FLEXIBLE URETEROSCOPY WITH THE DIGITAL URETEROSCOPE FLEX XC

2nd Edition

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Introduction

The KARL STORZ Flexible Ureteroscope has continued to evolve from a fiberoptic-based imager to a state-of-the-art digital endoscope. The KARL STORZ Flex Xc is the newest in the series of flexible ureteroscopes, maintaining both a small outer diameter and all of the mechanical features that facilitate ease in access of the upper urinary tract and the most complex interventions for both intrarenal and ureteral disorders (Fig. 1.1).

This progression in instrument design has helped to facilitate many ureteroscopic procedures and has simplified not only access to the ureter, but also placement of working instruments within the entire collecting system.

1.1 Features

As with its fiberoptic predecessor, this digital based endoscope maintains thumb lever controlled exaggerated tip deflection, (270 degrees in both up and down directions), a stiff shaft which helps facilitate direct placement of the endoscope into many ureters often without dilation, and a robust 3.6 French working channel. (Fig. 1.1) In addition The KARL STORZ Flex Xc has a secondary passive deflecting component which allows for access and placement of the tip of the ureteroscope into the most dependant lower pole calyces (Figs. 1.2) These unique mechanical features are combined with a state-of-the-art CMOS digital chip imager with eighteen times the pixel power of the fiberoptic ureteroscope.

The digital imager has revolutionized the entire endoscopic platform. No longer is a light cable and camera head required, rather a single cord carries the image from the endoscope, while two tiny LEDs produce a bright, crisp clear high definition image without shadowing. This lighter weight handpiece is ergonomically designed and easier to use. Digital image enhancement, (i.e., IMAGE1 S) allows the surgeon to enhance the image which can be particularly helpful in differentiating various urothelial lesions including malignancies. Real-time adjustments in image technique can be implemented by the surgeon from the handpiece by scrolling through a menu of options including image size, brightness. Apart from that, IMAGE1 S can be operated in various modes that permit subtle adjustments to be made to color and image texture which results in a more sensitive diagnostic image. In this way, the surgeon is enabled to refine the image as needed to optimize therapeutic interventions employing varied energy sources including laser energy delivered through the working channel.

As the mechanical components inherent in this series were game changers in their time, the addition of this unique high quality tiny digital imager on the same small steerable flexible shaft reflects a new standard in flexible ureteroscopy (Fig. 1.3).
1.2 Tip Deflection

The KARL STORZ Flex X® flexible ureteroscope represents a unique concept in active tip deflection. In the past, deflection was termed either active at the tip or passive along the shaft. A combination of active and passive deflection was required to access the lower pole, for example. The current flexible digital instrument, like its fiberoptic predecessor, has continuous controlled dual deflection with increased downward and upward deflection, up to 270 degrees in both directions. The radius of deflection is thus broader, allowing the endoscope to be regularly placed directly into the ureteral orifice under direct vision, as well as facilitating therapies throughout the intra-renal collecting system. This larger radius of deflection and the increased deflectability help not only to facilitate access to the lower pole, but also to place working instruments into the lower pole calyces (Fig. 1.3b). The full range of deflection can be achieved in an adequate space, such as a dilated renal pelvis (Fig. 1.3a). In addition, the novel tip design allows for maximum deflectability, to all but the last few mm’s of the endoscope, maximizing the ability to place the tip around corners and edges in complex collecting systems. In addition, just proximal to the active deflecting segment of the endoscope, there is also a passive deflecting segment which allows the instrument to be placed into the most dependent lower pole (Fig. 1.3b).

One of the instruments most commonly passed into the lower pole for intrarenal retrograde ureteroscopic therapy is a quartz holmium laser fiber (Fig. 1.3d). With the Flex X®, this and other accessories can be placed into the lower pole, providing over 220 degrees of active tip deflection with the laser fiber in the channel (Fig. 1.3c).

Fig. 1.3a–d Fluoroscopic image of KARL STORZ Flex X® ureteroscope fully deflected in a dilated renal pelvis (a). Full active continuous controlled dual deflection of the tip of the KARL STORZ Flex X® ureteroscope brings the tip to 270° deflection in each direction (b). Extended active deflection is reached even with a 365-micro-meter laser fiber (c) or a 2.4 Fr. nitinol basket in the working channel (d).
The KARL STORZ Flex Xc does have a component of passive deflection as well. The shock absorber system is located proximal to the deflecting segment. This allows for gentle rolling of the entire deflecting mechanism, protecting the instrument and giving the endoscopist access more deeply into calyces (Fig. 1.4).

1.3 Protecting the Working Channel

The KARL STORZ Flex Xc has an innovative tip design (Fig. 1.5). Historically, flexible ureteroscopes could be damaged by inadvertent laser energy delivery or arcing of energy from electrosurgical devices into the distal end of the working channel.

The KARL STORZ Flex Xc has a Laserite™ ceramic liner in the distal end of the working channel for 2.5 mm. This not only protects the instrument from thermal or electrocautery damage, but allows the endoscopist to work closer to a tumor or stricture when delivering various forms of energy. This innovative tip design is unique to the KARL STORZ instruments and has increased instrument longevity.
2 Use of the Flexible Ureteroscope

2.1 General

The flexible ureteroscope is an essential component of urologic endoscopy. It can extend the reach of the urologist throughout the ureter as well as the intrarenal collecting system (Figs. 2.1a, b). It can be passed atraumatically over the iliac vessels and psoas muscle into the mid and proximal ureter and intrarenal collecting system. The development of flexible ureteroscopes that can reach the entire collecting system and of small flexible working instruments suitable for use within the flexible endoscope has extended diagnostic and therapeutic endoscopy throughout the urinary tract. Small working devices that can be delivered through flexible ureteroscopes include biopsy forceps, baskets, graspers, snares and wire-pronged graspers. Endoscopic lithotriptors and laser fibers can be delivered through the working channel. Appropriate lasers can be employed to fragment calculi, as well as to ablate, coagulate and incise tissue. The indications for flexible ureteroscopy have expanded as the capabilities of the endoscopes and working devices have advanced (Table 2.1). Larger stones are now routinely treated. With advanced imaging tumors are more easily differentiated from benign and inflammatory lesions. In select patients, urothelial tumors can also be treated with varied energy sources delivered through the working channel of the endoscope.

<table>
<thead>
<tr>
<th>Indications for Flexible Ureteroscopy</th>
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<tr>
<td>Calculi</td>
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<tr>
<td>Filling Defects</td>
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<tr>
<td>Neoplasms</td>
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<tr>
<td>Ureteral Obstructions</td>
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<tr>
<td>Intrarenal Obstruction</td>
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<tr>
<td>All lesions in the ureter, renal pelvis or intrarenal collecting system</td>
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</table>

Table 2.1

Fig. 2.1a,b The tip of the ureteroscope reaches the lower calyces easily with continuous controlled deflection (a). A cross sectional view with the patient in the supine position demonstrates the flexible ureteroscope coursing through the renal pelvis into a posterior calyx (b).

2.2 Passing Working Instruments

There are a number of important points to consider when the endoscopist is employing accessories through the working channel of the flexible ureteroscope. Accessories that are smaller inhibit the active tip deflection less. However, the material that is being placed through the working channel also affects tip deflection.

Graspers and baskets with sheaths made of brown polyimide tend to be stiff, tacky when wet, and inhibit deflection more than polytetrafluoroethylene-sheathed accessories.

Instruments should be passed through the working channel only when the tip is straight and not when it is deflected. Sharp straight accessories like a stiff guidewire or laser fiber will disrupt the soft lining of the working channel if forced through the instrument when it is significantly deflected (Fig. 2.2).

It is important to note that one should never force any accessory through the working channel. Working devices, laser fibers and electrosurgical instruments must extend from the channel beyond the tip of the endoscope.
before they are activated. It is also just as important to note that accessories that are particularly rigid or tacky and not lubriciously coated will be more difficult to pass, in general. The working channel of the KARL STORZ Flex Xc ureteroscope is 3.6 Fr. from the hub to the tip of the endoscope. Accessories that are smaller, specifically 2 Fr. graspers and baskets or a 200-micron laser fiber, facilitate maximal endoscope deflection (see Figs. 1.3a–d).

2.3 Irrigation

Irrigating fluid is needed to distend the lumen and clear the visual field. It is delivered through a side arm to the same channel used for working instruments. When there is a working instrument within the channel, it may be necessary to pressurize the irrigant to achieve adequate flow through the entire endoscope. There are a variety of irrigation devices available. The simplest means of irrigating through the working channel of the flexible instrument is to use two 60 cc syringes, a three-way stopcock and arterial line tubing (Fig. 2.3a). The surgical assistant irrigates just enough to clear the optical field. When the optical field is clear, no irrigation is needed. The entire bag of irrigant can be pressurized, but it is difficult to manage the flow through the channel (Fig. 2.3b).

The most common, and what has become the standard, irrigation solution is sterile normal saline. When electro-cautery is being employed through the working channel, Sorbitol is commonly used. Small aliquots of sterile water can also be used to clear a bloody field during electro-surgical procedures, but the volume must always be carefully limited.

Do not mix irrigants within the collecting system. As irrigants of different densities mix, the differences in refraction indices cause distortion of the visual image.

This is common when a retrograde ureteropyelogram is performed initially and contrast is left in the collecting system during the initial diagnostic ureteroscopy. This phenomenon can be avoided by first emptying the visual field of one irrigant by aspirating through the working channel before introducing the second irrigant.

Fig. 2.3a,b Two 60 cc syringes connected through a 3-way stopcock to Luer-lock extension (arterial line) tubing are an effective irrigating device capable of infinite variations in pressure and flow (a). The entire bag of irrigant can be pressurized with an inflatable cuff, but it is less easily controlled (b).
2.4 Flexible Ureteroscopic Access

Passage of the flexible ureteroscope into the upper urinary tract has been simplified in part by the KARL STORZ Flex X design. Earlier flexible ureteroscopes had a smaller radius of deflection at the tip and less overall deflectability. The passively deflectable segment resulted in a region of buckling along the shaft that prevented direct passage of the endoscope through the intramural ureter without the added stiffening effect of a guidewire within the channel. The KARL STORZ Flex X, like its fiberoptic predecessor, has a larger radius of curvature and extended deflectability, as well as a shaft that is stiffer than previous endoscopes.

With this design, the KARL STORZ Flex X flexible ureteroscope can frequently be passed directly into the ureteral orifice (Fig. 2.4) and through the intramural tunnel into the upper collecting system (Figs. 2.5–2.9) often without the aid of a guidewire or working sheath, and without initial dilation of the ureteral orifice. A guidewire is employed as necessary through the channel of the ureteroscope to straighten the intramural tunnel or to increase the stiffness of the endoscope.

Intramural dilation with a graduated dilator or balloon is only rarely needed to pass the small diameter ureteroscope. When the ureter is too small to accept the endoscope, it is dilated to no more than 10 to 12 Fr. to minimize trauma to the ureteral wall.
Fig. 2.8a–c  Solitary papilla (a). Solitary papilla with small embedded calculi (b). Stone on solitary papilla (c).

Figs. 2.9a–d  Various examples of compound papillae.
2.5 Difficult Access

In clinical situations in which the endoscope cannot be placed, it is necessary to employ traditional access techniques commonly used with the earlier larger flexible ureteroscopes.

A guidewire is placed initially into the ureter proximal to the area for treatment. The wire can be introduced directly or through an angiographic ureteral catheter. The use of an angle-tipped nickel-titanium guidewire with a lubricious coating facilitates access to the upper collecting system. Once the wire has passed the obstructing segment, the catheter can be advanced over the wire and the wire is exchanged to a more stable traditional Teflon-coated wire. The catheter is then removed, leaving the wire in place. A second working wire is then placed using a 10 Fr. dual-lumen catheter.

This catheter dilates the intramural tunnel to 10 Fr. and also introduces a second channel that can be used for injection of a contrast agent to perform a retrograde ureteropyelogram or to place the second wire. The flexible ureteroscope is then passed over one of the wires to the level of interest while the second wire is maintained as a safety wire (Fig. 2.10).

In certain selected cases, an operating sheath can be placed over one of the wires to facilitate prompt passage of the endoscope through the intramural tunnel. The operating sheath allows easy access through the urethra and bladder and is particularly valuable in cases where multiple passage of the endoscope is required or in a situation where the distal ureter is sharply angled secondary to prostatic hypertrophy. However, the outer diameter of the sheath is significantly larger than the ureteroscope and if the sheath kinks, it may trap an endoscope and make it more difficult to remove it. When choosing an operative sheath it is important to note that the shaft of the Flex Xc is oval, and thus the inner diameter of the working sheath employed must accommodate this design.

![Fig. 2.10](image)

An angled hydrophilic wire can be used to pass obstructing lesions such as an impacted calculus or stricture or sharply angled ureter. The wire can lead a catheter beyond the calculus and then be exchanged for a more stable guidewire.

2.6 Safety Wire

A safety wire can be employed when the intended procedure involves placing, removing and then again replacing the ureteroscope, particularly when access to the ureter was complex. This can be useful, for example, when the planned procedure involves incision of a ureteral stricture.

In general, the small diameter and relatively stiff shaft of the ureteroscope will often allow for direct endoscope access without a guidewire, and in that setting a safety wire is optional. Calculi or urothelial tumors can often be treated without the need for a safety wire.

A safety wire is used less commonly with the KARL STORZ Flex X series based in part on these features and the precise mechanical steerability of the endoscope tip.
2.7 Fluoroscopy

Each step in access to the ureter is often performed with simultaneous real-time fluoroscopic imaging (Figs. 2.11, 2.12). The position of the guidewire, any dilator and the ureteroscope is commonly followed fluoroscopically. A small amount of contrast agent can be passed through the working channel of the endoscope to opacify the ureter or intrarenal collecting system for fluoroscopic monitoring. In this way, the collecting system can be mapped to direct positioning of the tip of the flexible ureteroscope.

Figs. 2.11a–c Fluoroscopic monitoring demonstrates the position of the ureteroscope as it enters the distal ureter with a guidewire in place (a) mid ureter (b) and the proximal ureter (c) after removal of the guidewire.

Figs. 2.12a–c The ureteroscope’s position can be confirmed within the renal pelvis which has been opacified with 30% iodinated contrast.
2.8 Instruments for Ureteroscopic Procedures

Successful ureteroscopy requires the availability of a wide array of access and working instruments. Many of the devices are rarely used but they can be irreplaceable when they are needed. The endoscopy suite should be equipped with a radiolucent table, fluoroscopic monitoring equipment and the appropriate anesthetic devices.

The instruments recommended for ureteroscopic procedure are listed in Table 2.

### Table 2

<table>
<thead>
<tr>
<th>Instrument Table</th>
<th>Additional Instrumentation and Units to be available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiolucent table</td>
<td><strong>Lithotriptor</strong></td>
</tr>
<tr>
<td>Fluoroscope (C-arm, image intensifier)</td>
<td>Holmium laser (KARL STORZ CALCULASE II®)</td>
</tr>
<tr>
<td>Personal radiation protection clothes</td>
<td><strong>Graspers</strong></td>
</tr>
<tr>
<td>Video camera and monitor</td>
<td>Three-pronged extractor</td>
</tr>
<tr>
<td>Cold light source</td>
<td>Nitinol loop graspers</td>
</tr>
<tr>
<td><strong>Guidewires</strong></td>
<td><strong>Baskets</strong></td>
</tr>
<tr>
<td>0.38 in. straight floppy tip, heavy duty</td>
<td>Stainless steel: biopsy device</td>
</tr>
<tr>
<td>0.035 angled tipped, Teflon-sheathed nitinol core</td>
<td>Nitinol: stone fragment extractor</td>
</tr>
<tr>
<td>Hydromer-coated nitinol</td>
<td><strong>Forceps</strong></td>
</tr>
<tr>
<td>Stiff, double floppy tip</td>
<td><strong>Fulgurating electrodes</strong></td>
</tr>
<tr>
<td><strong>KARL STORZ Cystoscope</strong></td>
<td>10 Fr. double-lumen catheter</td>
</tr>
<tr>
<td><strong>KARL STORZ Flex Xc ureteroscope</strong></td>
<td><strong>Ureteral dilators or balloons – 12 French most commonly</strong></td>
</tr>
<tr>
<td><strong>Saline solution for irrigation</strong></td>
<td><strong>Ureteral access sheath</strong></td>
</tr>
<tr>
<td><strong>Irrigating tubing</strong></td>
<td></td>
</tr>
<tr>
<td>Connecting tubing, Luer tip</td>
<td></td>
</tr>
<tr>
<td>3-way stopcock</td>
<td></td>
</tr>
<tr>
<td>Syringes, 2–60 cc, 1–20 cc</td>
<td></td>
</tr>
<tr>
<td>Radiographic contrast agent</td>
<td></td>
</tr>
</tbody>
</table>
3.1 Calculi

The most common indication for ureteroscopic intervention is the treatment of an upper urinary tract calculus. The flexible ureteroscope has facilitated this therapy by allowing atraumatic access to the ureter and proximally into the entire intrarenal collecting system.

The flexible ureteroscope can then be used to deliver endoscopic lithotriptors or retrieval devices. Simplified access with this newer class of endoscope shortens operative time and helps facilitate even the most complex procedures.

The treatment of upper urinary calculi most commonly includes fragmentation with subsequent extraction of small stones or fragments. Larger calculi, and even stones in dependent lower pole location can be successfully treated. Endoscopic lithotripsy techniques vary from precise division of very dense mobile calcium oxalate monohydrate calculi, to laser dusting of moderate sized stones converting them into tiny passable debris often too small to extract. With larger metabolic stones treated ureteroscopically, staged therapy with interval stenting has been found to be useful particularly when the surgeon has reached a point in the procedure where the collecting system is coated with dust and debris potentially obscuring sizeable residua. In that setting interval stenting will often facilitate clearance of this debris, while a second look can ensure no sizeable residua.

There is a variety of stone fragment retrieval devices including three pronged graspers, two-arm nitinol grasping devices and small diameter nitinol baskets. It is clear that an impacted stone which is too large to pass should not be engaged in a grasping device and forcibly extracted.

In addition, devices that allow for easy disengagement of a fragment which on extraction is found to be too large, (e.g. uninkable nitinol graspers) are beneficial.

If the stone is too large to pass, it is also too large to extract and thus endoscopic lithotripsy should be employed (Figs. 3.1–3.6). Because it is impossible to determine accurately which fragments can be removed intact, it is important to use a reversible device to grasp calculi for removal. For example, baskets with stainless-steel wires may kink and entrap the calculus and become unable to release it. It is here that a reversible nitinol grasper of the smallest diameter will facilitate efficient fragment extraction while allowing for sufficient irrigant flow to maintain a clear optical field of view.

Fig. 3.1 A large 1.7 cm calyceal stone is fragmented using holmium laser fiber.

Fig. 3.2a, b Grasping stone in calyx with basket (a). Retrieving stone from kidney and ureter (b).
Flexible Ureteroscopy with the Digital Ureteroscope Flex Xc

Figs. 3.3a–b  Calcium oxalate monohydrate calyceal stone (a). Calyceal stone after initial laser fragmentation (b).

Figs. 3.4a–c  Renal pelvic stone with inflammatory debris on surface (a). Early fragmentation (b). Continued laser fragmentation (c).

Figs. 3.5a–c  Stone retrieval with basket (a). Small fragments in calyx (b). Fragments in ureter which are small enough to pass (c).

Figs. 3.6a,b  Cystine stone (a). Cystine stone fragmented with holmium laser forming a bubble of sulphur dioxide (b).
The most efficient endoscopic lithotrite currently employed is the Holmium:YAG laser (Fig. 3.7). The light energy is delivered through low water density quartz fibers. The two most common diameter fibers employed through the flexible ureteroscope are either 365 or 230 microns. The larger the fiber diameter, the stiffer it is, inhibiting endoscope deflection to some degree.

In a very sharply angled intrarenal location or in a dependent lower pole calyx, the 200-micron fiber is superior. Smaller diameter fibers also allow a greater flow of irrigant to pass simultaneously through the channel to clear the optical field and cool the fiber tip. Lower-pole calculi can be moved to the renal pelvis or upper calyx with a nitinol grasper to offer easier access for lithotripsy (Figs. 3.8, 3.9).

During Holmium: YAG laser lithotripsy, the laser is initially set at 1.0 J per pulse and 6 Hz. The energy and frequency are then adjusted to obtain the desired effect. Most commonly, the central portion of the stone is converted to fine dust initially. As the peripheral portions of the stone begin to fragment, the laser settings are lowered to decrease movement of the stone fragments. This is particularly important when the surgeon is trying to convert all of the remaining fragments into the smallest pieces that can be passed easily (i.e. stone dusting).

Direct visualization through the ureteroscope is used to estimate the adequacy of fragmentation. A guidewire can be used as a marker (3 Fr. = 1 mm) to help estimate the size of stone fragments.

It is important to note that proper patient positioning on the operating room table may facilitate ureteroscopic lithotripsy. A stone that is in the proximal ureter may migrate into the intrarenal collecting system during the procedure. An important technique is to place the patient in a Trendelenburg position with elevation of the ipsilateral flank prior to manipulating a proximal ureteral stone. This maneuver may facilitate positioning of a migrating stone into a more easily accessible upper or middle calyx where the endoscope can be passed more readily during lithotripsy.
3.2 Diagnostic Procedures

The *Flex Xc* is the ideal endoscope for the diagnosis of many upper tract lesions. The digital imager employs eighteen times the pixel power of the fiberoptic predecessor, improving the accuracy of diagnosis. It is essential for defining the diagnosis of upper tract filling defects and gross unilateral hematuria. The entire upper urinary collecting system is mapped by visualizing the entire intra-renal collecting system, with specific areas sampled or coagulated as indicated. The additional use of the IMAGE1 S digital enhancement system helps improve diagnostic accuracy, particularly in patients with upper urinary tract urothelial carcinoma.

**Gross Unilateral Hematuria**

Benign essential hematuria or gross unilateral hematuria is defined as gross hematuria for one renal unit, the etiology of which cannot be diagnosed by standard radiologic techniques. Earlier studies with open nephroscopy showed that a small hemangioma was often a source of bleeding. Flexible ureteroscopic examination of these patients gives access through the normal urinary tract with even better ability to visualize the intrarenal collecting system. Bleeding lesions have been treated with a very high success rate with hematuria clearing in 93% of patients after endoscopic treatment with either fulguration or laser ablation. Benign essential hematuria was an early specific indication best suited to flexible ureteroscopic diagnosis and treatment.

**Filling Defects**

Filling defects within the upper urinary tract can be visualized and sampled directly with the *Flex Xc* flexible ureteroscope. With digital imaging and use of the IMAGE1 S system it is much easier to differentiate malignant from inflammatory lesions (Fig. 3.10). Biopsy is used to obtain tissue to define the neoplasm and in the case of transitional cell carcinoma to grade the lesion. There are several devices available to obtain tissue samples through a flexible ureteroscope.

A cup biopsy forceps (Fig. 3.11) can be used to sample any type of tissue, but severely limits the deflection of the ureteroscope. Therefore, it is useful throughout the ureter, the renal pelvis and the mid to upper calyces. More friable lesions, such as a papillary urothelial carcinoma, can be biopsied very effectively with a flat-wire basket. It can remove a relatively larger fragment of tissue (Figs. 3.12–3.14). Irrigation fluid within the collecting system is aspirated through the working channel of the ureteroscope for a cytology sample. Any sample obtained should be prepared with cytopathologic techniques to maximize the yield and prevent tissue loss during processing. Any visible sample is then prepared as a cell block to yield specimens that are adequate for histology and, therefore, grading.

![Fig. 3.10](image1) Renal pelvic edema caused by stone which had been impacted at the UPJ.

![Fig. 3.11](image2) A cold cup biopsy forceps is used to sample all types of lesions in the upper urinary tract.
Fig. 3.13 Flat wire baskets can sample friable papillary tumors and often provide a larger sample than other devices.

Fig. 3.14 Large mixed renal pelvic tumor (a). Basket biopsy of renal pelvic tumor (b).
3.3 Treatment of Upper-Tract Neoplasms

Upper-tract neoplasms are regularly treated with the flexible ureteroscope. The significantly greater sensitivity of the Flex Xc digital imager facilitates precise mapping of the upper urinary tract urothelium, essential in crafting a treatment plan.

Considerable volume of tumor can be removed with holmium laser energy, employing low energy setting which both coagulate and remove/resect papillary tumor. Energy of 0.4 joules with 8 hertz frequency of pulsation is often all the power required. Supplemental electro-cautery can be applied with a flexible 2 or 3 French Bugbee electrode to treat lesion inaccessible to the stiffer laser fiber (Fig. 3.15). Larger vascular lesions are challenging to treat for they are often associated with significant hematuria which can obscure the optical field of view.

The holmium YAG laser coagulates tissue superficially, but is an efficient means of removing tumor volume.

Fig. 3.15 The holmium laser or a 2 Fr. electrosurgical electrode is effective for ureteroscopic ablation and coagulation of papillary tumors.

Figs. 3.16a–c Low grade renal pelvic tumor (a). Renal pelvic tumor coagulated with laser (b). Low grade renal pelvic tumor resected to base (c).

Figs. 3.17a–c Small papillary tumor in calyx (a). Biopsy of small papillary tumor on calyx with forceps (b, c).
Figs. 3.18a,b Small papillary tumor (a). Small papillary tumor in calyx after holmium laser ablation (b).

Figs. 3.19a,b Small papillary tumor (a). Tumor cleared after Holmium laser ablation (fish eggs) (b).

Figs. 3.20a–c Ureteral fibroepithelial polyp seen on end as approached by the ureteroscope (a). With the pressure of irrigating fluid, the position of the polyps is reversed and the base of each polyp can be seen (b). Each polyp was resected at its base with the Holmium laser leaving the ureteral lumen open (c).
3.4 Incisional Procedures

Endopyelotomy
Endopyelotomy can be performed readily with a flexible ureteroscope. The major indication is a secondary ureteropelvic junction obstruction, since most primary UPJ obstructions are treated with laparoscopic pyeloplasty. It is essential that imaging is performed either preoperatively or intraoperatively to rule out adjacent crossing vessels. When vessels are present, endopyelotomy is less successful and can result in hemorrhage and, therefore, laparoscopic pyeloplasty should be considered.

The direction and length of the incision is determined in large part by the anatomic variant encountered. A short, annular ureteropelvic junction stricture requires a short full-thickness incision with either an electrosurgical device or laser. This is contrasted with a ureteropelvic junction obstruction caused by a high insertion, where there is a flap valve effect. This septum forming the valve can vary in length from a few millimeters to a few centimeters and can be incised directly with a device passed through the flexible ureteroscope. All of these variants can be seen in recurring obstructions as well as primary UPJ obstruction. The incision of an endopyelotomy should open any mechanical narrowing, open an obstructive segment of a high insertion and result in a more dependent anatomically open ureteropelvic junction.

The endoscopic incision for endopyelotomy is performed with either a small diameter (200 micron) holmium laser fiber or a 2 Fr. electrosurgical electrode. Holmium laser energies of 1.2 J and a frequency of 15–20 Hz will facilitate a clean full-thickness incision. It is important to incise through the segment promptly in order to minimize coagulation of the surrounding tissue from the thermal laser energy. Frequently, the incision is interrupted with crossing bands. This allows the cooling irrigant to pass into the periureteral tissues to separate them from the ureteral wall. When electrosurgery is employed, it should be used with a pure cutting current, without coagulation or blend to minimize periureteral scarring.

Ureterotomy
Incision of ureteral strictures is facilitated with a flexible ureteroscope. It is just as important in the ureter to be sure that there are no crossing vessels prior to endoscopic incision. Preoperative or intraoperative imaging is essential to rule out crossing vessels. As with an endopyelotomy, the incision should be full thickness (Figs. 3.21, 3.22). Success of primary ureterotomy for ureteral strictures is related to the length of the stricture and the extent of periureteral fibrosis. Strictures that are longer than 2 cm rarely remain patent after incision, and other treatment should be considered. The techniques employed are similar to those noted for endopyelotomy. Again, postprocedural stenting is an essential part of the procedure.

Intrarenal Incision
Narrow segments in the intra-renal collecting system can also be incised. Obstructed infundibula and calyces are superficially incised to provide drainage or to gain access for endoscopic procedures with similar techniques to those described above. Rather than creating a deep defect along one wall of an obstructed infundibulum, multiple superficial incisions will widen the lumen and minimize the risk of hematuria.

Fig. 3.21 The flexible ureteroscope delivers incisional devices to the ureteropelvic junction for incision of obstructive segments.

Fig. 3.22 Ureteral strictures can be incised with the holmium laser or an electrosurgical device under direct vision with the flexible ureteroscope.
Other Applications

4.1 Above-and-Below Technique

Ureteroscopic-Assisted PCN, Antegrade Ureteroscopy, and Combined Simultaneous URS

The flexible ureteroscope is an important adjunct to percutaneous renal access. When the percutaneous puncture is challenging or tenuous, the application of simultaneous retrograde flexible ureteroscopic visualization can often define the difficulty and promptly direct proper guidewire purchase. A flexible ureteroscope can also be advanced in an antegrade fashion into the ureter through a percutaneous access when necessary. Any procedure that can be performed in a retrograde fashion can then be performed with antegrade technique employed in this way when clinical parameters dictate.

The flexible ureteroscope is considerably smaller than a flexible nephroscope and can be passed much more easily into the undilated ureter. Employing two flexible ureteroscopes, one antegrade, the other retrograde (i.e. Above-and-Below Technique), is particularly useful in treating complex strictures or for ureteral re-alignment in case of ureteral obliteration.

4.2 Biliary

The flexible ureteroscope can also be used within the biliary tract. It has been used through a percutaneous tract into the biliary system either transhepatically or through an established biliary cystostomy. It can also be placed laparoscopically, into the common bile duct for both lithotripsy and to treat intra-hepatic biliary strictures, similar to treatment in the upper urinary tract.

- Techniques of irrigation, lithotripsy, biopsy and tissue ablation are very similar to those used in the urinary tract.
- Fluoroscopy is also used to guide positioning of the instrument.

4.3 Pediatric Endoscopy

Ureteroscopy

Flexible ureteroscopy has been used in pediatric patients for treating calculi, hematuria and for incisions in those who have failed an open pyeloplasty. The flexible ureteroscope can often be placed in the ureter without prior dilation.

If the ureter does not accept the ureteroscope, however, it may be safer to place a stent for passive ureteral dilation rather than mechanically dilating the ureter acutely. This varies based on the child’s age, size of the ureter, and other clinical parameters.

Cystoscopy

The small flexible ureteroscope has been used effectively as a pediatric cystoscope. The length of the ureteroscope itself makes it inconvenient for positioning, but the diameter is well suited to the urethra in children and can be used to avoid rigid cystoscopy.
Advanced Capabilities of the Digital Ureteroscope

The optical image from the digital ureteroscope is ideally suited for video presentation during the procedure. The superior optics of the KARL STORZ Flex Xc can be viewed by all members of the surgical team to maximize their understanding and participation in the procedure. Use of the IMAGE1 S system improves the diagnostic accuracy, and helps differentiate benign from malignant lesions.

With the Flex Xc there is no need for an external optical camera or light cord. The ergonomic hand piece has controls that allow the surgeon to adjust image size and brightness. Digital imaging is sent directly from the CMOS chip. Illumination is provided by two tiny LED’s, placed opposite to each other on either side of the working channel to minimize shadowing and to enhance depth perception.

There are some important differences between the digital and fiberoptic images. The quality of the digital image is eighteen times as sensitive as the fiberoptic, and can be enhanced. White balancing is no longer required. The actual viewed image is rectangular, not oval. As opposed to the pendulum camera system employed with the fiberoptic endoscope where the image and endoscope tip are continuously orientated, one must remember with the digital imager this is not the case and so intra-renal anatomic landmarks must be used to define orientation. For example, if the hand piece is rotated 180 degrees during a procedure, the orientation between the image and the endoscope tip is no longer synchronous.

KARL STORZ AIDA-DVD system is a key component. This device allows the surgeon to obtain reproducible single images or complete video segments of the procedure. These are rapidly burned onto a standard writable and readable CD or DVD and can be placed either in the patient’s chart or archived. This forms an image capture superior to thermal pictures of VHS recorders since the images can be archived indefinitely, and a greater number of images are stored with superior reproducibility. All of the endoscopic images in this presentation were captured and reproduced with the KARL STORZ AIDA-DVD system.

5.1 Innovative Visualization Tools

CLARA

A good endoscopic image features a clear display of details in both, light and dark areas. CLARA supports proper illumination in each part of the endoscopic image.

Figs. 5.1a,b  White light image (a). CLARA (b). Courtesy of Prof. T. Knoll, Dept. of Urology, Clinical Center of Sindelfingen-Böblingen, Klinikverbund Südwest, Germany.
CHROMA

Surgical interventions are more efficient if clear differentiation of tissue is possible. CHROMA intensifies the color contrast in the image. Clearly visible structure surfaces are given added emphasis while retaining the natural color perception in the image.

Figs. 5.2a,b White light image (a). CHROMA (b).
Courtesy of Prof. T. Knoll, Dept. of Urology, Clinical Center of Sindelfingen-Böblingen, Klinikverbund Südwest, Germany.

SPECTRA*

SPECTRA* allows recognition of the finest tissue structures. The bright red portions of the visible spectrum are filtered out and the remaining color portions are expanded. This makes it easier to differentiate between tissue types.

SPECTRA* offers two different modes so that the user can select the display that suits best.

Figs. 5.3a–c White light image (a). SPECTRA A* (b) and SPECTRA B* (c).
Courtesy of Prof. T. Knoll, Dept. of Urology, Clinical Center of Sindelfingen-Böblingen, Klinikverbund Südwest, Germany.

*SPECTRA A and SPECTRA B: Not for Sale in the U.S.
SIDE-BY-SIDE VIEW
Simultaneous display of white light and IMAGE1 S images.

Figs. 5.4 The simultaneous display of a white light image and an image in the SIDE-BY-SIDE VIEW enables a direct comparison of tissue structures on the monitor during surgery and thus facilitates diagnosis. Courtesy of Prof. T. Knoll, Dept. of Urology, Clinical Center of Sindelfingen-Böblingen, Klinikverbund Südwest, Germany.

6 Care and Handling

6.1 Sterilization

The flexible ureteroscope is a delicate precision optical instrument that should be treated with care. In handling the endoscope, the shaft should not be sharply angulated. While it is on the surgical table in the operative theatre, no other instruments should ever be placed upon it. Immediately after use, the endoscope should be cleaned outside and inside to prevent drying of any bloody or protein-containing fluid on the surfaces.

The Flex Xc is validated for use with a variety of reprocessing methods (cleaning, sterilization, and/or high level disinfection) including STERRAD NX and STERIS V-PRmaX. and STERIS SS1E.

The vent cap on the flexible ureteroscope should be removed during use in endoscopic procedures and prior to immersion in any liquid. The vent cap should be in place before gas sterilization or before shipping. The endoscope should be stored carefully. It should never be stored in the foam-padded case unless it is completely dry. It can be stored in the sterilization tray specifically designed for the endoscope or hung suspended on the wall rack.

Refer to the Instruction Manual for specific techniques in the care and sterilization of the flexible ureteroscope. These comments are not intended to replace that manual, but only to emphasize these points in handling.

Fig. 6.1 The KARL STORZ Flex Xc in its specially designed tray.
Summary

The small diameter flexible ureteroscope is an ideal instrument to access the upper portions of the ureter and the intrarenal collecting system. The KARL STORZ Flex Xc represents a new era in digital optical imaging with mechanical attributes that facilitate access and complex therapies throughout the collecting system, a mainstay of the Flex X series (Fig. 7.1). The addition of IMAGE1 S digital optical enhancement provides optimal clinical information, making this instrument the premier diagnostic endoscope.

These endoscopes can deliver instruments capable of efficient and effective lithotripsy, tissue sampling and ablation. Flexible ureteropyeloscopy is a valuable component of urologic endoscopy. It is a current technique that extends the urologist’s diagnostic and therapeutic reach throughout the entire upper urinary tract.

Fig. 7.1 The KARL STORZ Flex Xc represents a new era in digital optical imaging with mechanical attributes that facilitate access and complex therapies throughout the collecting system.
Video-Uretero-Renoscope FLEX-X\textsuperscript{C} in combination with the IMAGE1 S camera system

With the IMAGE1 S System, KARL STORZ has developed a new FULL HD camera platform that supports urologists with innovative visualization technologies for diagnosis and surgery. By combining this platform with the flexible 8.5 Fr. video uretero-renoscope FLEX-X\textsuperscript{C}, the user benefits from excellent visualization as well as the high image quality of the video uretero-renoscope.

Special Features:
- Excellent image quality: Due to CMOS technology
- Extremely thin and steerable sheath: Minimal sheath circumference of only 8.5 Fr. and maximum 270° deflection in either direction
- Ergonomic handle: Integrated LED light source allows convenient work without requiring an additional light cable
- Easier access to the kidney: Direct implementation of hand movements through to the distal end thanks to high torque stability facilitates access to the kidney
- Modular camera platform: Homogeneous illumination, contrast enhancement and clearer tissue differentiation by shifting the color spectrum in various modes from the IMAGE1 S System

It is recommended to check the suitability of the product for the intended procedure prior to use.
Flexible Ureteroscopy with the Digital Ureteroscope Flex X C

Flexible Video Uretero-Renoscope
for access to the entire intrarenal collecting system

<table>
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<th>Part No.</th>
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<th>Direction of view</th>
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**IMAGE 1 HUB™**

- **HD Camera Control Unit**
- **Adaptor**
- **TC 002**

**IMAGE1 S Camera System**

- **TC 200EN / TC 301**

White light only possible

**for use with**

**IMAGE1 HUB™**

- **11278 VK/VUK**
- **22 20 10 11-1XX**

**for use with IMAGE1 S Camera Control Unit**

- **11278 VSK/VSUK**
- **TC 200EN / TC 301**

**for use with all visualization modes**
Flexible Video-Uretero-Renoscope
for access to the entire intrarenal collecting system

Set 11278 VK/VUK/VSK/VSUK Video-Uretero-Renoscope FLEX-Xc, steerable
The following accessories are included:

- 27677 X  Case
- 11278 V/U/V/S/U  Video Uretero-Renoscope FLEX-Xc, steerable
- 13242 XL  Leakage Tester, with bulb and manometer
- 27651 AL  Cleaning Brush, round, flexible, outer diameter 2 mm, for working channel diameter 1.2–1.8 mm, length 150 cm
- 27014 Y  Luer-Adaptor, with seal
Optional accessories:

11014 Y Fiber Fixation, instrument port for the insertion and fixation of LASER fibers, stone baskets, wires etc. in flexible endoscopes

11275 FE Grasping Forceps, double action jaws, flexible, 3 Fr., length 100 cm

11275 ZE Biopsy Forceps, double action jaws, flexible, 3 Fr., length 100 cm

27023 VB Stone Basket, sterile, for single use, 2.5 Fr., length 120 cm

11770 T Coagulation Electrode, unipolar, 3 Fr., length 110 cm

39406 AS Plastic Container for Flexible Endoscopes, specially suited for gas and hydrogen peroxide (Sterrad®) sterilization and storage, for use with one flexible endoscope, external dimensions (w x d x h): 550 x 260 x 90 mm

27550 N Seal, for Instrument Ports 27001 G/GF/GH/GP, package of 10, single use recommended

27001 RA Cleaning Adaptor

TC 002 IMAGE1 HUB™ FLEX-X® Adaptor, video endoscope adaptor, for use with IMAGE1 HUB™ and FLEX-X® (11278 VSK/VSUK)
CALCULASE II
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
- For use with rigid, semiflexible and flexible endoscopes
- For use on endoscopic equipment carts
- Easy to maintain
CALCULASE II
Holmium LASER System for Endoscopic Stone Therapy and Soft Tissue Treatment, Recommended System Configuration

27 7502 01-1  CALCULASE II, 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
- Safety Goggles Ho:YAG LASER 2080 µm
- Ion Exchanger

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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<tr>
<td>0.8 J</td>
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<tr>
<td>1.2 J</td>
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<tr>
<td>1.7 J</td>
<td>–</td>
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<td>2 J</td>
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Parameters for 365 µm and 600 µm Fibers

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<td>0.8 J</td>
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<tr>
<td>1.2 J</td>
<td>4.8 W</td>
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<td>6.8 W</td>
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<tr>
<td>2 J</td>
<td>8 W</td>
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Parameter settings are selected via the LASER fiber code.
CALCULASE II
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

**Additional accessories**

- **27 7500 82** Fiber Cutter
- **27 7502 80** Fiber Stripper Set, sterilizable, for use with CALCULASE II 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).

* Not for Sale in the U.S.
CALCULASE II Equipment Cart

Special Features:
- Flexible use of CALCULASE II 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, smoothrunning 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 in mm (w x h x d):
Equipment cart: 830 x 1265 x 730,
shelf: 630 x 25 x 510,
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

**Sustainable investment**
- Compatible with all light sources

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

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

FULL HD image

CLARA

FULL HD image

CHROMA

FULL HD image

SPECTRA A*

FULL HD image

SPECTRA B**

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

TC 200EN

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

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<th>Format signal outputs</th>
<th>LINK video inputs</th>
<th>USB interface</th>
<th>SCB interface</th>
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<td>3x</td>
<td>4x USB, (2x front, 2x rear)</td>
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<tr>
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For use with IMAGE1 S

IMAGE1 S CONNECT Module TC 200EN

TC 301

TC 301 IMAGE1 X-LINK, link module, for use with flexible video endoscopes, power supply 100–120 VAC/200–240 VAC, 50/60 Hz, for use with IMAGE1 CONNECT TC 200EN including:

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

Specifications:

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<td>Dimensions w x h x d</td>
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<td>Weight</td>
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Monitors

9619 NB

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

9826 NB

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

### KARL STORZ HD and FULL HD Monitors

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### Inputs:

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</table>

### Outputs:

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

### Signal Format Display:

<table>
<thead>
<tr>
<th>Format</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<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:

<table>
<thead>
<tr>
<th>Product no.</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>9826 SF</td>
<td>Pedestal, for monitor 9826 NB</td>
</tr>
<tr>
<td>9626 SF</td>
<td>Pedestal, for monitor 9619 NB</td>
</tr>
</tbody>
</table>

### Specifications:

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