ENDOUROLOGICAL UPPER URINARY TRACT PROCEDURES IN PEDIATRICS

Authors:
Antonio FRATTINI, M.D.
Head of Operative Unit of Urology – Hospital of Guastalla (RE), Italy

Stefania FERRETTI, M.D.
Endourology-Laparoscopy Team*

Co-Authors:
Paolo E. SALSI, M.D.
Endourology-ESWL Team*

Pietro GRANELLI, M.D.
Endourology-Laparoscopy Team*

*) Operative Urology Unit
Clinical Director of Operative Urology Unit: Pietro Cortellini
Parma Hospital and University, Parma, Italy
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Endourological Upper Urinary Tract Procedures in Pediatrics

Authors: Antonio Frattini, M.D.
Head of Operative Unit of Urology
Hospital of Guastalla (Reggio Emilia), Italy

Stefania Ferretti, M.D.
Endourology-Laparoscopy Team*

Co-Authors: Paolo E. Salsi, M.D.
Endourology-ESWL Team*

Pietro Granelli, M.D.
Endourology-Laparoscopy Team*

*) Operative Urology Unit
Clinical Director of Operative Urology Unit: Pietro Cortellini
Parma Hospital and University, Parma, Italy

Correspondence address of the author:
Dott. Antonio Frattini
Dirigente Medico di Urologia dell’Ospedale di Guastalla
Via Donatori di Sangue 1
42016 Guastalla, Reggio Emilia, Italia

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Fax: +49 (0) 74 61/708-529
E-mail: endopress@t-online.de

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1.0 Introduction

Urolithiasis is a worldwide disease, the incidence of which exhibits considerable geographic variability, when grouped according to anatomic location of calculus formation. In Southeast Asia and Africa, bladder stones are the most widespread entity, whereas in the USA and Europe, upper urinary tract stones are seen more frequently. In the past 30 years, there are reports in the literature that give evidence of epidemiological trends in the occurrence of pediatric urolithiasis. Such trends are observed not only in terms of incidence rates, ranging between 0.3 and 0.94 of cases per 1,000 hospitalizations in western countries, but also regarding the apparently shifting etiological pattern of lithogenesis. In this context, the most significant trend observed in Europe is the apparent decrease in the rate of so-called ‘infectious stones’ in favor of unknown metabolic anomalies increasing from 16% in the early 1980s up to 44%, these days. These epidemiological findings are probably linked to the increased effectiveness in detection and treatment of urinary tract infections in children. Another reason for this trend may have to do with the improved etiopathogenetic knowledge of pediatric urolithiasis. Therefore, the authors assume that the incidence of the metabolic anomalies in Europe is quite similar to that reported in the USA. Early detection of metabolic anomalies is of crucial importance, because the most severe lithogenic risk factors can be eliminated. Many children suffering from stone disease are also afflicted with congenital urinary malformations, but so far, the contrary case could not be demonstrated.

2.0 Stone Management in Children: Treatment Options and Related Chronicity

2.1 Extracorporeal Shock-Wave Lithotripsy (ESWL)

ESWL was successfully introduced into the pediatric setting in 1986. For quite a long time, it was ranked as first-line treatment modality for single or multiple stones in the kidney and ureter. Nowadays, ESWL is the preferred therapeutic approach for pediatric patients with renal calculi smaller than 20 mm (less than 1.5 cm in cystine calculi) as published in the ‘Guidelines on Urolithiasis’ of the European Association of Urology (EAU). Stone-free rates range between 57% and 92%. It is well known, that ESWL in the case of lower caliceal stones (stone-free rate 50-62%) has a low success rate which stems from the specific anatomical site and gravity; it is determined by the length of the calyx infundibulum, the infundibulopelvic angle (cut off: 40°) and, of course, by the stone burden. The conditions for spontaneous stone expulsion are more favourable in children compared with adults, which is reflected by the lower rate of auxiliary procedures (5-38%), e.g., stent placement or ureteroscopy.
2.2 Semi-Rigid and Flexible Ureteroscopy

Semi-rigid ureteroscopy is indicated as first-line treatment option for proximal and mid ureteral stones in experienced centers and secondary to a single treatment session of unsuccessful ESWL. The rigid and flexible instruments currently available on the market have a larger working channel than years ago. Flexible endoscopes can be deflected up to 270° which has shown to be particularly useful in the removal of calculi from the lower pole. The incidence of ureteral strictures or vesicoureteral reflux (nowadays, ostium dilation is very rarely employed owing to miniaturization of instruments) is low and associated complications apparently do not differ from those encountered with ureteroscopy in adults.

2.3 Retrograde Intrarenal Surgery (RIRS)

The evolution and miniaturization of flexible instruments along with the advent of laser lithotripsy have propelled the development of the retrograde ureterorenoscopic approach and thus expanded the scope of treatment options available for pediatric lithiasis.

Retrograde intrarenal surgery has been shown to offer a high level of efficacy and reduced invasivity in patients with stones of less than 2.5 cm in diameter. At any rate, the size of the ureter in children aged less than 3 years imposes a limiting factor, because insertion of the ureteral access sheath is not always feasible; in such cases placement of an ureteral stent may be scheduled some days prior to ureteroscopic lithotripsy. RIRS should be preferred to percutaneous nephrolithotomy (PCNL) provided minimal invasivity does not compromise effectiveness. The supine position allows to modify the surgical technique from RIRS to endovision PCNL if required, obviating the need for changing the patient position, if the operating surgeon realizes that the retrograde approach alone is inappropriate for achieving a satisfactory stone-free state. In patients, for instance, with very hard stones composed of calcium oxalate monohydrate, it is advisable to convert to a PCNL procedure by using a large-diameter laser probe to obtain complete stone clearance in less surgical time.

2.4 Miniature/Mini (14–20 Fr), Medium (22–24Fr) or Standard (28–30 Fr) Percutaneous Nephrolithotomy (PCNL)

The percutaneous approach is routinely reserved for larger calculi and more complex conditions of lithiasis; for cases of ESWL-refractory stones or in the presence of anatomical abnormalities, particularly in caliceal diverticula, where disintegration or expulsion of fragments becomes difficult. PCNL is considered an invasive treatment but complication rates are very low (transfusion rate 0–23%, no statistically significant loss of kidney function is reported). In conclusion, PCNL is a successful procedure in experienced hands.
3.0 Laparoscopic Versus Open Surgery

In developed countries, open surgery remains the mainstay of urolithiasis treatment for 0.3–5.4% of the pediatric population. Generally, the combination of stone removal and surgical repair of anatomical abnormalities is the gold standard all over the world (open versus laparoscopic-robotic surgery).

4.0 Indications of PCNL

Based on the personal experience of the authors and review of worldwide literature, the indications of PCNL treatment can be summarized as follows:

- Kidney stones larger than 2 cm, or cystine stones ≥ 1.5 cm
- Lower-pole stones of ≥ 1.5 cm, or calculi located in an unfavourable infundibular angle.
- ESWL-refractory stones.
- Stones in the presence of anatomical abnormalities amenable to percutaneous management, e.g., caliceal diverticula, ureteral stenosis, recurrence after surgery for ureteropelvic junction (UPJ) stenosis.
- In cases, inappropriate for use of RIRS, e.g., urinary diversion with a difficult retrograde ureteral approach.

In conclusion, the indications are substantially the same as those in adults, provided the absence of a malformation that might mandate the use of open or laparoscopic surgery.

5.0 Personal Experience of the Authors

In a joint-specialty group setting at the urology unit in collaboration with the pediatric surgery unit, from January 2000 to September 2011, a total of 30 percutaneous procedures were performed in 25 children – four percutaneous procedures on a single kidney were needed to treat one case of complex bilateral urolithiasis – of whom 10 on the right and 15 on the left. Age distribution ranged from 6 months to 16 years (14 females and 11 males). Mean stone size was between 18 and 45 mm (34 ± 10.6 mm) and stone location as presented in Table 1. The case reports drawn from the above patient group included one case of complete duplicated pyeloureteral system, a case of hypertonlic and low-compliance neurogenic bladder in spina bifida (treated with enterocystoplasty and bilateral vesicoureteral reimplantation), a case of nephrocalcinosis, a case of horseshoe kidney and a case of VACTERL syndrome. In two patients, previous ESWL treatment had failed at first attempt. 12 out of 25 patients had suffered from previous urinary tract infections. Between 2000 and 2005 (10 procedures) all PCNL techniques were performed in a prone position, while from 2005 until now (20 procedures) the same approach was used in supine position. In 18 patients, the percutaneous approach was performed using an endovision technique.

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a Prof. P. Cortellini, Clinical Director of Operative Urology Unit, Parma Hospital and University, Parma, Italy
b Prof. C.G. del Rossi, Clinical Director of Pediatric Surgery Unit, Parma Hospital and University, Parma, Italy
c Vertebral abnormalities, Anal atresia, Cardiac abnormalities, Tracheoesophageal fistula and Esophageal atresia, Renal agenesis and dysplasia, and Limb defects
5.1 Outcomes of Treatment

The study included 25 patients with a total of 30 kidneys treated with PCNL. Case reports drawn from this patient group included one case of complex nephrolithiasis (bilateral staghorn renal stones that required four percutaneous interventions to be conducted on just one kidney) and one case of complex lithiasis (5 calyceal stones – the biggest one sized more than 2 cm) necessitating two procedures. Through a nephrostomy tube a descending pyelography was performed, confirming a stone-free status in 22/25 patients (fragments < 3 mm) at the end of the percutaneous procedure (88 %), and in 2/25 patients after a second-look procedure (96 %). In 1/25 patients (with a complete duplicated pyeloureteral system on the ipsilateral side of lithiasis), colic pain developed after ureteral catheter removal, necessitating adjunctive placement of an ureteral stent (removed after 10 days) to obtain complete pain relief. In the case of complex nephrolithiasis (bilateral staghorn stones, low-compliance bladder in spina bifida, distal tubular acidosis) two additional flexible ureterorenoscopies had to be performed to achieve a stone-free status. A contralateral nephrectomy was performed for functional renal failure, which justified an off-limits percutaneous approach to rapidly restore a complete stone-free status of the single functional kidney. In the other 23 cases, no adjunctive procedures were needed. The postoperative complications were as follows: Postoperative anemia in 1/30 procedures (3.3 %) managed by transfusion of one blood unit; persistent gross hematuria: 1/30 procedures (3.3 %) managed by nephrostomy drainage removal at 11th postoperative day. Hyperpyrexia: 4/30 procedures (13.3 %) ≤ 38 °C for no longer than 48 h, treated by administration of paracetamol. Postoperative pain: 5/25 patients (20 %) treated by administration of common analgesic drugs. The ureteral catheter used during the procedure was removed between the first and seventh postoperative day (mean 4.7 days), while nephrostomy tube removal was performed between the 2nd and 11th postoperative day (mean: 4.7 ± 2.7 days).

<table>
<thead>
<tr>
<th>Staghorn Calculi (4)</th>
<th>Single Stones (8)</th>
<th>Multiple Stones (13)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stone Location</strong></td>
<td><strong>Stone Location</strong></td>
<td></td>
</tr>
<tr>
<td>4 (2 bilateral)</td>
<td>Pyelic Ureteropelvic Junction (UPJ)</td>
<td>Renal</td>
</tr>
<tr>
<td></td>
<td>P + IC 4</td>
<td>SC + IC + LU 2</td>
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<tr>
<td></td>
<td>P + IC + SC 4</td>
<td>P + LU 2</td>
</tr>
<tr>
<td></td>
<td>P + DU 1</td>
<td></td>
</tr>
</tbody>
</table>

Table 1

Key of Acronyms: pyelic (P), inferior calyx (IC), superior calyx (SC), lumbar ureter (LU), distal ureter (DU).
6.0 Essentials Specific to the Needs of Children

Vital Precautions and Objectives in a Pediatric Setting

- Minimal invasiveness (calibre)
- Minimal duration of anesthesia
- Minimal X-ray exposure
- Maximum stone-free rate – stone clearance in one session
- Reduced time for post-operative drain results in more comfort, less pain
- Tubeless procedure is desirable

7.0 Operative Armamentarium

While the design of most instruments is basically the same as in an adult setting, in pediatric endourological upper urinary tract procedures they should be reduced in both calibre and length. However, this does not necessarily mean that a specific pediatric endoscopy set be available to perform a PCNL approach in a child or adolescent. The new generation of semi-rigid 7-Fr. uretero-renoscopes has a 4.8-Fr. operating channel making them also suitable for use in adults (e.g., KARL STORZ item no. 27000 K, length 34 cm; 27000 L, length 43 cm). Of course, in children younger than 3 years of age, the use of pediatric instruments (especially in terms of length) has proven to be more comfortable for the surgeon and more suitable for the little patient. Flexible ureteroscopes play a major role in all percutaneous/endoscopic procedures, which is why they need to be adapted to the pediatric urinary system both in calibre and length. At the authors’ department, a standard 7.5-Charr. Flex-X² ureteroscope (KARL STORZ Tuttlingen, Germany) is used, that is also suitable in a pediatric approach, provided a small-diameter ureteral sheath (9.5 Fr) is used.

7.1 Dilation Set

According to the protocol employed at the authors’ institution, a pneumatic set is used for dilation of the nephrostomy tract; only in a mini-percutaneous (‘mini-perc’) approach, a coaxial teflon catheter for tract dilation is used to achieve the 14–19-Fr. Amplatz calibre (MINI-PCNL). As an alternative option, balloon dilation with 18–24-Fr. can be used (MIDI-PNL). Standard PCNL dilating up to 30–34-Fr. is deemed to be reserved to treatment of staghorn renal calculi in teenagers.
7.2 Technical Aspects

7.2.1 Preparation of Patient

Patient in Supine Position

- Use of an antidecubitus cushion nearby the costal arch and the gluteus, in order to lift and expose the flank involved.
- The contralateral leg is lifted in a semiflexed position.
- The leg is slightly abducted in order to facilitate insertion of the cystoscope / ureteroscope.
- The ipsilateral arm is adducted and laid on the chest in order to allow adjunctive elevation of the posterior axillary line (PAL).
- The contralateral arm is abducted and fixed horizontally for intravenous access.

1. Skin markings are placed for proper orientation prior to initiating the procedure. The following landmarks should be included: Posterior axillary line (PAL), lower margin of costal arch and upper margin of iliac crest.

2. Double paddings applied to the patient in supine position. Jelly-like bolsters may also be used for this purpose.
3 Frontal view of patient in supine position.

4 The operative field is prepared and draped in a sterile manner.
7.2.2 Percutaneous Puncture, Creation of the Nephrostomy Tract and Videoendoscopic Procedure

Percutaneous puncture of the pelvi-calyceal system in a child is based on the same concepts as in adults and is subject to the surgeon’s preferences (C-arm fluoroscopic imaging and/or ultrasound guidance). If possible, definitive puncture of the renal papilla should be performed under direct endoscopic vision permitting a higher level of safety regarding proper (in-line) advancement in relation to the puncture axis, thus reducing to a minimum the potential risk of bleeding. Apart from that, videoendoscopic guidance allows to follow all steps of tract dilation while reducing x-ray exposure time for the child.

5 Highlighted by a green arrow is the most favourable infundibulopelvic route that should be adopted for a percutaneous approach to the lower renal calyx; the red line shows the course of a false route.

6 Radiological and endoscopic views of renal papilla.

7 Radiological and endoscopic views of renal puncture.
7.2.3 Special Considerations

Always keep in mind, that
- the pediatric kidney is not as ‘small’ as you think, but in proportion to adults, the hypochondriac viscera are larger. Prior to initiating renal puncture (for those who do not routinely perform puncture under ultrasound guidance) ultrasound is an alternative imaging modality that may be used effectively to obtain a general preoperative survey of the exact location of the upper, middle and lower calyces.
- In children of less than 3 years, the ureter is less compliant than in those who have exceeded this age. Therefore, it has proven useful to insert a double-J ureteral stent a few days before the endourological procedure.
- Pediatric urolithiasis is frequently associated with urinary malformations, which is why a therapeutic planning in close collaboration with pediatric surgeons is highly recommended.

8.0 Case Histories

Case 1

A 7 year-old girl presented with VACTERL association, a syndrome pattern of non-random birth defects. The patient had a previous history of repeat reconstructive surgery and urinary diversion with surgical obliteration of the bladder neck in favor of a continent catheterizable conduit (Mitrofanoff appendicovesicostomy). She was referred to us for treatment of left ureteral and inferior pyelocaliceal stones.
The arrows show lumbar and inferior caliceal stones.

Flexible ureteroscopy performed through a Mitrofanoff conduit. Identification of the urinary left meatus. Laser lithotripsy of a calculus at the level of the lumbar region.

Nephrostomy tube after percutaneous inferior transcalyceal stone clearance.
Case 2

5 year-old girl with a left pyelocaliceal stone treated by using a mini-percutaneous access of 14/19 Fr. under videoendoscopic guidance.

The patient is placed in a supine position and adequately supported with gel pads.

Detection of calculi in the lower renal calyx using flexible ureteroscopy. Calyceal morphology is checked while reducing to a minimum X-ray exposure to the patient.

Percutaneous puncture provides access to the lower calyx. Prior to establishing the nephrostomy tract, the access route to the renal papilla is checked by flexible ureteroscopy.
Creation of the nephrostomy tract by use of a coaxial dilator set, 14/19 Fr., for insertion of an Amplatz sheath.

Concurrent real-time inspection of the renal cavities via both retrograde and antegrade access routes.

At the end of the procedure, no nephrostomy tube is needed (tubeless procedure).
9.0 Recommended Literature


Recommended Instrument Set for Endourological Upper Urinary Tract Procedures in Pediatrics
KARL STORZ Uretero-Renoscopes
The right solution for every anatomical circumstance and indication

27000 L

Uretero-Renoscope, 7 Fr., 6°, length 43 cm, distal tip 6.5 Fr., instrument sheath 7 Fr., one-step, 9.9 Fr., autoclavable, with angled eyepiece, fiber optic light transmission incorporated, 2 lateral irrigation ports and 1 working channel 4.8 Fr., for use with instruments up to 4 Fr.

Following accessories are included:
- 27001 E Insertion Aid
- 27001 G Instrument Port with Sealing System and Quick Release Lock
- 27500 Luer-Lock Tube Connector
- 27502 Luer-Lock Tube Connector
- 27550 N Seal, package of 10
- 27504 Flow Control Stopcock
- 39501 X Wire Tray

It is recommended to check the suitability of the product for the intended procedure prior to use.
Uretero-Fiberscopes KARL STORZ Flex-X²™

For access to the entire intrarenal collection system

11278 A1

Uretero-Fiberscope KARL STORZ Flex-X²
steerable,
Deflection of distal tip 270°/270°
Direction of view 0°
Angle of view 88°
Working channel
inner diameter 3.6 Fr.
Sheath size 7.5 Fr.
Working length 67.5 cm

Following accessories are included:
27677 A Case
11025 E Pressure Compensation Cap
13242 XL Leakage Tester,
with bulb and manometer
27651 AL Cleaning Brush, flexible,
for working channel, > 1 mm,
working length 150 cm

11278 AC1

Pediatric Cysto-Urethro-Fiberscope,
FLEX-X, steerable,
Instrument channel: 3.6 Fr.
Direction of view: 0°
Angle of view: 88°
Working length: 45 cm
O.D. shaft: 7.5 Fr.

Following accessories are included:
27677 XA Case
11025 E Pressure Compensation
13242 XL Leakage Tester
27651 AL Cleaning Brush
27014 Y Luer connector
Modular Miniature Nephroscope System

with Automatic Pressure Control

Special Features:
- Maximum inflow due to large central working channel
- The large working channel allows the use of rigid instruments and probes up to 5 Fr.
- The rigid angled eyepiece makes working more comfortable and ensures easy handling of instruments as well as a safe distance to the surgeon while using lithotripsy probes

Specifications:
- Instrument sheath: 12 Fr.
- Working channel: 6.7 Fr. for use with instruments up to 5 Fr.
- Telescope: KARL STORZ fiber optic system, direction of view 12º
- Length: 22 cm
- Eyepiece: angled

27830 KA

Miniature Nephroscope 12º, with angled eyepiece, 12 Fr., length 22 cm, autoclavable, one working channel 6.7 Fr. for instruments up to 5 Fr., fiber optic light transmission incorporated

Following accessories are included in delivery:
- 27001 GP Instrument Port with Sealing System and Quick Release Lock, 1 channel
- 27550 N Seal, for working channel, package of 10, single use recommended
- 27500 Luer-Lock Tube Connector, male, tube diameter 9 mm
- 27502 Luer-Lock Connector, with stopcock, dismantling
- 27001 E Insertion Aid, for guide wires in ureterorenoscopy
- 39501 XK Tray, 460 x 150 x 80 mm including: Cleaning Adaptor, for Ports 27001 GP

Additional:
- 27001 GG Instrument Port with Sealing System and Quick Release Lock, large, 1 channel, for use with instruments up to 2 mm diameter in combination with Miniature Nephroscope 27830 KA
Modular Miniature Nephroscope System with Automatic Pressure Control

27830 AA

27830 AA **One Step Dilator**, with central channel for guide wires, for use with 15/16 Fr. Operating Sheath 27830 BA

27830 BA

27830 BA **Operating Sheath**, 15/16 Fr., for continuous suction and irrigation

27830 CF

27830 CF **Applicator for Sealing**, including sheath and rod, for use with Operating Sheaths 27830 BA/BB/BC

27830 FK

27830 FK **Forceps for Foreign Body Removal**, double action jaws, flexible, 5 Fr., length 40 cm

27830 H

27830 H **Grasping Forceps**, for large stones and stone fragments, triple serrated jaw parts and U-spring handle, 5 Fr., length 36 cm
CALCULASE II SCB
LASER System for Endoscopic Stone Therapy and Soft Tissue Treatment

20 Watt LASER Power
The brand CALCULASE II SCB stands for a cost-effective and efficient Holmium: YAG LASER system for endoscopic LASER lithotripsy.

Soft Tissue Treatment
The system can be used for, among others, soft tissue treatment such as ureteropelvic junction stenosis and ablation of urethral carcinoma.

Diverse LASER Fibers and Instruments
KARL STORZ offers LASER fibers in various sizes (230, 365 and 600 µm) for both single and multiple use. Together with its wide range of rigid and flexible ureterorenoscopes equipped with fiber optic and sensor technology, KARL STORZ offers the ideal complete solution for stone therapy and soft tissue treatment.

Automatic Fiber Detection
This feature enables automatic adjustment of energy settings to the fiber sizes and, consequently, prevents damage to the fibers or the unit itself.

Mobility
Its compact design makes CALCULASE II SCB a very versatile and mobile system. With its innovative handles, the LASER system can easily be placed on the urological equipment cart and moved from one OR to the next.
Alternatively, the LASER system can be placed on an equipment cart specially designed for this purpose and transported as required.
CALCULASE II SCB
LASER System for Endoscopic Stone Therapy and Soft Tissue Treatment

LASER System for the Treatment of Bladder, Ureter and Kidney Stones
and for opening stenoses/strictures as well as tumor ablations

Special Features:
- 20 Watt for effective and precise treatment: precise cutting effect in the case of stenoses
- Extremely fast lithotripsy
- Automatic fiber detection:
  - High user-friendliness
  - Increased safety
- Green pilot laser: Good visibility even in challenging situations
- Special design with:
  - Mobile desktop housing
  - Automatically controlled energy output
  - Integrated low-noise cooling system
- Least possible tissue damage
- High success rate independent of stone composition
- Lithotripsy under endoscopic control
- Intensity preselection adjustable in 5 steps
- Pulse frequency adjustable in 5 steps
- For use with rigid, semiflexible and flexible endoscopes
- For use on endoscopic equipment carts
- Easy to maintain
- With connections to the KARL STORZ Communication Bus (KARL STORZ SCB)
CALCULASE II SCB
Holmium LASER System for Endoscopic Stone Therapy
and Soft Tissue Treatment, Recommended System Configuration

27 7502 01-1 CALCULASE II SCB, Holmium LASER system, power supply 230 VAC, 50/60 Hz
including:
Mains Cord
One-Pedal Footswitch
Key Set, package of 2, for key-operated switch
Remote Interlock Connector
SCB Connecting Cable, length 100 cm
Safety Goggles Ho:YAG LASER 2080 µm

27 7502 01U1 Same, power supply 115 VAC, 50/60 Hz

Please note:
Each lithotripsy system requires a separate basic fiber set: 27 7502 87 or 27 7502 86.

Parameters for 230 µm Fibers

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<th>Energy</th>
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<tr>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Parameters for 365 µm and 600 µm Fibers

<table>
<thead>
<tr>
<th>Energy</th>
<th>4 Hz</th>
<th>6 Hz</th>
<th>8 Hz</th>
<th>10 Hz</th>
<th>15 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 J</td>
<td>2 W</td>
<td>3 W</td>
<td>4 W</td>
<td>5 W</td>
<td>7.5 W</td>
</tr>
<tr>
<td>0.8 J</td>
<td>3.2 W</td>
<td>4.8 W</td>
<td>6.4 W</td>
<td>8 W</td>
<td>12 W</td>
</tr>
<tr>
<td>1.2 J</td>
<td>4.8 W</td>
<td>7.2 W</td>
<td>9.6 W</td>
<td>12 W</td>
<td>18 W</td>
</tr>
<tr>
<td>1.7 J</td>
<td>6.8 W</td>
<td>10.2 W</td>
<td>13.6 W</td>
<td>17 W</td>
<td>–</td>
</tr>
<tr>
<td>2 J</td>
<td>8 W</td>
<td>12 W</td>
<td>16 W</td>
<td>20 W</td>
<td>–</td>
</tr>
</tbody>
</table>

Parameter settings are selected via the LASER fiber code.
CALCULASE II SCB
System Components

UNIT SIDE

PATIENT SIDE

One-Pedal Footswitch

CALCULASE II Fiber

LASER Suction Tube

Video Uretero-Renoscopes FLEX-Xc IMAGE1 S/ FLEX-Xc

Uretero-Renoscope

Nephroscope for MIP XS/S

Percutaneous Nephroscope

11278 VS/VSU/V/VU

27001 L/K

27820 KA

27290 LL

27750271

27700124

27292 AMA/27293 AA/27092 AMA/27093 AA
CALCULASE II SCB

Accessories

**Fiber Sets, reusable**

- **27 7502 71-P6** CALCULASE II Fiber 230 µm, reusable, sterile, length 300 cm, package of 6
- **27 7502 72-P6** CALCULASE II Fiber 365 µm, reusable, sterile, length 300 cm, package of 6
- **27 7502 73-P6** CALCULASE II Fiber 600 µm, reusable, sterile, length 300 cm, package of 6

- **27 7502 87** CALCULASE II Fiber Kit
  - including:
    - 3x CALCULASE II Fiber 230 µm, reusable
    - 3x CALCULASE II Fiber 365 µm, reusable
    - 3x CALCULASE II Fiber 600 µm, reusable

**Fiber Sets, for single use**

- **27 7502 77-P6** CALCULASE II Fiber 230 µm, for single use, sterile, length 300 cm, package of 6
- **27 7502 78-P6** CALCULASE II Fiber 365 µm, for single use, sterile, length 300 cm, package of 6
- **27 7502 79-P6** CALCULASE II Fiber 600 µm, for single use, sterile, length 300 cm, package of 6

- **27 7502 86** CALCULASE II Fiber Kit
  - including:
    - 3x CALCULASE II Fiber 230 µm, for single use, sterile
    - 3x CALCULASE II Fiber 365 µm, for single use, sterile
    - 3x CALCULASE II Fiber 600 µm, for single use, sterile

**Further accessories**

- **27 7500 82** Fiber Cutter

- **27 7500 81** Fiber Stripper

- **27 7502 80** Fiber Stripper Set, sterilizable, for use with CALCULASE II SCB fibers
  - including:
    - Silicone Pad
    - Ceramic Knife
    - Fiber Strippers 230, 365 and 600 µm

- **27 7500 95** Safety Goggles Ho:YAG Laser, 2080 µm

The CALCULASE II fibers above are compatible with the previous model CALCULASE (27 7501 20-1).
CALCULASE II SCB Equipment Cart

Special Features:
- Flexible use of CALCULASE II SCB in various ORs
- Spacious storage room for accessories and expendable materials in two lockable drawers (LASER safety goggles or LASER fibers)
- Integrated cable winding and footswitch holder maintain an uncluttered OR
- Easy to transport due to large, smooth-running and antistatic dual wheels
- Powder-coated panels and shelves meet the most stringent quality and hygiene standards

UG 210 Equipment cart wide, low, rides on 4 antistatic dual wheels equipped with locking brakes, mains switch on cover, double rear panel with integrated electrical subdistributors with 6 sockets, potential earth connectors,
Dimensions:
Equipment cart: 830 x 1265 x 730 mm (w x h x d),
shelf: 630 x 510 mm (w x d), caster diameter: 150 mm,
including:
Base module equipment cart, wide
Cover, equipment cart wide
Beam package, equipment cart low
Shelf, wide
2x Drawer unit with lock, wide
2x Equipment rail, long
**IMAGE1 S Camera System**

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

**Innovative Design**
- Dashboard: Complete overview with intuitive menu guidance
- Live menu: User-friendly and customizable
- Intelligent icons: Graphic representation changes when settings of connected devices or the entire system are adjusted

**Automatic light source control**
- Side-by-side view: Parallel display of standard image and the Visualization mode
- Multiple source control: IMAGE1 S allows the simultaneous display, processing and documentation of image information from two connected image sources, e.g., for hybrid operations

**Dashboard**

**Live menu**

**Intelligent icons**

**Side-by-side view: Parallel display of standard image and Visualization mode**
IMAGE1 S Camera System

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

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

FULL HD image

CLARA

FULL HD image

CHROMA

FULL HD image

SPECTRA A*

FULL HD image

SPECTRA B**

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

**NEW**

**TC 200EN**

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

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

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

---

**Specifications:**

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

**For use with IMAGE1 S**

**IMAGE1 S CONNECT Module TC 200EN**

---

**TC 300**

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

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

**Specifications:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>TC 300 (H3-Link)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported camera heads/video endoscopes</td>
<td>TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S)</td>
</tr>
<tr>
<td>LINK video outputs</td>
<td>1x</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.86 kg</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Specifications:</th>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-Z</th>
<th>IMAGE1 S H3-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 100</td>
<td>TH 103</td>
<td></td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
<td>3x 1/3&quot; CCD chip</td>
<td></td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 114 mm</td>
<td>35 x 47 x 88 mm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
<td>226 g</td>
<td></td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, f = 15-31 mm (2x)</td>
<td>pendulum system, fixed focus f = 16 mm</td>
<td></td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
<td>F 1.4/1.17 Lux</td>
<td></td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
<td>standard eyepiece adaptor</td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
<td>non-detachable</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
<td>300 cm</td>
<td></td>
</tr>
</tbody>
</table>
Monitors

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

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

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wall-mounted with VESA 100 adaption</strong></td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td><strong>Inputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Outputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
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<tr>
<td><strong>Signal Format Display:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:3</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

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

### Specifications:

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

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

WD 200-XX* AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, power supply 100-240 VAC, 50/60 Hz
including:
- **USB Silicone Keyboard**, with touchpad
- **ACC Connecting Cable**
- **DVI Connecting Cable**, length 200 cm
- **HDMI-DVI Cable**, length 200 cm
- **Mains Cord**, length 300 cm

WD 250-XX* AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, including SMARTSCREEN® (touch screen), power supply 100-240 VAC, 50/60 Hz
including:
- **USB Silicone Keyboard**, with touchpad
- **ACC Connecting Cable**
- **DVI Connecting Cable**, length 200 cm
- **HDMI-DVI Cable**, length 200 cm
- **Mains Cord**, length 300 cm

*XX Please indicate the relevant country code (DE, EN, ES, FR, IT, PT, RU) when placing your order.
Workflow-oriented use

**Patient**
Entering patient data has never been this easy. AIDA seamlessly integrates into the existing infrastructure such as HIS and PACS. Data can be entered manually or via a DICOM worklist. All important patient information is just a click away.

**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 for sustainably increasing patient safety.

**Record**
High-quality documentation, with still images and videos being recorded in FULL HD 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 very rapidly completed. Recordings can be quickly optimized and then directly placed in the report. In addition, freeze frames can be cut out of videos and edited and saved. Existing markings from the Record module can be used for quick selection.

**Complete**
Completing a procedure has never been easier. 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 report can be easily retrieved from the Reference module.
Fiber Optic Light Cable

495 NA  Fiber Optic Light Cable, with straight connector, diameter 3.5 mm, length 230 cm

Cold Light Fountain XENON NOVA® 300

20134001  Cold Light Fountain XENON NOVA® 300, power supply: 100–125 VCA/220–240 VAC, 50/60 Hz
including:  Mains Cord

20132028  XENON Spare Lamp, only, 300 watt, 15 volt

Cold Light Fountain Power LED 175 SCB

20161401-1  Cold Light Fountain Power LED 175 SCB, with integrated SCB, high-performance LED and one KARL STORZ light outlet, power supply 110–240 VAC, 50/60 Hz
including:  Cold Light Fountain Power LED Mains Cord
SCB Connecting Cable, length 100 cm

20132026  Xenon-Spare-Lamp, 175 Watt, 15 Volt
**Equipment Cart**

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

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

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

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

**UG 310**

*Isolation Transformer,*

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

**UG 410**

*Earth Leakage Monitor,*

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

**UG 510**

*Monitor Holding Arm,*

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