally, and after proper placement of the mesh via TEP. We prefer laparoscopic suturing because working in the larger intraperitoneal space is easier and faster than suturing in the narrow preperitoneal space. There were no conversions and no intraoperative complications. Small, clinically insignificant hematomas in the scrotum and penis occurred in 8 patients. Two patients developed asymptomatic small hydrocele, that regressed after 3 months, and no infection occurred. All patients were discharged between 6 and 24 hours of the end of the procedure, with analgesics on demand. No patient reported the use of analgesics for more than 5 days and no pain was reported that lasted longer than a week. No recurrence was observed during the 3-month follow-up period. All patients were very satisfied with the overall results of surgery (Fig. 10) and all resumed their normal daily activities from 2 days to 2 weeks.\(^\text{1,10}\)

Postoperative views of the umbilical access and the 3.5-mm ports, (red circles). The primary incision is performed across the umbilicus, allowing for a hidden scar.
3.5 Use of ENDOCAMELEON® in MLC and Hernia Repair

Even though the standard 10-mm HOPKINS® 30°-laparoscope, can be effectively used to manage most gallbladder and hernia cases, the use of an endoscope with adjustable viewing angle, also known as ENDOCAMELEON®, offers considerable advantages owing to its multidirectional viewing characteristics. The ENDOCAMELEON® (KARL STORZ Tuttlingen, Germany) is a special 10-mm endoscope that allows to intraoperatively adapt the viewing angle, ranging from 0° to 90°. The desired angle is easily selected by a control knob that changes the position of a small swing prism. This major optical feature is particularly useful when dealing with highly demanding cases of hernioplasty, such as obese patients, scrotal, recurrent or femoral hernias, or during a cholecystectomy under the challenging circumstances of pedicle dissection in the presence of acute cholecystitis or chronic fibrosis or when it is necessary to perform a fundus-first (antegrade) dissection. In all these complex situations, working with a versatile endoscope offering various angles of view can be very helpful in defining the anatomical key structures that need to be identified in order to prevent iatrogenic injuries.

3.6 Conclusions

With the advent of new low-friction trocars, improvements have been achieved especially in hernia surgery in terms of surgical precision during dynamic maneuvers (e.g., dissection of hernia sac), resulting in reduced stress for the surgical team and higher effectivity. Trocar dislocation and skin reinsertions were significantly diminished, consequently reducing skin trauma, resulting in improved aesthetics.2, 7, 15 In the course of the procedure, the pneumoperitoneum is usually adapted to the individual situation and according to the surgeon’s preferences. Most surgeons use a portal from 11 to 13 mm at umbilical site for placing the laparoscope as well as for mesh placement. A 0°-laparoscope, 3 mm in diameter, may also be used instead, however, at the cost of reduced image quality and the drawback of considerable fragility. In hernia surgery, considering, that mesh placement is commonly performed through an 11/13 mm trocar, the use of an umbilical port of the same size and a 10-mm laparoscope is easily justified (Fig. 11).

The proposed minilaparoscopic hernia repair technique combines features of the two main gold standards of videoscopic hernia repair, employing both TEP and TAPP techniques with the delicacy and precision of dedicated mini instruments. The combined laparoscopic and extraperitoneal access facilitates minilaparoscopic preperitoneal dissection and allows diagnosis and treatment of complex hernias, thus constituting a useful option for almost scarless videoscopic hernia repair.

It may also be concluded that the minilaparoscopic combined TAPP-TEP approach may be as safe and effective as the 5-mm/10-mm laparoscopic procedure, and probably with improved aesthetic outcomes. The technique presented in this booklet does not show any difference regarding the operative risk when compared with the common needlescopic hernia procedure or the already established 5-mm/10-mm laparoscopic TEP approach.
The combined minilaparoscopic TAPP-TEP approach also involves a considerable reduction in cost, and avoids the use of a 3-mm laparoscope, sutures or tackers, which makes it possible to perform this type of hernia repair on a wider scale. Finally, considering the virtually invisible scars remaining from minilaparoscopic hernioplasty, in terms of cosmesis, the procedure should be regarded as effective as SILS, a technique that has shown to be fraught with larger abdominal wall damage in patients with collagen deficiency, as is normally found in hernia patients.

3.7 References


Recommended Sets for
Minilaparoscopic Clipless Cholecystectomy
and Minilaparoscopic Inguinal Hernia Repair

High-Definition Video Camera System IMAGE1 S™
and Monitors
Recommended Set for Minilaparoscopic Clipless Cholecystectomy

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

30103MA  Trocar, with blunt tip, insufflation stopcock, multifunctional valve, size 11 mm, working length 10.5 cm, color code: green, including:
  - Trocar only, with blunt tip
  - Cannula, without valve, with insufflation stopcock
  - Multifunctional Valve, size 11 mm

30214KAK  3 x CARVALHO Trocar, with blunt tip, without connector for insufflation, working length 15 cm, for use with instruments size 3 mm, including:
  - Low-friction Cannula
  - Trocar only
  - Insertion Aid

25775CL  CADIERE Coagulating and Dissecting Electrode, L-shaped, distal tip tapered, with cm-marking, with connector pin for unipolar coagulation, size 3 mm, length 36 cm

30351MWG  CLICKLINE Scissors, rotating, dismantling, with connector pin for unipolar coagulation, double action jaws, serrated, curved, conical, size 3 mm, length 36 cm, including:
  - Plastic Handle, without ratchet
  - Outer Sheath, with scissors insert

30351MLG  CLICKLINE KELLY Dissecting and Grasping Forceps, rotating, dismantling, insulated, with connector pin for unipolar coagulation, double action jaws, long, size 3 mm, length 36 cm, including:
  - Plastic Handle, without ratchet
  - Outer Sheath, with forceps insert

30361MGG  CLICKLINE MAHNES Dissecting and Grasping Forceps, rotating, dismantling, without connector pin for unipolar coagulation, double action jaws, tiger jaws, 2x 4 teeth, size 3 mm, length 36 cm, including:
  - Metal-Handle
  - Outer Sheath, with forceps insert

30361ULG  CLICKLINE REDDICK-OLSEN Dissecting and Grasping Forceps, rotating, dismantling, without connector pin for unipolar coagulation, double action jaws, robust, size 3 mm, length 36 cm, including:
  - Metal-Handle
  - Outer Sheath, with forceps insert

30351KG  CLICKLINE Grasping Forceps, rotating, dismantling, insulated, with connector pin for unipolar coagulation, with Luer-Lock irrigation connector for cleaning, double action jaws, atraumatic, fenestrated, size 3 mm, length 36 cm, including:
  - Plastic Handle, without ratchet, with larger contact area
  - Outer Sheath, with forceps insert

30361ONG  CLICKLINE Grasping Forceps, rotating, dismantling, without connector pin for unipolar coagulation, with Luer-Lock irrigation connector for cleaning, single action jaws, with fine atraumatic serration, fenestrated, size 3 mm, length 36 cm, including:
  - Metal Handle, without ratchet, with larger contact surface
  - Outer Sheath, with forceps insert

26167TL  Palpation Probe, with cm-marking, size 3 mm, length 36 cm

26167H  Two-Way Stopcock, for use with Suction and Irrigation Tubes 26167LH/LHS/LHL

26167LHL  Suction and Irrigation Tube, size 3 mm, length 36 cm, for use with Two-Way Stopcock 26167 H or modular handles for irrigation and suction

26167FNL  KOH Ultramicro Needle Holder, jaws curved to left, with tungsten carbide inserts, straight handle, with disengageable ratchet, size 3 mm, length 36 cm
Recommended Set for Minilaparoscopic Inguinal Hernia Repair

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

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

30103MA  Trocar, with blunt tip, insufflation stopcock, multifunctional valve, size 11 mm, working length 10.5 cm, color code: green, including:
- Trocar only, with blunt tip
- Cannula, without valve, with insufflation stopcock
- Multifunctional Valve, size 11 mm

Additional:
- 30103C Trocar with conical tip

30214KAK  3 x CARVALHO Trocar, with blunt tip, without connector for insufflation, working length 15 cm, for use with instruments size 3 mm, including:
- Low-friction Cannula
- Trocar only
- Insertion Aid

30217KAK  3 x CARVALHO Trocar, with blunt tip, without connector for insufflation, working length 10 cm, for use with instruments size 3.5 mm, including:
- Low-friction Cannula
- Trocar only
- Insertion Aid

26665UEL  Coagulating and Dissecting Electrode, spatula-shaped, blunt, insulated, with connector pin for unipolar coagulation, size 3 mm, length 36 cm

30351MWG  CLICKLINE Scissors, rotating, dismantling, insulated, with connector pin for unipolar coagulation, with LUER-Lock irrigation connector for cleaning, double action jaws, serrated, curved, conical, size 3 mm, length 36 cm, including:
- Plastic Handle, without ratchet, with larger contact area at the finger ring
- Outer Sheath, with forceps insert

30351MDG  CLICKLINE KELLY Dissecting and Grasping Forceps, rotating, dismantling, insulated, with connector pin for unipolar coagulation, with LUER-Lock connector for cleaning, double action jaws, size 3 mm, length 36 cm, including:
- Plastic Handle, without ratchet, with larger contact area
- Outer Sheath, with forceps insert

30351MLG  CLICKLINE KELLY Dissecting and Grasping Forceps, rotating, dismantling, insulated, with connector pin for unipolar coagulation, double action jaws, long, size 3 mm, length 36 cm, including:
- Plastic Handle, without ratchet
- Outer Sheath, with forceps insert

30361ULG  CLICKLINE REDDICK-OLSEN Dissecting and Grasping Forceps, rotating, dismantling, without connector pin for unipolar coagulation, with LUER-Lock irrigation connector for cleaning, double action jaws, robust, size 3 mm, length 36 cm, including:
- Metal Handle, without ratchet, with larger contact surface
- Outer Sheath, with forceps insert

26167TL  Palpation Probe, with cm-marking, size 3 mm, length 36 cm

26167H  Two-Way Stopcock, for use with Suction and Irrigation Tubes 26167LH/LHS/LHL

26167LHL  Suction and Irrigation Tube, size 3 mm, length 36 cm, for use with Two-Way Stopcock 26167H or modular handles for irrigation and suction

Optional:
- 26167FNL  KOH Ultramicro Needle Holder, jaws curved to left, with tungsten carbide inserts, straight handle, with disengageable ratchet, size 3 mm, length 36 cm

30361ONG  CLICKLINE Grasping Forceps, rotating, dismantling, without connector pin for unipolar coagulation, with LUER-Lock irrigation connector for cleaning, single action jaws, with fine atraumatic serration, fenestrated, size 3 mm, length 36 cm, including:
- Metal Handle, without ratchet, with larger contact surface
- Outer Sheath, with forceps insert
**HOPKINS® Telescopes**

**Diameter 3.3 mm**

![HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 3.3 mm, length 25 cm, autoclavable, fiber optic light transmission incorporated, color code: red](image)

**Diameter 10 mm**

![HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 10 mm, length 31 cm, autoclavable, fiber optic light transmission incorporated, color code: red](image)

![ENDOCAMELEON® HOPKINS® Telescope, diameter 10 mm Ø, length 31 cm, autoclavable, variable direction of view from 0°–90°, adjustment knob for selecting the desired direction of view, fiber optic light transmission incorporated, color code: gold](image)

**Adaptor, autoclavable, permits telescope changing under sterile conditions**

---

It is recommended to check the suitability of the product for the intended procedure prior to use.
CARVALHO Trocars
Size 3 mm and 3.5 mm

![Image of CARVALHO Trocars with details: Trocar, Cannula, Insertion aid.]

<table>
<thead>
<tr>
<th>Size</th>
<th>3 mm</th>
<th>3.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working length / color code</td>
<td>15 cm / green</td>
<td>10 cm / red</td>
</tr>
<tr>
<td>CARVALHO Trocar, with blunt tip including:</td>
<td>30214KAK</td>
<td>30217KAK</td>
</tr>
<tr>
<td>Low-friction cannula, Trocar only</td>
<td>30214K</td>
<td>30217K</td>
</tr>
<tr>
<td>Insertion aid</td>
<td>30214AK</td>
<td>30217AK</td>
</tr>
<tr>
<td></td>
<td>30214K1</td>
<td>30214K1</td>
</tr>
</tbody>
</table>

Standard Trocar
Size 11 mm

![Image of Standard Trocar 30103MA with details: Trocar, Cannula, Multifunctional Valve.]

30103MA  Trocar, with blunt tip, insufflation stopcock, multifunctional valve, size 11 mm, working length 10.5 cm, color code: green, including: Trocar only, with blunt tip Cannula, without valve, with insufflation stopcock Multifunctional Valve, size 11 mm

Additional: Trocar with conical tip 30103C
Dissecting and Grasping Forceps

CLICKLINE – rotating, dismantling, insulated, with connector pin for unipolar coagulation

**Size 3 mm**

Operating instruments, **length 36 cm**, for use with trocars size 3.5 mm

<table>
<thead>
<tr>
<th>Length</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td>33151</td>
</tr>
</tbody>
</table>

**Double Action Jaws**

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310MLG</td>
<td>30351MLG</td>
</tr>
<tr>
<td></td>
<td>30352MLG</td>
</tr>
<tr>
<td></td>
<td>30353MLG</td>
</tr>
<tr>
<td></td>
<td>30356MLG</td>
</tr>
<tr>
<td></td>
<td>30321MLG</td>
</tr>
<tr>
<td></td>
<td>30348MLG</td>
</tr>
<tr>
<td></td>
<td>30349MLG</td>
</tr>
<tr>
<td>CLICKLINE KELLY Dissecting and Grasping Forceps, long</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310MDG</td>
<td>30351MDG</td>
</tr>
<tr>
<td></td>
<td>30352MDG</td>
</tr>
<tr>
<td></td>
<td>30353MDG</td>
</tr>
<tr>
<td></td>
<td>30356MDG</td>
</tr>
<tr>
<td></td>
<td>30321MDG</td>
</tr>
<tr>
<td></td>
<td>30348MDG</td>
</tr>
<tr>
<td></td>
<td>30349MDG</td>
</tr>
<tr>
<td>CLICKLINE KELLY Dissecting and Grasping Forceps</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310ULG</td>
<td>30351ULG</td>
</tr>
<tr>
<td></td>
<td>30352ULG</td>
</tr>
<tr>
<td></td>
<td>30353ULG</td>
</tr>
<tr>
<td></td>
<td>30356ULG</td>
</tr>
<tr>
<td></td>
<td>30321ULG</td>
</tr>
<tr>
<td></td>
<td>30348ULG</td>
</tr>
<tr>
<td></td>
<td>30349ULG</td>
</tr>
<tr>
<td>CLICKLINE REDDICK-OLSEN Dissecting and Grasping Forceps, robust</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310ONG</td>
<td>30351ONG</td>
</tr>
<tr>
<td></td>
<td>30352ONG</td>
</tr>
<tr>
<td></td>
<td>30353ONG</td>
</tr>
<tr>
<td></td>
<td>30356ONG</td>
</tr>
<tr>
<td></td>
<td>30321ONG</td>
</tr>
<tr>
<td></td>
<td>30348ONG</td>
</tr>
<tr>
<td></td>
<td>30349ONG</td>
</tr>
<tr>
<td>CLICKLINE Grasping Forceps, with fine serration, fenestrated</td>
<td></td>
</tr>
</tbody>
</table>
**Minilaparoscopy – Cholecystectomy and Hernia Repair**

**Dissecting and Grasping Forceps**

CLICKLINE – rotating, dismantling, without connector pin for unipolar coagulation

**Size 3 mm**

Operating instruments, length 36 cm, for use with trocars size 3.5 mm

<table>
<thead>
<tr>
<th>Length</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td>33161</td>
</tr>
</tbody>
</table>

### Double Action Jaws

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310ULG</td>
<td>30361ULG</td>
</tr>
<tr>
<td>CLICKLINE REDDICK-OLSEN Dissecting and Grasping Forceps, robust</td>
<td></td>
</tr>
</tbody>
</table>

| 30310MGG | 30361MGG | 30341MGG | 30332MGG | 30333MGG | 30341MGG | 30346MGG | 30347MGG |
| CLICKLINE Dissecting and Grasping Forceps, “tiger-jaws”, 2x 4 teeth |

| 30310AFG | 30361AFG | 30341AFG | 30332AFG | 30333AFG | 30341AFG | 30346AFG | 30347AFG |
| CLICKLINE Grasping Forceps, atraumatic, fenestrated |

### Single Action Jaws

| 30310ONG | 30361ONG | 30331ONG | 30332ONG | 30333ONG | 30341ONG | 30346ONG | 30347ONG |
| CLICKLINE Grasping Forceps, with fine atraumatic serration, fenestrated |

| 30310KG | 30361KG | 30331KG | 30332KG | 30333KG | 30341KG | 30346KG | 30347KG |
| CLICKLINE Grasping Forceps, atraumatic, fenestrated |
Scissors
CLICKLINE – rotating, dismantling, with connector pin for unipolar coagulation

Size 3 mm
Operating instruments, length 36 cm, for use with trocars size 3.5 mm

<table>
<thead>
<tr>
<th>Length</th>
<th>Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td>33151</td>
</tr>
<tr>
<td></td>
<td>33121</td>
</tr>
</tbody>
</table>

Double Action Jaws

<table>
<thead>
<tr>
<th>Outer Sheath with Working Insert</th>
<th>Complete Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>30310MWG</td>
<td>30351MWG</td>
</tr>
<tr>
<td></td>
<td>30321MWG</td>
</tr>
</tbody>
</table>

CLICKLINE Scissors, serrated, curved, conical
Coagulating and Dissecting Electrodes
without suction channel, insulated sheath, with connector pin for unipolar coagulation

Size 3 mm
Operating instruments, length 36 cm, for use with trocars size 3.5 mm

<table>
<thead>
<tr>
<th>Length</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distal Tip</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26665UEL</td>
</tr>
</tbody>
</table>

Special Features:
- The hook electrode is suitable for resection, isolating structures as well as dissection and coagulation.
- The distal tip is semicircular: The thick outer curvature enables dissection.

<table>
<thead>
<tr>
<th>Length</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 cm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distal Tip</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25775CL</td>
</tr>
</tbody>
</table>
Needle Holders, Palpation Probe

Size 3 mm

Operating instruments, **length 36 cm**, for use with trocars size 3.5 mm

- **26167FNL** KOH Ultramicro Needle Holder, jaws curved to left, with tungsten carbide inserts, straight handle, with disengageable ratchet, size 3 mm, length 36 cm

- **26167FKL** KOH Ultramicro Needle Holder, jaws slightly curved to right, with tungsten carbide inserts, straight handle, with disengageable ratchet, size 3 mm, length 36 cm

- **26167TL** Palpation Probe, with cm-marking, size 3 mm, length 36 cm
Suction and Irrigation Tube

Size 3 mm

Operating instruments, **length 36 cm**, for use with trocars size 3.5 mm

![Image of Suction and Irrigation Tube]

26167LHL  **Suction and Irrigation Tube**, size 3 mm, length 36 cm, for use with Two-Way Stopcock 26167H or modular handles for irrigation and suction

![Image of Two-Way Stopcock]

26167H  **Two-Way Stopcock**, for use with Suction and Irrigation Tubes 26167 LH/LHS/LHL
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.

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

CLARA: Homogeneous illumination

<table>
<thead>
<tr>
<th>Standard Image</th>
<th>CLARA</th>
</tr>
</thead>
</table>

*SPECTRA A: Color hue shift and exchange (filtering reds)

<table>
<thead>
<tr>
<th>Standard Image</th>
<th>*SPECTRA A</th>
</tr>
</thead>
</table>

CHROMA: Contrast enhancement

<table>
<thead>
<tr>
<th>Standard Image</th>
<th>CHROMA</th>
</tr>
</thead>
</table>

*SPECTRA B: Spectral color shift (intensification of greens and blues)

<table>
<thead>
<tr>
<th>Standard Image</th>
<th>*SPECTRA B</th>
</tr>
</thead>
</table>

*SPECTRA A / SPECTRA B: Not available for sale in the U.S.A.
Minilaparoscopy – Cholecystectomy and Hernia Repair

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

* 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
Display Port Cable, length 300 cm
SDI Cable, length 300 cm
SCB Connecting Cable, length 100 cm
USB Flash Drive, 32 GB
USB Silicone Keyboard, with touchpad, US

*Also available in the following languages: DE, ES, FR, IT, PT, RU. Please indicate the required language code when placing your order.

Specifications:

<table>
<thead>
<tr>
<th>Feature</th>
<th>TC 201EN*</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD video outputs</td>
<td>1x DVI-D; 1x 12 / 3G-SDI</td>
</tr>
<tr>
<td>4K video outputs</td>
<td>2x Display Port, 1.2, 1x 12 / 3G-SDI</td>
</tr>
<tr>
<td>Format signal outputs</td>
<td>max. 3840 x 2160p, 50 / 60 Hz</td>
</tr>
<tr>
<td>LINK video inputs</td>
<td>3x</td>
</tr>
<tr>
<td>USB interface</td>
<td>4 x USB, (2x front, 2x rear)</td>
</tr>
<tr>
<td>SCB interface</td>
<td>1 x 6-pin mini-DIN</td>
</tr>
<tr>
<td>Power supply</td>
<td>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>3.1 kg</td>
</tr>
</tbody>
</table>

For use with IMAGE1 S CONNECT® II Module TC201EN

TC304 IMAGE1 S 4U-LINK®, link module, for use with IMAGE1 S 4U camera heads, power supply 100 – 120 VAC / 200 - 240 VAC, 50 / 60 Hz including:
Mains Cord, length 300 cm
Link Cable, length 20 cm, for use with IMAGE1 S CONNECT® II TC201EN

TC300 IMAGE1 S H3-LINK®, link module, for use with IMAGE1 S™ FULL HD three-chip camera heads, power supply 100 – 120 VAC / 200 – 240 VAC, 50 / 60 Hz including:
Mains Cord, length 300 cm
Link Cable, length 20 cm, for use with IMAGE1 S CONNECT® II TC201EN
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 TC304, IMAGE1 S 4U-LINK, module for 4K endoscopy

TH120

IMAGE1 S 4U, One-Chip 4K UHD Camera Head,
S-technologies available, progressive scan, soakable, gas- and plasma-
sterilizable, focal length f = 18 mm, 2 freely programmable camera head buttons,
for use with IMAGE1 S 4U-LINK

Specifications

<table>
<thead>
<tr>
<th>Frame rate</th>
<th>50 / 60 Hz</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image sensor</td>
<td>1-chip</td>
<td>Cable routing</td>
</tr>
<tr>
<td>Resolution</td>
<td>3840 x 2160 pixels</td>
<td>Camera head buttons</td>
</tr>
<tr>
<td>Scanning method</td>
<td>progressive scan</td>
<td>freely programmable</td>
</tr>
<tr>
<td>Lens</td>
<td>fixed focus</td>
<td>Reprocessing</td>
</tr>
<tr>
<td>Focal length</td>
<td>f = 18 mm</td>
<td>soakable, sterilizable with EtO gas</td>
</tr>
<tr>
<td>Dimensions (w x h x l)</td>
<td>46 x 37 x 133 mm</td>
<td>H₂O₂ plasma</td>
</tr>
<tr>
<td>Weight</td>
<td>210 g</td>
<td></td>
</tr>
</tbody>
</table>

Reprocessing
- soakable, sterilizable with EtO gas
- sterilizable with H₂O₂ plasma

S-Technologies CLARA, CHROMA, SPECTRA*

Degree of protection in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib

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

IMAGE1 S™ Three-Chip FULL HD Camera Heads

TH100

IMAGE1 S™ H3-Z Three-Chip FULL HD Camera Head

TH104

IMAGE1 S™ H3-ZA Three-Chip FULL HD Camera Head

Specifications

<table>
<thead>
<tr>
<th>Frame rate</th>
<th>50 / 60 Hz</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image sensor</td>
<td>3-chip</td>
<td>Cable routing</td>
</tr>
<tr>
<td>Resolution</td>
<td>1920 x 1080 pixels</td>
<td>Camera head buttons</td>
</tr>
<tr>
<td>Scanning method</td>
<td>progressive scan</td>
<td>freely programmable</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Focal length</td>
<td>f = 15 – 31 mm (2x)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (w x h x l)</td>
<td>39 x 49 x 114 mm</td>
<td>39 x 49 x 100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
<td>299 g</td>
</tr>
</tbody>
</table>

Reprocessing
- soakable, sterilizable with EtO gas
- sterilizable with H₂O₂ plasma

S-Technologies CLARA, CHROMA, SPECTRA*

Degree of protection in conjunction with Camera Control Unit IMAGE1 S™; CF-Defib

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

**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:
- 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

**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
Documentation  
KARL STORZ 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 whole new documentation experience – AIDA®.

AIDA® allows seamless integration into existing infrastructures and data exchange with other systems using common standard interfaces.

WD300-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

WD350-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).
**Documentation**

**KARL STORZ AIDA® – Workflow-Oriented Use**

**Patient**
AIDA® allows seamless integration into the existing infrastructure such as HIS and PACS. Data can be entered manually or via a DICOM worklist.

**Checklist**
Central administration and documentation of time-out. The checklist simplifies the documentation of all critical steps in accordance with clinical standards. All checklists can be adapted to individual needs.

**Record**
High-quality documentation through freeze frames and videos in FULL HD, 4K and 3D. The Dual Capture function allows for the parallel (synchronous or independent) recording of two sources. All recorded media can be marked for further processing with just one click.

**Edit**
With the Edit module, simple adjustments to recorded still images and videos can be rapidly completed. Recordings can be quickly optimized and then directly placed in the report.

In addition, freeze frames can be cut out of videos, edited and saved. Existing markings from the Record module can be used for quick selection.

**Complete**
AIDA® offers a large selection of storage locations. The data exported to each storage location can be defined. The Intelligent Export Manager (IEM) then carries out the export in the background. To prevent data loss, the system keeps the data until they have been successfully exported.

**Reference**
All important patient information is always available and easy to access. Completed procedures including all information, still images, videos, and the checklist reports can be easily retrieved from the Reference module.
Cold Light Fountain Power LED 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

Fiber Optic Light Cable, with straight connector, extremely heat-resistant, with safety lock, increased light transmission, diameter 3.5 mm, length 230 cm, can be used for ICG applications

Equipment Cart

Equipment Cart

- wide, tall, rides on 4 antistatic dual wheels equipped with locking brakes, 3 shelves, mains switch on top cover, energy beam package with integrated electrical subdistributors with 12 sockets, grounding plugs
- Dimensions (w x h x d):
  - Equipment cart: 830 x 1474 x 730 mm
  - Shelf: 630 x 25 x 510 mm
  - Caster diameter: 150 mm
- consisting of:
  - Base module, equipment cart, wide
  - Cover, equipment cart, wide
  - Beam package, equipment cart, tall
  - 3x Shelf, wide
  - Drawer unit with lock, wide
  - 2x Equipment rail, long
  - Camera holder
  - 2x Mains Cord, length 100 cm
Equipment Cart

Recommended Accessories

**Monitor Swivel Arm,**
height- and side-adjustable,
can be mounted on the left or right,
swivel range 180°, overhang 780 mm,
overhang from center 1170 mm,
load capacity max. 15 kg,
with monitor mount VESA 75 / 100,
for use with equipment carts UGxxx

**Isolation Transformer,**
200 V–240 V; 2000 VA with 3 special mains
sockets, automatic cut-out, 3 grounding plugs,
dimensions: 330 x 90 x 495 mm (w x h x d),
for use with Equipment Carts UGxxx

**Earth Leakage Monitor,**
200 V–240 V, for mounting to equipment cart,
control panel dimensions:
44 x 80 x 29 mm (w x h x d),
for use with Isolation Transformer UG310

**Monitor Holding Arm,**
height- and side-adjustable, tilting,
mountable to the left or right,
swivel range up to 320°, overhang 530 mm,
load capacity max. 15 kg,
monitor mount VESA 75 / 100,
for use with Equipment Carts UGxxx
Notes:
Notes: