

**WITH COMPLIMENTS OF
KARL STORZ—ENDOSKOPE**

MANUAL OF HYSTEROSCOPY

DIAGNOSTIC, OPERATIVE AND OFFICE HYSTEROSCOPY

Prof. **Luca MENCAGLIA**, M.D. · **Luiz CAVALCANTI de ALBUQUERQUE NETO**, M.D. · Prof. **R. Alfonso ARIAS ALVAREZ**, M.D.

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© 2013 **Endo:Press**® Tuttlingen

ISBN 978-3-89756-409-1, Printed in Germany

P.O. Box, D-78503 Tuttlingen, Germany

Phone: +49/7461/14590

Telefax: +49/7461/708-529

E-mail: Endopress@t-online.de

Editions in languages other than English and German are in preparation.

For up-to-date information, please contact **Endo:Press**® Tuttlingen, Germany, at the address shown above.

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Typesetting and image processing:

Endo:Press® Publisher, D-78532 Tuttlingen, Germany

Printed by:

Straub Druck+Medien AG, D-78713 Schramberg, Germany

01.13-1

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Instruments and Room Setup for Hysteroscopy

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1.0 Instruments and Room Setup for Hysteroscopy

Hysteroscopy was one of the very earliest approaches to the direct study of the uterine cavity. Hence, it is rather ironic that advances in hysteroscopy had to wait for technical innovations in other endoscopic fields before the technique became feasible in routine clinical practice. A number of specific problems impeded the scientific progress in the field of hysteroscopy for several decades. Not the least of these were the difficulty in distending the uterine cavity, the friable nature of the uterine mucosa, and the frequent need for dilatation of the cervical canal making the use of anesthesia mandatory.

Since the early 1980s, hysteroscopy has opened up new diagnostic vistas for the diagnostic evaluation of the cervical canal and uterine cavity, revealing the inherent limits of dilatation, curettage and endometrial biopsy if performed without visual guidance.

In recent years, techniques have evolved that allow *office hysteroscopy* to be performed in an outpatient setting without the use of any type of anesthesia. Dilatation of the cervical canal is also employed for biopsy sampling or hysteroscopy-guided treatment of endometrial polyps, small myomas, synechiae, or uterine malformations, such as septate uterus.

Nowadays, the vast majority of surgical procedures performed under hysteroscopic assistance provide better results than those achieved by using the traditional laparoscopic technique which, in terms of invasiveness, cannot be determined by absolute comparison.

The advent of recent technical innovations have revolutionized the field of hysteroscopy making it possible to perform a comprehensive endoscopic examination of the uterine cavity in an outpatient session, without using any type of anesthetic or preliminary dilatation of the cervical canal. As a consequence, the indication range for hysteroscopic procedures has been expanded considerably. The hysteroscopic technique is indicated in all those cases that require, at least theoretically, direct visualization of the cervical canal and uterine cavity. Diagnostic and surgical hysteroscopy have become gold standards in gynecological practice.

Office hysteroscopy allows minor pathologies to be treated in an outpatient setting. Surgical hysteroscopic procedures, or in other words, major hysteroscopic surgery, is performed in the operating room. Some indications that were previously reserved for conventional laparotomy operative techniques, such as uterine malformations, intrauterine adhesions, submucous and intramural myomas, have nowadays been included in the scope of hysteroscopic techniques. Treatment of dysfunctional uterine bleeding by hysterectomy has nowadays been largely superseded by ablation or resection of the endometrium under hysteroscopic control, since the latter technique is considered more suited to preserve integrity of the urogynecological tract and has shown to be less invasive for the patient.

As with all endoscopic procedures, the surgeon's dexterity plays a decisive role, in particular as regards use of the instruments and equipment. In-depth knowledge of the instrument allows the surgeon to prevent and control a series of snags and malfunctions occurring with well-defined frequency during hysteroscopy, and which could jeopardize meeting the objective of the exploration or the surgical procedure as a whole.

1.1 Media for Distending the Uterine Cavity

All hysteroscopic procedures require adequate distension of the uterine cavity. Various media are employed for uterine cavity distension in diagnostic and operative hysteroscopy. When a hysteroscopic resectoscope is used for intrauterine electrosurgery, additional safety measures are required. The introduction of office hysteroscopy and the bipolar resectoscope have also revolutionized especially uterine cavity distension. Indeed, thanks to these two techniques it is today possible and highly appropriate to use physiological saline solution as the unique method of distension both in office diagnosis and surgical hysteroscopy. The use of a resectoscope for high-frequency bipolar intrauterine electrosurgery no longer requires the use of a non-conducting distension medium in order to prevent uncontrolled diffusion of the electric current.

Owing to the fact, that the current is strictly limited to the resectoscope's two poles (positive and negative) without flowing through the patient's body, it is possible to use physiological saline as distension medium.

As such, we list below the various distension media that have been used throughout the history of modern hysteroscopy, even though today physiological saline solution is considered the safest and most appropriate medium.

The most frequently used distension media can be divided into gases (reserved exclusively for diagnostic hysteroscopy) and liquids, that have a double use in both diagnostic and operative hysteroscopy.



1.1 The HAMOU Micro-Hysteroflator® is an automatic, micro-processor-controlled insufflation unit that provides for constant intrauterine insufflation pressure and prevention of embolism-related complications.

■ **Carbon dioxide (CO₂).** Distension with carbon dioxide via an insufflator that automatically controls the pressure was introduced into hysteroscopy in 1972 by *Lindemann*. Continuing technological innovation allowed to obtain high levels of reliability and safety, so that distension with CO₂ was the preferred modality until the early years of the new millennium. Initial concerns related to the potential risk of air embolism were definitively dispelled by *Lindemann* and *Rubin's* findings. They reported 90,000 insufflations performed by 380 different practitioners without any type of complication. The quantities necessary to develop the first signs of CO₂ intoxication are indeed much higher than those used for an entire hysteroscopic exam performed with the correct insufflation criteria: in other words, with an insufflation system that maintains the insufflation pressure between 100 and 120 mmHg and with a flow of 30–60 ml/min, corresponding to an intrauterine pressure ranging between 40 and 80 mmHg.

An *electronic hystero-insufflator* (**Fig. 1.1**) is required for distension of the uterine cavity. Its technical specifications should provide a gas flow of 30–60 ml/min and an insufflation pressure of 100–120 mmHg. The hystero-insufflator should be equipped with an electronic control/measuring system to constantly maintain intrauterine pressure below the safety threshold of 80–100 mmHg. Owing to this constant control, complications related to embolism can be avoided.

■ **High molecular weight liquids (Hyskon®).** The 32% dextran solution is a high molecular weight (70,000 Da) solution marketed under the name Hyskon®. It is inserted with a 50-ml syringe, and usually 100 ml is enough to distend the uterine cavity. The advantages of dextran are its low miscibility with blood, good light transmission properties, and its straightforward way of administration. Its high viscosity sometimes makes it difficult to insert the liquid, and requires immediate and thorough cleaning of instruments in hot water to avoid crystallization. There are reports in the literature that attribute allergic reactions to dextran, including severe cases of anaphylactic hypersensitivity reaction and death.

■ **Low molecular weight liquid media.** It is necessary to distinguish between electrolytic and non-electrolytic solutions when discussing low molecular weight liquid media.

Solutions containing glucose, glycine, dextran (Hyskon), mannitol, and a mixture of mannitol-sorbitol (Purisol) are non-electrolytic fluids, that are non-conductive and therefore suitable for use with unipolar current. On the other hand, electrolytic solutions, such as physiological saline and lactated Ringer's solution, are conductive and therefore only suited for use with a bipolar resectoscope.

Dextrose solutions of 5% and 10%, and 4% and 6% dextran solutions were used in the 80's but now considered outdated due to their difficulty of use and adverse effect on the average life span of endoscopes.

Physiological saline solution has now become the distension medium of choice, which, owing to recent innovations, can be used both for office diagnostic hysteroscopy and for high-frequency surgery using the bipolar technique. The advantages are principally its availability, low cost, and physiological reabsorption at peritoneal level. The drawbacks of low molecular weight liquid media are their higher miscibility with blood and the need for constant perfusion of liquid in order to keep the cavity constantly distended. In any case, these problems are easily managed and can be resolved with the use of an automated microprocessor-controlled pump system for distension of the uterine cavity and continuous-flow irrigation.



1.2 The gravity fall system (liquid bag).



1.3 The pressure cuff is a simple device to increase the outflow of the distension medium, but does not permit control of the intrauterine pressure.



1.4 The HAMOU ENDOMAT® is an automatically microprocessor-controlled suction and irrigation pump.

Saline solution therefore has shown to be the best-suited distension medium. Not distorting the intrauterine view in any way, it offers a very natural vision of the uterine cavity and permits highly specific and elaborate evaluation of endometrial pathologies. Minor surgical procedures may be performed in an office setting, whereas more complex surgeries should be reserved to operative hysteroscopy with a resectoscope, provided the bipolar technique is employed.

Non-electrolytic hypertonic solutions (glycine and sorbitol-mannitol) are indicated for strictly unipolar hysteroscopy since they do not conduct electricity and allow good endoscopic vision. Among the complications related to absorption of the non-electrolytic hypertonic solutions employed for operative hysteroscopy are hypervolemia with hyponatremia and intravasation syndrome. It must be remembered that the complication of intravasation syndrome can still occur when using saline as distension medium, even though its effects are more easily controlled and managed owing to its physiological reabsorption at peritoneal level and, above all, the absence of neurotoxicity, which is typical of glycine.

While using low molecular weight liquid media, continuous-flow irrigation should be applied in order to obtain good distension of the cavity and provide adequate endoscopic vision. The key parameters that must be controlled are as follows: The flow rate, which should be sufficient to provide for rapid irrigation of the cavity, and the irrigation pressure, that ensures adequate distension of the uterine cavity. If irrigation pressure is too high, there is a risk of significant intravasation of distension liquid.

Saline and non-electrolytic hypertonic solutions (glycine and sorbitol-mannitol) are generally available in 3- or 5-liter bags, that can be connected to the resectoscope via a special high-flow irrigation pump. It is recommended to use Touhy Borst Y-connectors in order to be able to use two bags of solution at the same time or alternately.

The systems commonly used to control flow rate and irrigation pressure are:

- **Gravity fall of liquid (Fig. 1.2).** The bag is suspended at a suitable height (90–100 cm from the patient's perineum is sufficient to obtain an irrigation pressure of approx. 70 mmHg). The liquid drains downwards due to the force of gravity. To obtain an irrigating effect, the silicone tubing, attached to the resectoscope's irrigation port, is connected to a receptacle. Alternatively, the outflow tubing can be connected to a suction pump, although in some cases it can be difficult to maintain a good balance between inflow and suction pressure.
- **Pressure cuff (Fig. 1.3).** These are devices similar to sphygmomanometers which apply pressure around the bag. The pressure is obtained by inflating the pressure cuff, and must be kept at around 80 mmHg by an assistant since the progressive emptying of the bag causes a fall in supply pressure. Generally, the irrigation effect is obtained as described in the gravity fall system.
- **Electronic suction and irrigation pump (Fig. 1.4).** Automatic control of the suction and irrigation parameters is of paramount importance as hysteroscopic surgery continuously requires clear vision of the operating field, and constant distension of the uterine cavity. Apart from the systems that allow to control flow rate, as well as suction and irrigation pressure, there are others that permit monitoring and automatic microprocessor-controlled adjustment of the preset volumetric difference between the in- and outflowing irrigation liquid, as well as instantaneous adjustment of this parameter. Such units are commonly operated using the following set values: flow rate approx. 200 mL/min, irrigation pressure of 75 mmHg and suction pressure of 0.25 bar. Simply by readjusting the set values of flow rate and irrigation pressure, the HAMOU ENDOMAT® can be used both for hysteroscopy and laparoscopy.

1.2 Cold Light Source

Since hysteroscopy is always conducted under videoendoscopic control, the technical specifications of the cold light source have a major impact on image quality. A high-quality cold light source, preferably equipped with a Xenon lamp, will usually yield the best results (**Fig. 1.5**). In general, a 175-watt light source is considered sufficient for routine procedures, whereas for special applications or those performed with miniature telescopes, a 300-watt light source is recommended. A light source operating at higher power levels usually produces more thermal energy, which in turn causes a greater rise in temperature. Light is transmitted through fiber-optic or fluid light cables with a diameter of 3.5 to 5 mm and a length of 180-350 cm (**Fig. 1.6**). For standard hysteroscopic procedures, cold light cables with a diameter of 5 mm and a length of 180 cm are used.

1.3 Imaging Systems

The use of an endocamera is essential in modern hysteroscopy. During specialist training, the surgeons learn to work in a comfortable position watching the hysteroscopic video image on the monitor. Different types of video cameras are available (**Fig. 1.7**); their quality depends on the following technical parameters: resolution (given by number of lines or pixels), and sensitivity (Lux), as well as the quality of the reproduction/video images. A high signal-to-noise ratio indicates that variations in image quality under extreme situations, e.g. hemorrhages or other reasons for loss of light intensity are reduced to a minimum. Modern High Definition (HD) cameras offer a very high resolution and almost natural color reproduction (**Figs. 1.7–1.9**). Video recorders and video printers are also available on the market. Complete systems such as the AIDA® compact NEO (KARL STORZ Tuttlingen, Germany) are also available, allowing still images, video and audio data to be recorded and archived (**Fig. 1.10**). This system also allows still images to be printed on an inkjet printer.



1.5 When a miniature telescope is used, a 300-W cold light source is highly recommended (XENON 300) because it provides extremely high light intensity for the best illumination conditions.



1.6 Fiber-optic light cable for light transmission from the cold light source to the endoscope.



1.7 Three-chip video camera KARL STORZ Endovision IMAGE 1™.



1.8 KARL STORZ IMAGE 1™ H3-Z Full HD video camera.



1.9 KARL STORZ IMAGE 1™ Pendulum H3-P Full HD 3-chip video camera.



1.10 Documentation system for digital storage of still images, video sequences and audio files, AIDA® compact NEO (KARL STORZ Tuttlingen, Germany).



1.11 Flexible hystero-fiberscope (KARL STORZ Tuttlingen, Germany).

1.4 Endoscopes

Endoscopes are essentially subdivided into flexible fiberscopes and rigid rod lens optical systems. Hystero-fiberscopes are rarely used because of their high cost, lack of durability, and the fact that they cannot be sterilized in an autoclave (**Fig. 1.11**). Rigid telescopes are usually available with different viewing angles: 0°, 12°, and 30°. Normally, the 30° forward-oblique telescope is used for diagnosis (best viewing angle for this purpose), whereas the 12° telescope is particularly suitable for surgical procedures involving the use of a resectoscope, which requires that the loop electrode always remain within the field of view.

1.5 Diagnostic Hysteroscopes

The endoscopes used in this field of application are available in different outer diameters. Miniature endoscopes should generally be used in diagnostic hysteroscopy in order to render the procedure minimally invasive. Micro-hysteroscopy is usually performed with a 2-mm telescope, which involves considerable limitations due to fragility of the scope (**Fig. 1.12**). This type of hysteroscope should be reserved for special cases of cervical stenosis.

The hysteroscope with a diameter of 2.9 mm is most widely used in an office setting, including purely diagnostic hysteroscopy, which is performed using physiological saline solution as the distension medium (**Fig. 1.13**).

The single-flow operating sheath is 4.3 mm in diameter and can be used as inner sheath in combination with the 5-mm continuous-flow operating sheath (**Fig. 1.14**, BETTOCCHI® system). The sheath has an oval design that perfectly fits the anatomy of the cervical canal. There is also the option of using the BETTOCCHI® Integrated Office Hysteroscope (B.I.O.H.™), which is fitted with a handle compatible for use with the Bettocchi system and includes operating sheath, fiber-optic light connector and connectors for irrigation and suction tubes (**Fig. 1.15**).



1.12 Miniature hysteroscope, diam. 2 mm. (KARL STORZ Tuttlingen, Germany).



1.13 The BETTOCCHI® system, diam. 5 mm (KARL STORZ Tuttlingen, Germany).



1.14 The BETTOCCHI® system, diam. 5 mm, with semi-rigid operating instruments (KARL STORZ Tuttlingen, Germany).

The HAMOU II 4-mm micro-hysteroscope with its examination sheath of 5 mm diameter provides a panoramic view of the entire uterine cavity and, in contact mode, allows for close-up inspection of the surface cellular layers after supravital staining (**Fig. 1.16**). This endoscope has now been superseded by the office hysteroscopy system, mainly because the larger diameter is not suitable for uterine distension using fluid media.

The TROPHYscope – CAMPO compact hysteroscope (**Fig. 1.17**) has a thin outer diameter of 2.9 mm and can be loaded either with a diagnostic sheath or a 4.4-mm operating sheath. The TROPHYscope may be used without sheath for diagnostic hysteroscopy in single-flow mode. In case of need, the continuous-flow diagnostic sheath or a continuous-flow operating sheath can be used in conjunction with the compact hysteroscope.



1.15 The BETTOCCHI® Integrated Office Hysteroscope (B.I.O.H.[™]), diameter 4 mm, hysteroscope for diagnostic and office-based procedures (5 Fr.), (KARL STORZ Tuttlingen, Germany).



1.16 The HAMOU II hysteroscope, diam. 4 mm (KARL STORZ Tuttlingen, Germany).



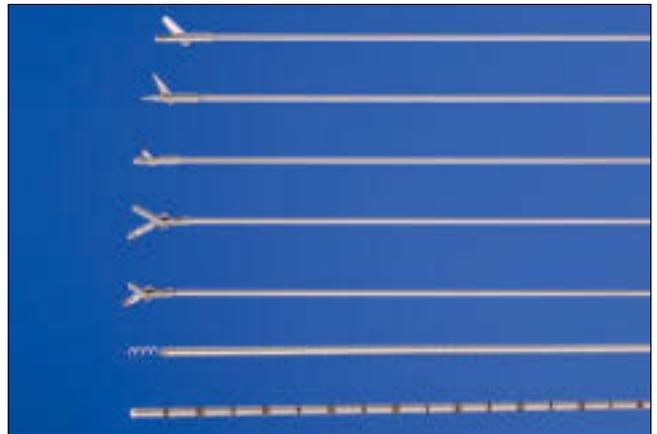
1.17 The TROPHYscope – CAMPO compact hysteroscope – has an outer diameter of 2.9 mm. It may either be loaded with an accessory diagnostic sheath, or with a 4.4-mm operating sheath.

1.6 Operative Hysteroscopes

Operative hysteroscopes have been definitively superseded by office hysteroscopy systems that allow for diagnostic hysteroscopy while providing the option to perform minor surgical procedures in an office setting (small endometrial polyps or pedunculated uterine leiomyomas). For this purpose, the inner diameter of the sheath used in conjunction with an office hysteroscope must be large enough to permit the passage of operating instruments. Indeed, even if the same telescope is used as in diagnostic hysteroscopy (2.9 mm diameter), the sheath must have an outer diameter ranging between 3.2 and 5.3 mm to permit the passage of surgical instruments and to provide adequate uterine distension by use of liquid media. In this field of application, most operating instruments have a semi-rigid design and a diameter of 1.67 mm (5 Fr): scissors, biopsy forceps, and various types of probes, electrodes for unipolar and bipolar coagulation, and Essure microinsert for hysteroscopic sterilization by tubal occlusion in a clinical setting (**Figs. 1.18–1.21**).



1.18 Instruments that can be inserted through the office hysteroscope: forceps, scissors, unipolar and bipolar electrodes.



1.19 Semi-rigid instruments: forceps, biopsy forceps, scissors and myoma fixation instrument.



1.20 Grasping forceps protruding from the operative hysteroscope.



1.21 Polypectomy loop protruding from the distal end of the operative hysteroscope.

1.7 Resectoscopes

Patterned after the instrument already familiar in urologic surgery, the gynecologic resectoscope is specially designed for the resection and removal of abnormal intrauterine tissue as well as endometrial ablation and septal dissection.

There are essentially two types of resectoscopes (**Fig. 1.22**), which differ in outer diameter: 7.3 mm (22 Fr) and 8.7 mm (26 Fr). The 8.7 mm-resectoscope is commonly used only in patients with a large uterus (endometrial ablation) or in the presence of pathologies (myoma) with a diameter larger than 3 cm, or if a myoma is found to have a difficult intramural location (**Fig. 1.23**). In cases which require dilation of the cervical canal (Hegar No. 8), the 22-Fr resectoscope is usually preferred (**Fig. 1.24**).

The resectoscope consists of a classic endoscope, with diameters ranging between 2.9 mm and 4 mm – preferably with a 12° viewing angle to keep the electrode within the field of view – combined with a cutting loop operated by a passive spring mechanism, and two sheaths for continuous irrigation and suction of the distension medium. Apart from the cutting loop, other instruments such as microknives and a variety of vaporizing or coagulating electrodes can be used with the working element of the resectoscope (**Fig. 1.25**). All these instruments are available for both the 22-Fr and the 26-Fr resectoscope.



1.22 Resectoscopes in comparison (22 Fr. and 26 Fr. in diameter).



1.23 Bipolar continuous-flow resectoscope for intrauterine electro-surgery (26 Fr. in diameter).



1.24 Bipolar continuous-flow resectoscope for intrauterine electro-surgery (22 Fr. in diameter).



1.25 Various bipolar electrodes for tissue resection: cutting loops, roller-ball electrode, and needle electrode.

Resectoscopes can be employed either in unipolar or bipolar technique. It is important to underline that the same resectoscope can be used both as unipolar and bipolar instrument, simply by changing the working element and the electrodes. Therefore, in order to switch from unipolar to bipolar resection technique with a suitable current generator, the same resectoscope (endoscope and sheath) can be used, requiring only the working element and the electrodes to be changed.

The benefits of bipolar energy compared to unipolar are described in the relevant chapter.

For distension and irrigation of the uterine cavity a 1.5% glycine solution or sorbitol-mannitol is used, as previously stated, for unipolar surgery. For bipolar resectoscopy, physiological saline solution must be used as distension medium.

1.8 Electrosurgical Unit for High-Frequency Surgery

The resectoscope is connected to an HF electrosurgical unit with automatic power supply control and alarm function (**Fig. 1.26**). Modern HF systems can be operated both in unipolar and bipolar mode, for hysteroscopy as well as for laparoscopy and open surgery. Resectoscopy can be performed with unipolar or bipolar current depending on the available system. In the unipolar system, the electrons flow from the high-frequency electrosurgical unit to the active electrode (e.g. cutting loop or knife electrode) before passing through the tissue to the neutral electrode and then returning to the electrosurgical unit. Broadly speaking, electrosurgery involves the potential risk of burns, because part of the electrons' path is unknown. In theory, electrical burns can occur, even at some distance from the active electrode. However, state-of-the-art equipment considerably reduces this risk if correct placement and good contact and/or adequate support surface of the neutral electrode in relation to the energy from the HF electrosurgical unit is respected.

In the bipolar system, the HF generator produces an initial peak of around 400 RMSV (Root Mean Square Voltage) which creates an electrical arc between the two bipolar electrodes. Once the electrode is sufficiently close to the tissue, the electrical arc converts the conductive solution of sodium chloride to a plasma containing sodium particles that are active because they are highly charged with energy. Once this plasma effect has been created, it can be maintained with a lower voltage (100–350 RMSV). Contact with the activated sodium ions (and thus not with the electrode) provokes disintegration of the tissue due to breaking of the carbon-carbon and carbon-hydrogen bonds and dissociation of the water molecules to H⁺ and OH ions. The result is collapse of the cellular membranes with ensuing cutting of the tissue.



1.26 High-frequency electrosurgical unit AUTOCON® II 400.

The temperature of the surrounding tissue remains between 40° and 70° C using the bipolar system, while with traditional unipolar current temperatures up to 400° C are reached, resulting in significant deep surrounding tissue damage.

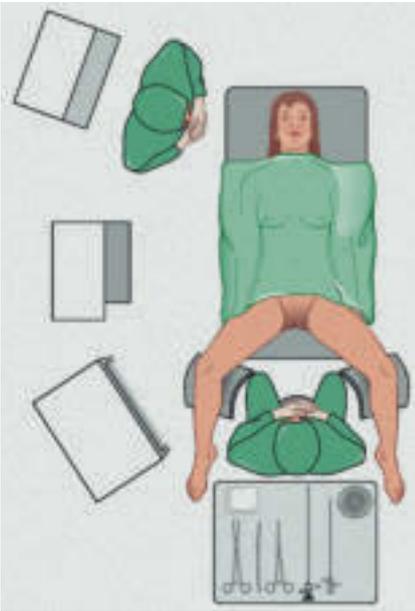
In short, bipolar current offers several indisputable advantages with specific results in surgical procedures using the resectoscope, as demonstrated and widely accepted for years in other types of surgery, such as laparoscopy:

- The flow of electricity is strictly contained between the two electrodes and is thus always under the direct visual control of the surgeon. In the unipolar system, the current passes through numerous layers of tissue, outside the surgeon's visual control, before returning to the generator. Therefore, the risk of iatrogenic burns either due to direct contact with the instrument or faults with insulation or diffusion of the electrical current are greatly reduced with the bipolar technique.
- The risk of interference with other electronic devices (ECG, pace makers etc.) which are also connected to the patient is virtually nil
- Electrical stimulation of peripheral nerves, such as the obturator nerve, is reduced
- Cleaner and sharper cuts with less thermal damage to the surrounding tissue are produced (also useful for histopathological interpretation)
- More efficacious coagulation
- Reduces the risk of intravasation damage as the distension medium used is physiological saline solution – this is more easily reabsorbed by the body, it is not neurotoxic, and it cannot lead to hyponatremia as other distension media can

It is highly recommended that equipment be used which, – with automatic mode selected – determines the resistance of the tissue and therefore, an automatically controlled resection is performed. Electrosurgery can be used for coagulation, dissection, and also for a combination of both modes, using a non-modulated flow of electrons (soft coagulation) or modulated flow (spray coagulation). The coagulation current is characterized by intermittent phases of electrical activity which cause dehydration of the cells and coagulation of the proteins with successive hemostasis. The non-modulated cutting current is a continuous flow of electrons which produces a rapid increase of temperature inside the cells, causing them to explode. In all applications, the use of non-modulated current is recommended for coagulation, as lower voltages are used. This is a less risky option and can be as efficacious as the modulated coagulation current. There are various types of unipolar or bipolar electrodes on the market, depending on the system you have available. The choice of the correct electrode will be based on its indications (**Fig. 1.27a–c**).



1.27 Various types of bipolar electrodes for use with the 22 Fr. resectoscope: loop electrode (a), roller-ball electrode (b) and needle electrode (c).



1.1 Positioning of the patient, surgeon, anesthesiologist, and instruments in the operating room.

1.9 Hysteroscopic Laser Surgery

Argon, neodymium, YAG and KTP lasers are the most frequently used lasers in hysteroscopy and have good characteristics in terms of coagulation, although they do have some weak points in terms of vaporization. Laser generators are significantly more expensive than electro-surgical equipment and do not offer particular advantages in clinical practice.

1.10 Preparation for Office Hysteroscopy and Operating Room Setup

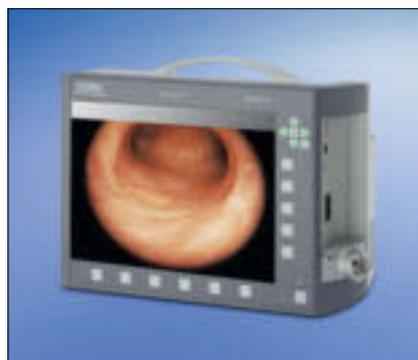
Diagnostic and office hysteroscopy are today considered routine procedures. To perform them, the gynecologist must have a mobile cart in their outpatients' clinic on which to place all the necessary equipment and video gear (**Fig. 1.28**). In the case that there are problems with space or it is necessary to transport the equipment for diagnostic hysteroscopy, it is possible to use small, easily transportable integrated systems. These contain a 24-Watt cold light source, camera control unit, LCD color monitor, documentation pack, and keyboard, and are called TELEPACK X (**Figs. 1.29, 1.30**).

Through the oval continuous-flow sheath with an outer diameter of 5 mm, a series of new instruments can be used. These allow minor surgery (polypectomy, adhesiolysis, tubular occlusion, extraction of foreign bodies) to be performed during diagnostic procedures, which do not require a speculum, Pozzi forceps, dilatation and anesthesia.

A well-equipped and well-organized operating room is mandatory for all surgical procedures using a resectoscope. In order to achieve the best possible outcomes of the operation, the surgeon must be thoroughly familiar with the instrument and know the equipment's layout perfectly. Operating room setup is of fundamental importance not only for the successful outcome of the operation, but also to keep costs down. The operating room must be spacious enough to accommodate all instruments needed during surgery. Prior to initiating the surgical procedure, all instruments, the continuous-flow system, the HF electro-surgical unit and the video system must be checked for proper operation. Generally, the surgeon is assisted by an operating room nurse. For operative hysteroscopy, control of the equipment (that is the suction/irrigation system and the HF electro-surgical unit) is taken by an assistant or a highly qualified nurse. All members of the surgical staff (including the surgeons) must be suitably trained and as such be able to deal with all technical problems which could occur before or during the operation. Positioning of the patient, the surgeon, the anesthetist and the equipment is shown in **Figure 1.1**.



1.28 Fully equipped mobile cart for both diagnostic and surgical hysteroscopy as well as laparoscopy.



1.29 Compact video system and integrated documentation / archiving system TELEPACK X.



1.30 Compact video system and integrated documentation / archiving system TELEPACK X with office hysteroscopy set.

1.11 Maintenance and Sterilization of Instruments

The person charged with cleaning, sterilization and maintenance of the instruments must be specifically qualified and aware of the fragility and cost of endoscopic instruments.

Before each operation, preparation of the operating room requires checking the video-endoscopic system, the cold light source, the irrigation/suction continuous flow system, and the HF electrosurgical unit used for coagulation. After each operation, the reusable surgical instruments must be cleaned and sterilized. Collecting, decontaminating and washing of the material are fundamental auxiliary procedures since the presence of organic residue seriously interferes with the sterilization process. To that end, cleaning must only be undertaken after the instruments have been fully disassembled and immersed in hot water. One particularly useful tool for the preliminary phases is the water gun that generates a higher pressure than the faucet, guaranteeing more thorough cleaning. Utmost care must be taken when cleaning the lenses and scopes as these can be easily damaged. They should be washed with warm water; it is sometimes possible to use alcohol or special agents. Endoscopes must be dried with cotton pledgets to avoid scratching the lenses. Upon completing these steps, it is useful to check that the cleaning has been performed correctly by simply looking through the scopes and rotating the lens so as to scrutinize it completely. In this fashion, it is possible to detect any spots on the edges of the lens or any residual blurring. These can be removed using cotton balls soaked in 90% alcohol. If the problem is not resolved after repeated washing, it is likely that the lens has been damaged and therefore requires repair. If the view provided by the scope presents a half-moon appearance, it is likely that it has been dented. The fiber optic light cable should be cleaned with special disinfectants and soapy water before being thoroughly rinsed. It is also important to inspect the light cable to make sure that the optical fibers are intact. The same cleaning procedures apply to the liquid in- and outflow channels. The stopcocks and sheaths must be completely disassembled after each use and washed (ideally with the water pistol) before being thoroughly dried. Everything must then be reassembled and tested. Lubricants may occasionally be useful to improve the instruments' ease of movement. Biopsy forceps and scissors must also be subjected to cleaning, rinsing, drying and lubrication. The HF cables must not be immersed but simply washed with water and an appropriate disinfectant. If it is necessary to immerse them in disinfectant solution, they should be dried thoroughly before being connected to the electrosurgery generator in order to avoid damaging the equipment, and above all, to prevent injury to the patient or operator.

Autoclave sterilization is the cheapest system, and owing to the diffusion of steam, it cleans even the smallest gaps and openings. Only the optical systems and instruments which are specifically certified for the autoclave may be sterilized with a 20-minute cycle at 121°C or 7 minutes at 134°C. Autoclave sterilization of endoscopes requires certain special steps – they must be placed in a perforated metal container, wrapped in suitable gauze. It is better to allow natural cooling in order to prevent damage to the shafts. Certain steps are also necessary for the fiber-optic cables, such as arranging them in large loops to avoid twisting the bundles of fibers.

Gas sterilization with ethylene oxide is an ideal system since it is performed at low temperatures obviating the risk of damaging the endoscopic instruments.

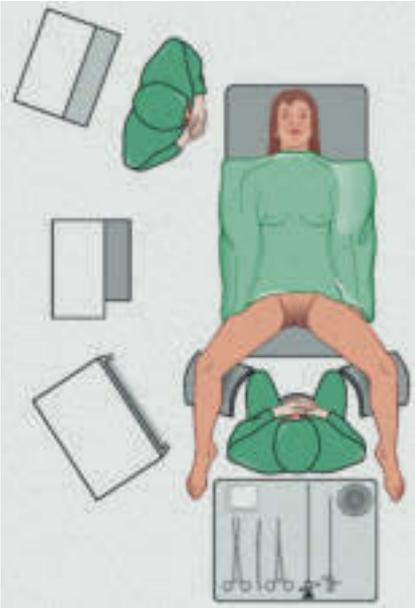
After sterilization, all instruments (previously disassembled) must be aired in the special tray for at least 4 hours to allow the gas to evaporate. Rubber, plastic and PVC require longer aeration times. Unfortunately this technique is costly both in terms of time and money, and requires to have multiple sets of instruments in standby. As such, it is used in few facilities only.

2

Basic Principles of Diagnostic Hysteroscopy

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- 2.2 Technique of Diagnostic Hysteroscopy or Office Hysteroscopy 22
- 2.3 Endometrial Biopsy Sampling 26
- 2.4 Indications for Office Hysteroscopy 26



2.1 The surgeon is positioned between the legs of the patient.

2.0 Basic Principles of Diagnostic Hysteroscopy

All efforts in the development and fine tuning of this diagnostic technique have been aimed at making it a routine examination, that is both reliable and reproducible, allowing the procedure to be performed without any sedation or anesthesia, while keeping patient discomfort to a minimum. It is for these reasons that hysteroscopy has become so widespread and is now an established diagnostic method in daily gynecological practice. Proper hysteroscopic evaluation requires perfect knowledge of the technique and accurate patient screening for choosing the right moment to perform the examination.

2.1 Patient Preparation

After taking a detailed medical history and performing a thorough clinical work-up, it is advisable to reassure the patient with a simple explanation of the techniques that will be used in the examination. Informed consent should be obtained from the patient regarding the therapeutic effects and potential risks of the procedure. The instruments and gauze are placed on a sterile tray in such a way that all instruments and materials are easily accessible to the surgeon (**Fig. 2.1**). It is important that the surgeon be seated on a chair with casters for ease of movement, the mobile cart be placed to the right of the surgeon, and the operator assume a slightly rotated position according to the principles of endoscopic ergonomics (**Drawing 2.1**).

The patient is placed in the gynecological position (**Drawing 2.1**), preferably on a table, so their position can be readily changed to facilitate adjustment of the telescope's inclination during its passage through the cervical canal in the uterine cavity. As such, it is preferable to use thigh supports and not leg supports and it is essential that the patient's pelvis stick out from the bed.

Before the exam is performed, a careful bimanual examination is recommended to assess uterine position, shape and volume. In some cases preventive IM or sublingual administration of atropine can be useful in order to prevent any vagal reflexes.

2.2 Technique of Diagnostic Hysteroscopy or Office Hysteroscopy

The technique of the vaginal hysteroscopy (VH) or office hysteroscopy is different from the standard technique as it has abandoned use of the speculum, Pozzi forceps and uterine manipulators. With the use of reduced-caliber, oval-shaped instruments, which adapt to the canal's anatomy by rotating, it is not necessary to dilate the cervical canal and, as such, neither anesthesia nor sedation are necessary. This makes it possible to perform all hysteroscopic diagnoses and a high percentage of surgical procedures in an outpatient setting, reserving only the most complex cases for the operating room.

For distension of the vagina, cervical canal, and uterine cavity, 0.9% physiological saline solution is used both for diagnostic and surgical vaginal hysteroscopy, always provided that only the bipolar (**not** the unipolar!) technique be used.



2.2 The patient is placed in the gynecological position.

The ideal distension system using physiological saline is an electronic pump (e.g., HAMOU Endomat), that allows constant control of intrauterine pressure in millimeters of mercury and of the flow rate, measured in millimeters per minute. The ideal intrauterine pressure is 100 mmHg, as good vision is obtained while limiting pain caused by the contraction reflex of the uterus as a response to the distension. Moreover, in keeping the pressure similar to average arterial pressure, intravasation of liquid through the arteries dissected during surgical maneuvers is reduced.

In women of reproductive age, the most favorable time to perform the exam is in the first half of the menstrual cycle, between the sixth and tenth days. In this period, the isthmus is hypertonic and it is noticeably easier to pass. The endometrial mucus is in the proliferative phase and lends itself to better endoscopic observation; indeed the morphological changes during and after ovulation, and in particular the abundant presence of cervical mucus, can sometimes obstruct detailed viewing. In the proliferative phase of the cycle, the risk of discovering an initial, unexpected pregnancy is also avoided. When it is an urgent case, or when the patient uses an oral contraceptive, the point in their cycle is in any case of little importance. Some specific circumstances sometimes favor a particular part of the cycle compared to another; functional exploration of the cervical canal, or cervicoscopy, must be performed, for example, in a preovulatory phase, while the differential evaluation of an endometrial hyperplasia must be performed in the secretory phase.

The position of the patient is a crucial factor in the success of the procedure. The patient is placed in a lowered gynecological position, with their legs arranged so as to allow access to the vagina.

The telescope is 2.9 mm in diameter, with 30° forward oblique vision. The scope is fitted with a sheath that measures a further 0.8–1.4 mm in diameter, depending whether the round diagnostic sheath or the oval diagnostic-operative sheath is used. The instrument with oval diagnostic-operative sheath has an overall diameter of 3.2 x 5.3 mm. The oval sheath design allows it to be adapted to the anatomy of the cervical canal and reduces pain experienced while forcibly advancing the hysteroscope.

The oval diagnostic-operative sheath allows the passage of 5 Fr. surgical instruments, such as scissors, forceps, unipolar or bipolar cutting or coagulation electrodes. These allows up to 75% of surgical procedures to be performed in an outpatient setting.

Generally, it is preferable to start the diagnostic exam with the operative sheath in simple flow; this way any difficulties encountered in the cervical canal, such as stenosis, can be dealt with using the surgical instruments. The procedure can then progress more easily with a higher degree of patient compliance. Moreover, if a uterine pathology requiring a biopsy is diagnosed, it is not necessary to retract the instrument from the uterine cavity to change sheath.

The continuous flow operating sheath, i.e. requiring suction, is not routinely used since its greater diameter makes initial entry for diagnosis more difficult and reduces patient compliance. This sheath is necessary, however, when there is major bleeding, an incompetent cervix, or when performing office surgery with continuous flow irrigation.



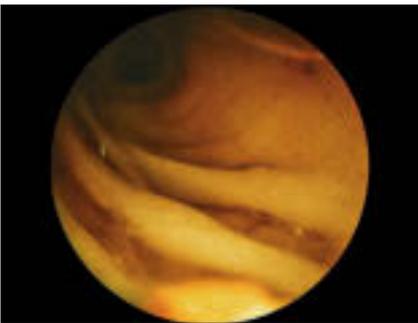
2.1 Normal appearance of the cervical canal.



2.2 Cervical canal papillary structure.



2.3 Cervical canal papillary structure.



2.4 Palmate folds within the cervical canal.



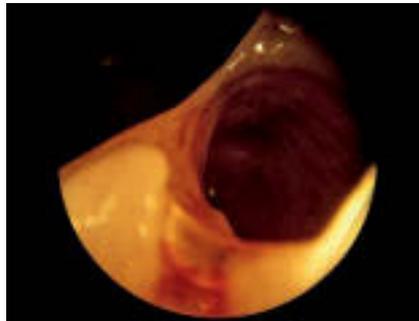
2.5 Cervical canal polyp.



2.6 Minor stenosis of the cervical canal.



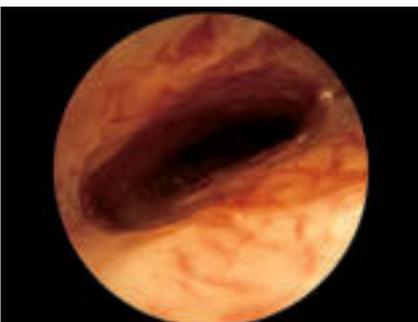
2.7 Pronounced stenosis of the cervical canal in a menopausal patient.



2.8 False route occurring while advancing the hysteroscope in the uterine cavity.



2.9 The isthmus is the true entrance to the uterine cavity.



2.10 Nerve and vascular terminations are concentrated in the isthmus.



2.11 Panoramic view of the uterine cavity.



2.12 Measurement of endometrial thickness.

The office hysteroscopy technique is as follows:

1. Introduction of the hysteroscope through the vulvar cleft. For spatial location and location of the cervix, it is essential to distend the vagina. In some cases, this can be facilitated by closing the labia majora, pushing the right labium onto the left with the thumb of the free hand. This maneuver, coupled with the flow of the distension medium, allows the vagina to be transformed from a virtual to an actual cavity.
2. Introduction is started lowering the camera head so that the scope is initially directed upwards and the rear vaginal wall, raised from the pressure of the rectum, can be avoided. At this point, it is necessary to slowly raise the hand supporting the camera to lower the tip of the scope and, upon reaching the upper third of the vagina, advancing the tip still further towards the rear fornix, where the cervix is most frequently found.
3. Once the external uterine orifice has been localized, the scope is guided further until it penetrates the os under direct vision, avoiding touching the walls.
4. To proceed easily, it is necessary to rotate the instrument, facilitating passage of the distension medium which permits distension of the cervical canal and lavage of the mucus, blood and any detritus present, allowing better vision of the cervical canal. The rotation is performed by adjusting the hysteroscope on-axis with the cervical canal (**Figs. 2.1–2.15**). For correct orientation of the telescope, the internal uterine os must always be kept at 6 o'clock on the screen (**Figs. 2.16–2.17**). One of the difficulties which is frequently encountered is stenosis of the external uterine os, the cervical canal or the internal uterine os. When the external or internal uterine ostia are punctiform, it is sufficient to dilate them using the forceps under visual control. If they do not allow entry of the forceps and the consistency is fibrous, radial cuts must be made using the fine tipped scissors, first at 9 and 3 o'clock, (**Figs. 2.18–2.20**), then if necessary at 12 and 6 o'clock. Once this difficulty has been overcome, we proceed to evaluate the cervical canal and the uterine cavity is accessed using the described technique.



2.13 Evaluation of cystic glands and capillary vessels of the endometrium.



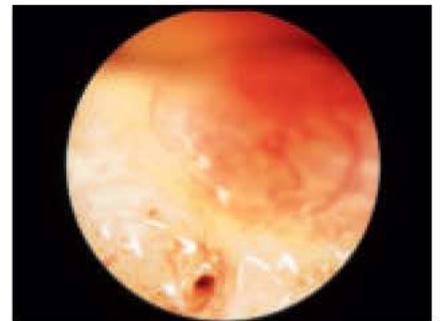
2.14 Evaluation of endometrial vascularization.



2.15 High magnification image showing capillary vessels with red blood cells.



2.16 The internal cervical os is **not** in the correct position.



2.17 After rotation of the hysteroscope, the internal cervical os should be in the 6 o'clock position.



2.18 The forceps are passed through the external uterine ostium, which is shown to be narrowed by stenosis.



2.19 The forceps are introduced into the orifice.



2.20 The forceps are opened multiple times to dilate the orifice.

5. Passage of the isthmus is the critical point and frequently represents the true point of access to the uterine cavity. And indeed, this moment can trigger the pain reflex in the woman, since most of the nerve endings are concentrated here.
6. Once the uterine cavity has been reached, a panoramic view should be obtained to evaluate and locate any possible lesions. A systematic evaluation avoids accidental omission of any areas. We suggest the following order: base of the uterus, right ostium, left ostium, anterior wall and posterior wall.
7. Finally, once the uterine cavity has been evaluated, the cervical canal is re-evaluated during extraction of the hysteroscope.

2.3 Endometrial Biopsy Sampling

For complete evaluation of the uterine cavity, in some cases histological assessment of the endometrium is required.

The endometrial biopsy technique always requires two steps, to compensate for limits in the sample size. The first phase requires the area identified for the biopsy probe to be collected using scissors, creating a square of tissue. Then, the distal part of the partially removed area is grasped with forceps and dragged down or sideways until it is completely detached. Extraction from the uterine cavity is performed keeping the forceps near to the tip of the scope but without retracting it into the operative sheath. As the biopsy sample is always larger than the operating sheath it would be otherwise get lost. It is thus necessary to retract the whole instrument in order to preserve the biopsy.

2.4 Indications for Office Hysteroscopy

Indications of office hysteroscopy are:

- Exploration of young girls and virgin women
- Abnormal uterine bleeding
- Submucous and intramural myoma
- Endometrial polyps
- Infertile patients
- Synechiae
- Uterine malformations
- Foreign bodies
- Hydatidiform mole follow-up
- Isthmocele
- Postpartum metrorrhagia
- Embryoscopy
- Permanent contraception

Each of these indications has a specific chapter further on which will explore it in depth.

3

Hysteroscopy in Patients with Abnormal Uterine Bleeding (AUB)

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- 3.2 Technique of Diagnostic Hysteroscopy 28
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- 3.4 Endometrial Polyps 29
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- 3.6 Postpartum metrorrhagia 30
- 3.7 Conclusions 30



3.1 Submucous myoma, covered by homogenous endometrium.



3.2 Pedunculated myoma covered by atrophic endometrium.



3.3 Large blood vessel on the surface of a submucous myoma.



3.4 Diffuse superficial vascularization of a submucous myoma.

3.0 Hysteroscopy in Patients with Abnormal Uterine Bleeding (AUB)

Abnormal uterine bleeding (AUB) is probably the most common symptom in gynecological practice especially in peri- and postmenopausal women. Various diagnostic techniques for management of AUB (i.e. dilatation and curettage, endometrial biopsy, vabra suction curettage, challenge test, hysterosalpingography and transvaginal ultrasound) have been proposed. In recent years, outpatient office hysteroscopy in combination with endometrial biopsy sampling has demonstrated its great potential as the first-line treatment of AUB patients.

Furthermore, experience has shown the usefulness of combined outpatient procedures (hysteroscopy and endometrial biopsy) versus blind dilatation and curettage, which requires anesthesia and hospitalization.

3.1 Patient Preparation

Curettage prior to hysteroscopy should **not** be performed.

3.2 Technique of Diagnostic Hysteroscopy

The hysteroscopic technique is applied as a classic office procedure. In patients with AUB, endometrial biopsy sampling is frequently performed upon completion of the hysteroscopic examination. Biopsy sampling can be practiced with the technique described above, using biopsy forceps and scissors; techniques employing disposable instruments may be used as well (e.g., Vabra aspiration, Perma or Novak curette).

The main causes of abnormal uterine bleeding are:

- Submucous and intramural myomas
- Endometrial polyps
- Endometrial atrophy
- Postpartum metrorrhagia

We will not concern ourselves with endometrial hyperplasia or carcinoma here as they will be discussed in a separate chapter.

3.3 Submucous and Intramural Myomas

In most cases, intrauterine myomas are liable to remain latent for a long time, manifesting themselves after the age of 35. In approximately 80% of cases, they protrude into the cavity to a varying extent; they are rarely pedunculated endocavitary myomas and displacement into the cervical canal is highly unusual. Under hysteroscopic vision, they assume a highly variable appearance: at times, they have a regular, smooth surface covered by a homogeneous endometrium similar to that of the remaining uterine cavity (**Figs. 3.1, 3.2**). If there is extensive intracavitary progression, the ensuing endometrial compression can give rise to ulceration and necrosis seen at the apex of the growth. At times, the surface of the submucous fibroid appears multilobulated, pearly white in color and grooved with one or more large blood vessels (**Figs. 3.3, 3.4**). Treatment of submucosal and intramural fibroids will be discussed in a separate chapter.

3.4 Endometrial Polyps

Endometrial polyps are exophytic mucous lesions that differ greatly in shape, size, number, and appearance. The surface epithelium of the single or multiple sessile forms is similar to that of the surrounding endometrium and soft in consistency upon contact with the tip of the hysteroscope (Figs. 3.5, 3.6). Pedunculated fibroids have a peduncle of varying length consisting of vascularized connective tissue. These lesions are lined by a cubic or short cylindrical epithelium, vascularized by a network of hypertrophic blood vessels. Polyps can be associated with glandular hyperplasia and can remain latent for rather long periods. Once diagnosed, endometrial polyps should be treated by hysteroscopy because curettage has been shown to be ineffective (Figs. 3.7, 3.8).

3.5 Endometrial Atrophy

Endometrial atrophy is a post-menopausal physiological phenomenon and may nevertheless give rise to bleeding. Within a few years of the onset of menopause, the hormonal changes which occur will lead to endometrial mucosal atrophy, with thinning of the epithelial lining and network of vascular capillaries closest to the surface. These morphological changes – associated with rarefaction of the glandular structure and increased fragility of the stroma – account for the appearance of minor uterine bleeding observed in 45% of post-menopausal women in the absence of any other organic causes. The hysteroscopic image is characteristic: since the endometrial mucosa is quite thin, it often appears transparent, revealing the underlying vascular structures. The presence of hemorrhagic suffusion and petechiae is typical; although these do not have any real pathological significance, they can often cause blood stilticidium (Figs. 3.9–3.12).

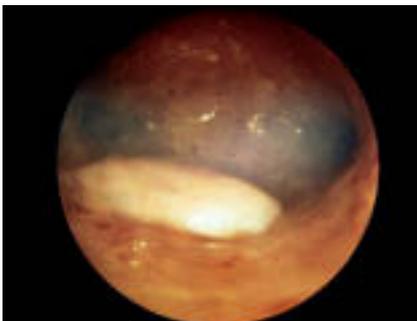
In severe atrophy, the epithelium is smooth and whitish, somewhat like porcelain.



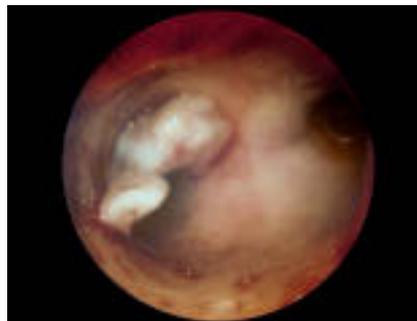
3.5 Multiple endometrial polyps.



3.6 Large soft endometrial polyp.



3.7 Endometrial polyp located in the inferior wall of the uterus.



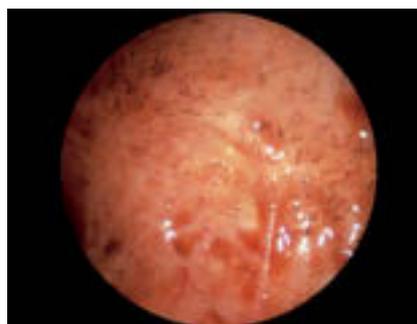
3.8 Cornual polyp cannot be removed by traditional curettage.



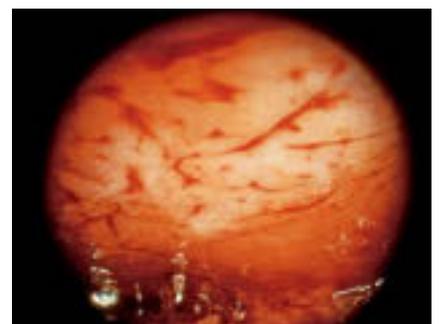
3.9 Presence of diffuse hemorrhagic suffusion in menopausal patient.



3.10 Focal hemorrhagic petechiae.



3.11 Presence of endometrial varices.



3.12 Premenstrual endometrium.

3.6 Postpartum metrorrhagia

In cases of postpartum or postabortal bleeding, diagnostic hysteroscopy is always advisable to confirm removal of all abortive debris from the uterine cavity (**Figs. 3.13, 3.14**). In fact, hysteroscopy also serves to prevent intrauterine synechiae subsequent to repeated curettage of the cavity itself (**Figs. 3.15, 3.16**).

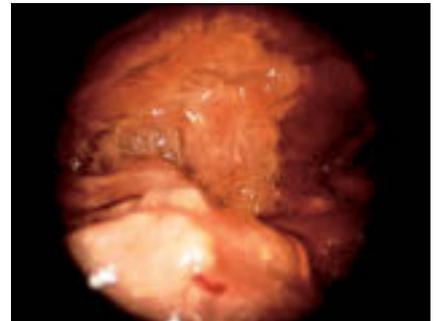
The hysteroscopic image exhibits a cheesy pattern, often focal and well adherent to the wall. It can prove difficult to remove and sometimes bleeds profusely, so it is highly advisable to plan removal of abortive debris in the operating room, in consideration of the potential need for a blood transfusion.

3.7 Conclusions

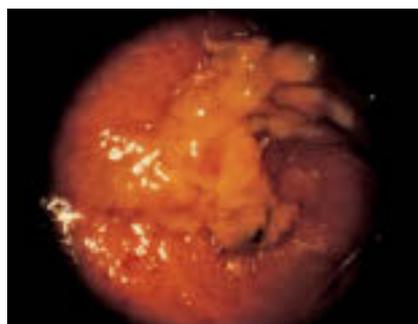
It is noteworthy that no lesions were found to have caused bleeding in at least 40% of the pre- and postmenopausal women with AUB. In other words: in the large population of AUB patients, it is possible to detect intrauterine pathology in only 60% of cases. Submucous myoma, endometrial polyps or hyperplasia are the most frequent pathologies detected by hysteroscopy in women of reproductive age. In postmenopausal women, however, it is more common to detect endometrial atrophy, polyps and/or uterine cancer. In these cases, hysteroscopic diagnosis should always be confirmed by histopathological assessment of endometrial biopsy samples. Conversely, patients with normal endometrial atrophy are not biopsied. In AUB patients with a hysteroscopic diagnosis of normal (functional and atrophic) or dysfunctional endometrium, biopsy sampling can be avoided, allowing the clinician and patient to save time and money.



3.13 Presence of abortive debris.



3.14 Presence of abortive pregnancy.



3.15 Abortive debris and intrauterine synechiae.



3.16 After two weeks, incipient synechiae develop from abortion residues.

4

Hysteroscopy in Patients with Endometrial Cancer and Hyperplasia

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4.0 Hysteroscopy in Patients with Endometrial Cancer and Hyperplasia

4.1 Endometrial Carcinoma

Tumor of the endometrium is the most common gynecological neoplasm in industrial countries, making up 6% of tumors in women, with a progressive reduction in mortality which is currently at 26%.

Different risk factors have been identified correlated to the development of endometrial tumors: ERT not accompanied by progestin, obesity, high-fat diet, early menarche, late menopause, tamoxifen, previous breast carcinoma, diabetes, hypertension. Aside from these factors, the data from three registers of hereditary tumors show a ten-fold increase in the risk of developing an endometrial tumor compared to the general population for women with a genetic anomaly correlated with hereditary nonpolyposis colorectal cancer (HNPCC). In these women, the cumulative risk of developing endometrial carcinoma can reach 43% by age 70.

The histological type of the endometrial carcinoma can be poorly differentiated: endometrioid and non endometrioid. There is no pre-cancerous lesion phase.

It is believed that type 1 evolves from histologically distinguishable hyperplastic lesions, classified as endometrial hyperplasia without atypia (EH), endometrial hyperplasia with atypia (AEH or EIN), before arriving at endometrial carcinoma (EC).

The most common histotype is endometrial adenocarcinoma, which represents 75-80% of diagnoses. Most of these carcinomas are well differentiated, they tend to develop with a background of endometrial hyperplasia and are estrogen dependent. These tumors, also known as type 1, have a favorable prognosis. About 10% of endometrial tumors are type 2. Women with these tumors are at high risk of relapse and metastasis. These tumors are not estrogen dependent, and most are associated with endometrial atrophy.



4.1 Increased endometrial thickness in low-risk endometrial hyperplasia.



4.2 Cystic glandular formations.



4.3 Cystic atrophy.



4.4 Endometrial polyp with cystic formations.

The main symptom presenting with endometrial neoplasia is abnormal uterine bleeding. Between 8 and 10% of post-menopause uterine bleeding cases are caused by carcinoma of the endometrium. The prevalence of endometrial hyperplasia amongst women suffering from AUB is estimated to be around 10%. In practice, early diagnosis of these lesions is important for the treatment and to avoid hyperplasias with cytological atypia progressing towards adenocarcinoma.

4.2 Endometrial Hyperplasia

In general, endometrial hyperplasia is deemed a precursor of endometrial cancer. Today, we know that only some of them pose a real risk of malignant transformation and some adenocarcinomas are preceded by endometrial hyperplasia as a precursor. Accordingly, early diagnosis of endometrial hyperplasia must be defined as the primary goal of any screening program of endometrial adenocarcinoma.

In patients with dysfunctional bleeding, endometrial hyperplasia represents one of the most complex diagnostic problems. Hysteroscopy offers the opportunity to inspect the lesion. If indeterminate or suspicious findings of endometrial hyperplasia are seen, those cases are selected for endometrial biopsy sampling. Unfortunately, it is not possible to find a corresponding hysteroscopic image for every histological aspect of endometrial hyperplasia. Consequently, a classification of hyperplastic endometrial lesions was established that is defined by developmental risk stages.

4.3 Low-Risk Endometrial Hyperplasia (EH)

Hysteroscopic Aspects

The hysteroscopic appearance of these cases often resembles that of normal glandular epithelium. Owing to the plasticity of the mucosa, the mucosal thickness can be assessed easily by palpation using the tip of the hysteroscope. The cystic form often shows a specific hysteroscopic appearance of widened glandular ostia with cystic-glandular formations approximately one millimeter in diameter (Figs. 4.1–4.3).

The same findings can be observed in an endometrium of reduced thickness where they indicate cystic atrophy. Aside from the cystic form, EH is characterized by varied and often multiple hysteroscopic changes (Figs. 4.4–4.9), including:

- Increased endometrial thickness
- Non-homogenous endometrial regeneration
- Increased vascularization
- Presence of ciliated epithelium
- Presence of cystic dilatation
- Polypoid formations
- Necrotic areas
- Irregular arrangement of the glandular orifices

If one or more of these characteristics are found, hyperplasia must be suspected and an endometrial biopsy should be performed.



4.5 Non-homogenous endometrial growth.



4.6 Polypoid formation and increased vascularization.



4.7 Polypoid formation and increased vascularization.



4.8 Focal endometrial hyperplasia.



4.9 Endometrial polypoid hyperplasia.



4.10 High-risk endometrial hyperplasia, arborescent capillary vascularization.

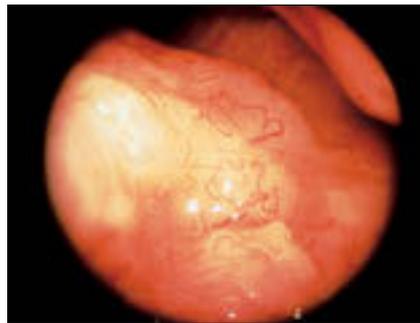
4.4 High-Risk Endometrial Hyperplasia

Hysteroscopic Aspects

The hysteroscopic and histological aspects of this condition are similar to pre-neoplastic or neoplastic lesions. In this situation, the hysteroscopic image is also extremely varied and can differ from the normal morphology. Polypoid aspects are often present and vascularization is clearly visible and pathological. Superficial vascularization takes on an arborescent appearance or possibly like that of a corkscrew in that it surrounds groups of glandular ostia (**Figs. 4.10–4.12**). In these cases, the endoscopist must immediately confirm the hysteroscopic appearance by endometrial biopsy sampling. The mucosal appearance could be described as “cerebroid” due to its abnormal growth and vascularization, similar to the irregular superficial appearance of brain tissue.



4.11 High-risk endometrial hyperplasia, corkscrew vascularization.



4.12 Endometrial abnormal growth and abnormal vascularization.



4.13 Endometrial cancer, view from the isthmus.



4.14 Endometrial cancer, view of the uterine cavity.

4.5 Endometrial Intraepithelial Neoplasia (EIN)

Hysteroscopic Aspects

Hysteroscopy has proven to be an extremely reliable technique in the diagnosis of endometrial neoplasia. The endoscopic images are so clear and obvious to interpret that they are rarely confused with other lesions. In its initial stage, adenocarcinoma gives a germinative picture, with irregular, multilobular, delicate excrescences which are partly necrotic or bleeding; vascularization is also irregular or anarchic (**Figs. 4.13–4.17**).



4.15 Endometrial cancer polypoid and necrotic aspect.



4.16 Endometrial cancer, well-differentiated form.



4.17 Endometrial cancer invading the uterine cavity.

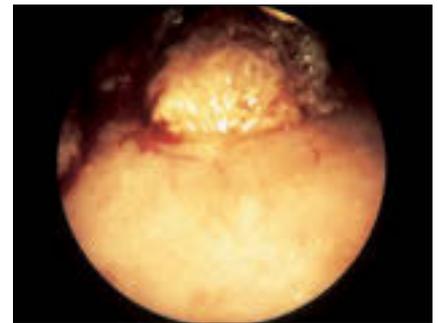
In some forms of lesions, the area can be clearly demarcated from the normal endometrium; in others, it is possible to see focal lesions, frequently found on the tubal cornua, which can easily be missed using blind sampling techniques (**Figs. 4.18–4.20**). The macroscopic appearance of the endometrium reveals changes in the glandular structure that demand subsequent histological evaluation.



4.18 Endometrial cancer, focal localization.



4.19 Endometrial cancer of fundal localization.



4.20 Endometrial cancer with clearly circumscribed boundary between normal and neoplastic epithelium.

4.6 Hysteroscopy in the Screening for Endometrial Carcinoma

Mass screening of the asymptomatic female population in pre- and post-menopausal age for early diagnosis of endometrial carcinoma, as is done for cervical cancer with PAP screening, is not feasible.

In patients with AUB, hysteroscopy is without doubt the gold standard. Hysteroscopy, despite its extreme diagnostic precision, must not be considered a diagnostic procedure per se, but rather an investigative method to be combined with endometrial biopsy. This technique must therefore serve to identify malignant or benign lesions of the endometrium for which a biopsy is required. In the same fashion, hysteroscopy also serves to exclude from further analysis patients with dysfunctional uterine hemorrhaging who do not present any signs of pathological modifications. Whether or not the hysteroscopy is sufficient to establish a definitive diagnosis without taking further tissue samples will depend directly upon the endoscopist's experience. After a certain period of practical experience, hysteroscopy can be used to identify patients with malignant or benign endometrial pathologies with approximately 20% false-positive results and no false-negatives. Hysteroscopic examination combined with the collecting of tissue samples increases the certainty of diagnoses up to 100% as regards endometrial neoplasia and pre-neoplastic forms.

According to some authors, irrigation of the endometrial cavity with saline solution during the course of hysteroscopy is supposed to provoke the spread of cancerous endometrial cells to the abdomen and as such could worsen both the prognosis and the progress of treatment. There are, however, many arguments against such a hypothesis.

It is well known that all investigative methods, i.e., the bimanual examination procedure, curettage, and even hysterectomy, are causes of the spread of cancerous cells to the circulatory system and the peritoneum, but do not in any case increase the incidence of metastasis. A meta-analysis performed on 5 studies and 756 cases underlined that among patients with positive peritoneal cytology, 38 had undergone a previous hysteroscopy and 41 had not, demonstrating that hysteroscopy does not increase the risk of spreading neoplastic cells to the peritoneal cavity.

4.7 Hysteroscopy in the Staging of Endometrial Carcinoma

As well as targeted biopsy, hysteroscopy is useful to evaluate cervical involvement in endometrial carcinoma. *Roki et al.* compared various diagnostic tests in relation to their capacity to evaluate cervical involvement. They arrived at the conclusion that while MRI is excellent in predicting stromal involvement, hysteroscopy is superior as regards involvement of the mucosa.

4.8 Hysteroscopy in the Conservative Treatment of Endometrial Carcinoma

Since the rate of young women with endometrial carcinoma has increased while at the same time the average child-bearing age has also grown, conservative treatment of women of reproductive age afflicted with low-risk endometrial carcinoma is an ever-more widespread situation. Since the early 80's, there have been various experiences of treating young women with endometrial carcinoma conservatively with progestins. Little is known regarding the risk of progression for women with atypical hyperplasia who opt for non-surgical treatment to preserve fertility or to avoid hysterectomy, and there are no therapeutic guidelines. Current estimates of the risk of progression are limited and imprecise, varying from 0% to 27% for endometrial hyperplasia without atypia and from 20% to 100% for hyperplasia with cytological atypia and adenocarcinoma in situ.

For patients who choose conservative hormonal treatment, hysteroscopy plays an important role during the follow-up. Indeed, the various protocols recommend a hysteroscopy with endometrial biopsy every 3 months during treatment as well as a transvaginal ultrasound every 6 months to evaluate the evolution of the lesions.

From the point of view of conservative treatment of a woman who wishes to become pregnant, hysteroscopic resection of the endometrial carcinoma has also been proposed. *Mazzon et al.* reported that a woman affected by stage-1 endometrial carcinoma had conceived after conservative treatment by use of a resectoscope, without encountering a relapse of the illness. Other similar cases have been reported in medical journals. Recently, *Laurelli et al.* published a study on 14 patients diagnosed with stage-1A endometrial adenocarcinoma treated with endometrial ablation and progesterone therapy. In the follow-up, only one patient had developed hyperplasia without atypia which was subsequently found to be negative, while the other patients tested negative; one patient later successfully carried a pregnancy to term.

4.9 The Technique

For diagnosis and staging procedures, the technique is that of the classic office hysteroscopy. In patients with suspected neoplastic or pre-neoplastic lesions, it is almost always necessary to perform an endometrial biopsy upon completion of the hysteroscopic exam. This can be performed in a targeted manner with the previously described technique, using biopsy forceps and scissors, or by using disposable instruments (e.g. Vabra aspiration, Perma or Novak curette) which allow a greater quantity of material to be sent for histological assessment in the case of large lesions.

For conservative treatment of cancerous or pre-cancerous lesions with a resectoscope, the technique requires the use of a unipolar or bipolar resectoscope, preferably 22 Fr. with an "U" loop to remove all visible suspected lesion and send the material for histological assessment.

5

Hysteroscopy in Infertile Patients

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5.0 Hysteroscopy in Infertile Patients

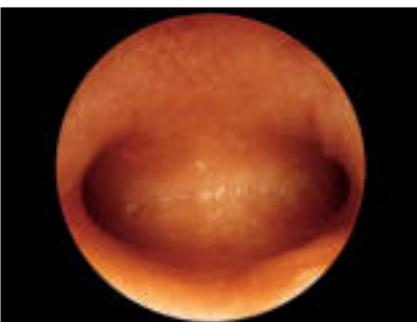
In the last decade, modern endoscopic procedures have increasingly gained acceptance as diagnostic methods employed for assessment of infertility. Hysterosalpingography (HSG) is the traditional technique used to evaluate the uterine cavity and fallopian tubes in infertile patients. HSG and hysteroscopy are alternative techniques used to examine the uterine cavity and cervical canal. Hysteroscopy allows inspection of the cervical canal and uterine cavity, and also permits examination of the tubal ostium and proximal intramural segment of the fallopian tube. The main advantage of hysteroscopy over HSG is the capability to inspect the uterine cavity. Filling defects and partial failure of fusion of Müllerian ducts can be suspected, but not always proven by HSG. Hysteroscopy is particularly accurate in the assessment of synechiae, submucous fibroids and polyps, all of which are frequently missed by HSG, but are found in 8% to 28% of infertile patients.

Based on the experience of several authors, lesions could be detected successfully by hysteroscopy in about 20% of cases determined as normal by HSG. The rate of false-positive findings in HSG was reported to be about 35%. It is clear then, that not only does hysteroscopy accurately define lesions, such as fibroids, synechiae and polyps, but it also makes them amenable to surgery.

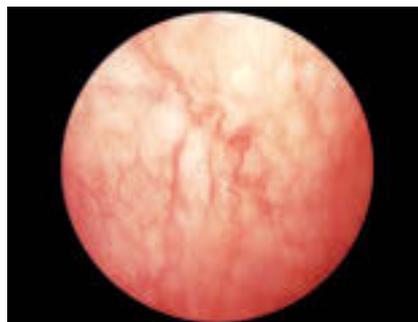
However, hysteroscopy has shown to be unreliable in the assessment of tubal patency; the intramural and isthmic segments of the tubes must be evaluated by hysterosonography, hysterosalpingography or laparoscopy.

5.1 Technique

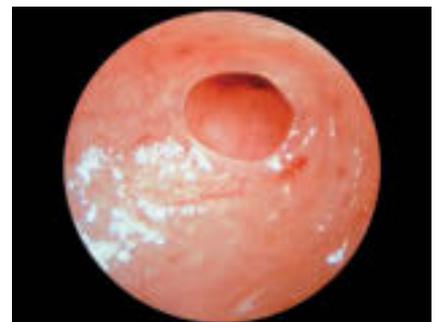
A hysteroscope providing a panoramic view should be used to perform detailed examination of the endometrium and tubal ostia. For hysteroscopic examination of the uterine cavity in infertile patients, the Bettocchi system with an outer diameter of 3.9 mm is generally preferred, but models with a smaller diameter may also be used. The hysteroscope is advanced as far as 2 cm from the fundus (**Figs. 5.1, 5.2**) and rotated 90° to visualize the tubal ostium (**Fig. 5.3**). If endometrial biopsy is required, this is accomplished by using the techniques described in the chapter on diagnostic hysteroscopy and endometrial biopsy.



5.1 Panoramic view of the entire uterine cavity.



5.2 The hysteroscope approaching the fundus affords a contact view of the endometrium.



5.3 Rotation of the telescope allows the tubal orifice to be viewed.

Cervical Canal

The cervical canal is routinely examined during insertion of the hysteroscope (Fig. 5.4). In this way, cervical polyps, adhesions, and cervical atresia can be diagnosed reliably (Figs. 5.5–5.8). However, cervical incompetence is not clearly diagnosed owing to the lack of precise diagnostic parameters. Of the cervical pathology documented by hysteroscopy, usually 80% is confirmed by hysterosalpingography.

Uterine Cavity

Hysteroscopy is the most accurate method of diagnosing endometrial polyps, submucous fibroids, and synechiae (Figs. 5.9–5.27). In our experience, adhesions, polyps, and submucous fibroids were found in 11%, 9.1%, and 8.2% of infertile patients, respectively. In these patients, the correlation with HSG was poor. Thirty-six patients were diagnosed by HSG as having a central filling defect (Fig. 5.20). In 12 out of these 36 patients, hysteroscopy demonstrated a normal appearance of the uterus. In the remaining 24 patients a pathology was identified, including five cases of polyps, six synechiae, eleven fibroids, and two cases of endometrial hyperplasia.

Passage of the distension medium through the tubal ostia can be seen during the hysteroscopic examination. The tubal ostia open slowly in response to the rising intrauterine pressure, allowing the operator to inspect the interior of the proximal intramural segment. The tubal ostia can be evaluated for changes during the different phases of the menstrual cycle (Figs. 5.28–5.31). Partial obstruction of the ostium by myomas or polyps was detected in 4% of the infertile women examined.

5.2 Conclusions

In the field of infertility treatment, diagnostic hysteroscopy has reached exceptional levels of reliability. Cervical canal dilatation in combination with the option of an anesthesia-free examination has made it an extremely important technique for all infertile patients. In fact, it permits a much better evaluation of the uterine cavity than either HSG or ultrasound. When compared with HSG, hysteroscopy is limited because it does not provide any information on tubal structure and patency. Combining hysteroscopy with hysterosonography or micro-laparoscopy or transvaginal laparoscopy should resolve the limitations of the technique.

Contraindications to Operative Hysteroscopy

- Pelvic inflammatory disease (PID)
- Acute cervicovaginitis
- Severe metrorrhagia
- Pregnancy



5.4 Panoramic view of the cervical canal.



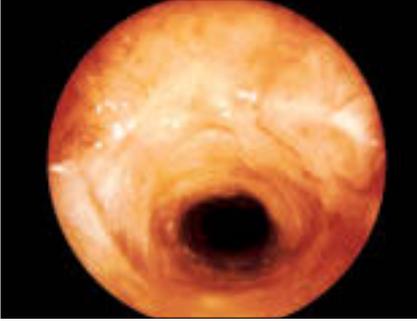
5.5 Cervical polyp.



5.6 Cystic polyp of the cervical canal.



5.7 Cervical adhesion.



5.8 Cervical atresia.



5.9 Endometrial polyp located at the inferior endometrial wall.



5.10 Polyp of the lateral uterine wall of the right side.



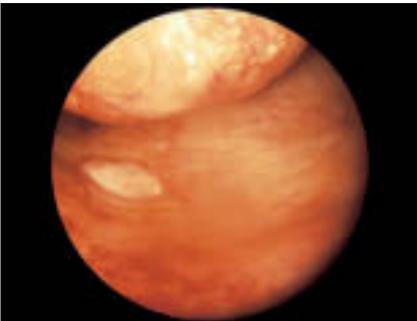
5.11 Necrotic polyp.



5.12 Submucous pedunculated myoma.



5.13 Submucous myoma, grade G0.



5.14 Submucous myoma and focal area of endometrial necrosis.



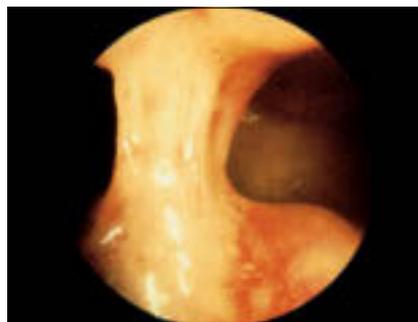
5.15 Myometrial adhesions.



5.16 Myometrial adhesion.



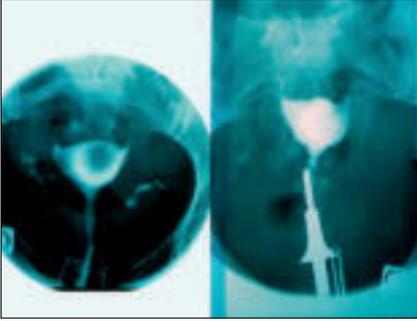
5.17 Diffuse myometrial adhesion.



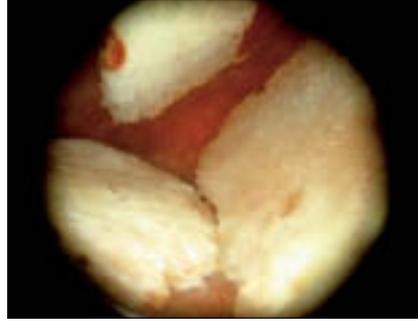
5.18 Fibrous central adhesion.



5.19 Marginal fibrous adhesion.



5.20 Hysterosalpingographic image demonstrating a central intrauterine filling defect.



5.21 Remnant of bone metaplasia in the uterine cavity.



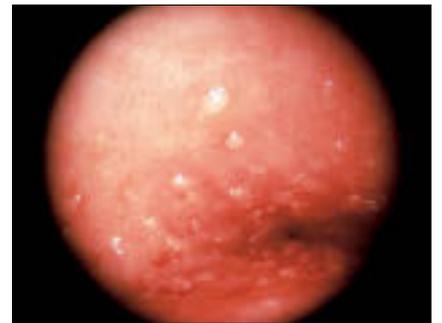
5.22 Large uterine septum.



5.23 Uterine septum occupying the entire cavity.



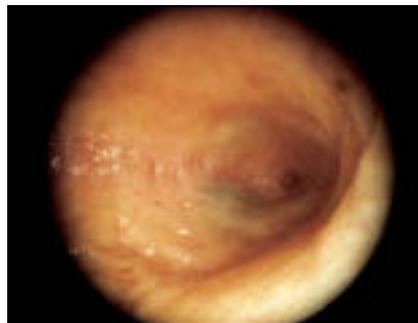
5.24 Uterine septum and cornual right polyp.



5.25 Endometritis.



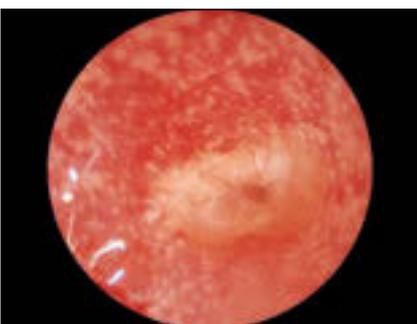
5.26 Adenomyosis with high level of vascularization.



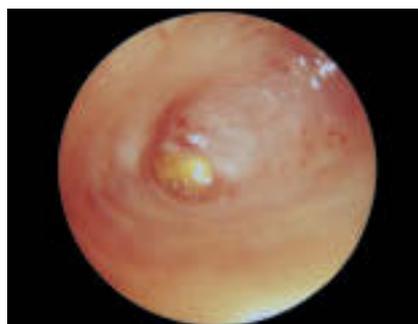
5.27 Cornual adenomyosis.



5.28 Normal appearance of the tubal ostium.



5.29 Contraction of the tubal ostium during passage of CO₂.



5.30 Small polyp located at the tubal orifice.



5.31 Uterotubal junction, endometrium and tubal epithelium are demonstrated by vital staining with methylene blue.

6

Basic Principles of Surgical Hysteroscopy

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6.0 Basic Principles of Surgical Hysteroscopy

Hysteroscopy is an endoscopic technique used not only for diagnostics but also for surgery. Today, surgical hysteroscopy is considered, at least in part, a continuation of diagnostic hysteroscopy, a fact that is attributed to the introduction of office hysteroscopy. The changes in instruments and techniques has allowed outpatient treatment of many pathologies during the diagnostic phase itself.

Theoretically, all the procedures should be carried out in an outpatient setting with the office technique and should then be converted to operative procedures if the pathology and patient tolerance require and allow it. In our experience, this can apply to 75% of surgical pathologies, reserving the most complex cases, requiring anesthesia, for the operating room. Current orientation therefore distinguishes between outpatient procedures with the office technique, and OR procedures, mostly with the resectoscope, depending on the level of complexity.

6.1 Levels of Technical Complexity

Given the same disease, a variety of factors contribute to the level of technical complexity inherent in its surgical treatment. Among the most important factors in this context are the availability of appropriate instrumentation and technology, patient compliance in particular, and the surgeon's technical skills and experience. Additional important issues for obtaining a good result are proper patient selection and the surgical setting in which the case will be treated.

Level 1 or Basic Level	Level 2 or Intermediate Level	Level 3 or Advanced Level	Level 4 or Expert Level
<ol style="list-style-type: none"> 1. Cervical canal stenosis or cervical fibroid 2. Endometrial biopsy 3. Minor synechiae (less than 25% of the uterine cavity) 4. Single polyp, less than 1 cm in size 	<ol style="list-style-type: none"> 1. Stenosis of external cervical os 2. Obstructed cervical canal 3. Moderate synechiae (less than 50% of the uterine cavity) 4. Polyp, less than 15 mm in diameter, or multiple polyps 5. Foreign body, non-fixed 6. Tubal obstruction 7. Myoma, G0 less than 1 cm 	<ol style="list-style-type: none"> 1. Moderate synechiae (occupying 50–75% of the uterine cavity) 2. Fibroid polyp, larger than 15 mm 3. Fixed foreign body or multiple foreign bodies 4. Metroplasty for unicornuate uterine malformation 5. Embryoscopy with biopsy sampling 6. Myoma G1, 1–2 cm 7. GIFT or ZIFT 	<ol style="list-style-type: none"> 1. Severe synechiae (occupying more than 75% of the uterine cavity) 2. Metroplasty for treatment of high-grade uterine malformation 3. Tubal cannulation 4. Endometrial ablation 5. Myomas G0–G1, larger than 2 cm

In view of the variable factors described above, it is necessary to establish reference levels to classify the technical complexity inherent in the application of specific hysteroscopic procedures.

Each level reflects the complexity of the procedure. The surgical treatment of conditions classified as Level 1 and 2 is performed using the outpatient hysteroscopic technique in an office setting. Given special circumstances, such as poor patient compliance or hysteroscopic training sessions, Level 1 and 2 procedures should be performed in the operating room under general anesthesia. Level 3 conditions may also be treated in an outpatient office procedure, if the following criteria are met:

- Adequately trained and experienced hysteroscopist
- Availability of dedicated instruments
- Patient compliance

Otherwise they must be performed in the OR. Level 4, even when carried out with office hysteroscopy, must without doubt be performed in the OR by a hysteroscopist who is not only a technical expert but is also able to recognize and adequately manage possible complications.

Operative hysteroscopic surgery is a true surgical technique and must therefore be carried out with a hospital or day-hospital care regime, depending on the requirements and type of surgery. It is, in any case, rare that a hysteroscopic operation requires a hospital stay of more than 24 hours. The technical details and fields of application of operative hysteroscopy will be explored in this chapter in relation to current technological advances which have allowed surgery to be performed endoscopically on an ever-increasing number of patients, for whom it is thus possible to avoid a laparotomy and even a hysterectomy.

6.2 Contraindications

A recent case history of Pelvic Inflammatory Disease (PID) must be considered as absolute contraindication for any hysteroscopic procedure due to the risk of a new acute phase of the inflammation occurring. As regards acute cervico-vaginal infection, it is recommended to postpone the procedure until after recovery in order to avoid it spreading to the endometrium and surroundings lymphatically, hematically or via the ascending canaliculi.

Table 1 lists the most important relative and absolute contraindications for hysteroscopic surgery.

Light or moderate metrorrhagia in and of itself does not impede intracavitary hysteroscopic procedures, whereas severe cases must be treated to render intrauterine surgical maneuvers possible and also to reduce the risk of circulating the distension medium. Pregnancy in and of itself must be considered a relative contraindication to hysteroscopy, although in some early pregnancies a retained IUD can be more easily removed under hysteroscopic control.

6.3 Instrumentation

A 2.9 mm rigid hysteroscope is used for office surgical procedures. A 5 mm external sheath with two channels is used, one for the distension medium to flow in and the other to introduce accessory instruments (**Fig. 6.1**). These comprise probes, catheters, miniaturized rigid or semi-rigid scissors and various biopsy forceps (**Figs. 6.2, 6.3**). For level 3–4 procedures, on the other hand, a resectoscope (**Figs. 6.4–6.5**) is generally used with a 400-Watt bipolar electro-surgical unit (**Fig. 6.6**). The complete set of instruments for operative resectoscopy is made up of the resectoscope, the video camera system, the cold light source, the HAMOU® ENDOMAT and an HF unipolar-bipolar electro-surgical unit with automatic power supply control and alarm function.

Relative and Absolute Contraindications of Surgical Hysteroscopy

- Pelvic inflammatory disease (PID)
- Acute cervicovaginitis
- Severe metrorrhagia
- Pregnancy

Table 1



6.6 High-frequency electro-surgical unit AUTOCON® II 400 SCB for unipolar and bipolar electro-surgery, maximum output power of 400 W.



6.1 Office hysteroscope, diameter 5 mm, with channel for insertion of instruments.



6.2 The office hysteroscopy set comprises instruments used through the channel of the operating sheath: grasping forceps, scissors, palpation probe and unipolar or bipolar electrodes.



6.3 Semirigid instruments: scissors, grasping forceps, biopsy forceps, myoma fixation instrument and palpation probe.



6.4 Resectoscope, diameter 26 Fr., including working element for unipolar and bipolar electro-surgical instruments.



6.5 Resectoscope, diameter 22 Fr. – due to its smaller diameter, this is the currently most widely used model.

6.4 Preoperative Preparation

As a rule, it is always prudent to perform surgical hysteroscopy in a fully equipped operating room, to better cope with any possible complications and, in more complex cases, to be readily prepared for a concurrent laparoscopy.

Office Hysteroscopy

Based on our standard protocol, office hysteroscopy does not involve any premedication. Currently, with smaller oval-section instruments, it is possible to adapt to the cervical canal, and with suitable technique make hysteroscopy an outpatient procedure which is well tolerated without the need for anesthesia, speculum or forceps.

The use of analgesics or anxiolytic before office procedures should be reserved for those patients who expressly request it due to a low pain threshold or anxiety. We do not feel this should be routine practice.

Operative Hysteroscopy in the OR

Hysteroscopic procedures which, due to their complexity are to be performed in the OR, are carried out under general anesthesia. We do not suggest premedication in this case either. Some authors recommend the use of vaginal misoprostol with or without oral estrogen prior to commencing hysteroscopy to facilitate passage of the cervical canal and avoid complications during dilatation. Our experience is negative as regards the use of this drug, in that:

- It causes pre-operative pain
- It can cause genital bleeding
- It produces uncontrolled and excessive dilatation of the cervical canal, impeding adequate dilation of the cavity
- The endometrial mucus appears ecchymotic and crumbly, and bleeds easily.

These considerations regarding misoprostol are also applicable to outpatient vaginohysteroscopy, where stenosis, phimosis or cervical synechiae are generally easily resolved with rotational maneuvers of the operative sheath, dilation with forceps or radial cuts with scissors.

6.5 Anesthesia

Hysteroscopic procedures with the resectoscope can be performed both under local anesthetic via epidural or paracervical block, and, especially for more complicated cases, under general anesthesia with orotracheal intubation. Epidural anesthesia is preferable in that, with the patient remaining conscious, symptoms relating to intravasation, the worst complication in this type of surgery, can be recognized early.

6.6 Distension Media

Solutions containing glucose, glycine, dextran (Hyskon), mannitol, and a mannitol-sorbitol mixture (Purisol) are non-electrolytic fluids that are non-conductive and therefore suitable for use with unipolar current. On the other hand, electrolytic solutions, such as physiological saline and lactated Ringer's solution, are conductive and therefore only suited for use with the bipolar technique.

6.7 Complications

The greatest risks in operative hysteroscopy are tied to the use of liquid distension medium, which is used to facilitate visual exploration of the uterine cavity. Considering the danger of intravasation syndrome, the surgeon and anesthetist must know precisely that syndrome in order to take adequate therapeutic measures upon the first signs of it appearing.

6.8 Medical Follow-up Treatment after Hysteroscopy

1. "Office" outpatient technique

Dorsal decubitus position: at the end of this gynecological procedure, even if it is neither invasive nor traumatic, the patient must be kept lying down for 3-5 minutes. This permits hemodynamic and parasympathetic stabilization which can be affected due to anxiety. If the procedure is prolonged, this time must be increased.

Analgesics/Anti-inflammatories: these are not routinely used, although if the procedure lasts a long time or causes pain, oral paracetamol (acetaminophen), ibuprofen or ketoprofen can be administered according to the intensity of symptoms.

2. Hysteroscopy in the OR

Antibiotics: may be used when a procedure is prolonged or requires greater manipulation.

Intra-Uterine Device (IUD): various authors use it in post-op to avoid the formation of uterine synechiae after grade-III or -IV synechiolysis or major myomectomies. They are generally removed after 5-6 weeks.

Intra-uterine Foley catheters are occasionally used after myomectomies, endometrial ablations, septoplasty, and occasionally for other surgery where post-operative bleeding is suspected. The balloon, placing pressure on the bleeding area, gives the internal hemostatic mechanisms the chance to activate without alarming the patient. It is placed immediately after the surgery is finished. Once in position, the balloon is filled with 3-5 cc depending on the dimensions of the uterine cavity. The Foley is removed 15 minutes after being placed, sufficient time for hemostasis to be obtained.

Estrogens are used when it is considered necessary to accelerate the re-epithelization and subsequent endometrial desquamation to take as little time as possible, specifically in the case of major synechiae. We recommend two months of conjugated equine estrogens, 0.625 mg every 8 hours continuously. It is surprising upon second look at these patients to see the complete re-epithelization of the endometrial cavity.

GnRH analogues: independently of pre-operative use, they are used after endometrial ablation. This is to produce a marked hypoestrogenism which completes the surgical procedure and avoids re-epithelization of the endometrium which starts from any small zones where the resection was not completed, so as to have greater and safer fibrotic scarring. After a myomectomy it is useful when the procedure was not completed and they are thus used to favor the remaining intramural portion protruding into the cavity and facilitate the second operation.

6.9 Indications

Indications for operative hysteroscopy have increased enormously in recent years. This is essentially due to the notable technological improvement of all instruments which has allowed an ever-increasing number of procedures to be performed (Figs. 6.7-6.11). The principal indications will be covered specifically in the next chapters.

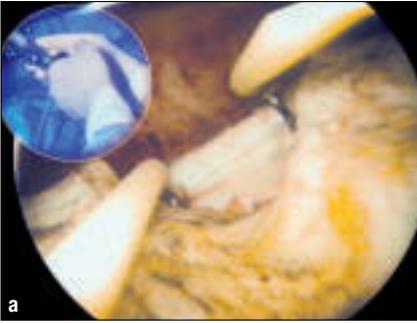


6.7 In the early 1980s, surgery was performed with a 7.5-mm hysteroscope and a unipolar electrode using CO₂ as distension medium: only small polyps or pedunculated myomas could be removed with this equipment.



6.8 The removal of a septate uterus with adhesions may also be accomplished using scissors; however, due to inherent

technical limitations, this should be reserved to simple cases.



6.9 The use of the resectoscope and continuous flow sheath for distension of the uterine cavity has greatly improved the therapeutic options available to the surgeon in the removal of submucous and intramural myomas.

6.10 In the presence of septate uterus and adhesions, the resectoscope has considerably enhanced the therapeutic armamentarium that can be used effectively in hysteroscopic surgery.

6.11 In endometrial ablation, the use of various instruments for resection and coagulation (loops and roller ball) provides the surgeon with a treatment method that is also advantageous in terms of patient convenience and comfort.

7

Hysteroscopic Endometrial Ablation

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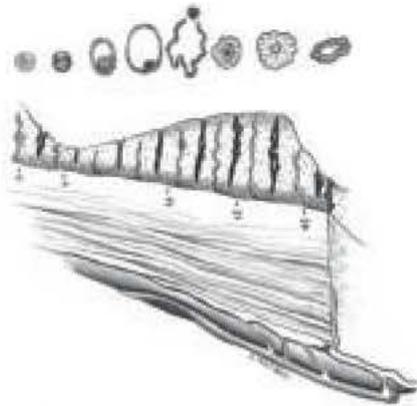
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7.1 Atrophic endometrium with hemorrhagic petechiae after two months of treatment with analogs.



7.2 Extreme atrophy revealing fasciculated structure of the myometrium.



7.1 Variation of the endometrial thickness during the menstrual cycle.

7.0 Hysteroscopic Endometrial Ablation

Endometrial ablation was introduced in the early 1980s as an operating technique for complete excision of the endometrium in patients with abnormal uterine bleeding with the aim of reducing or completely eliminating the bleeding. Dysfunctional bleeding is always a major gynecological problem, particularly in women over 40, and is not easy to resolve from the medical point of view. In fact, hormonal medication often has a transitory effect and cannot be administered for long periods.

7.1 Indications

As we know, the main indication for endometrial ablation is abnormal uterine bleeding, provided the disease is refractory to medical therapy, and there are no signs of precancerous or malignant endometrial lesions. Recently, endometrial ablation has also been proposed for the treatment of recurrent endometrial hyperplasia without any cytologic atypia, and also for certain cases of focal endometrial adenocarcinoma. From a theoretical point of view, because of its low oncological potential and a high recurrence rate after drug treatment, it appears logical to include this form in the range of indications for endometrial ablation.

The procedure is currently indicated if a high risk of hysterectomy is anticipated, and in those patients who, for various reasons, are reluctant to undergo or resistant to traditional surgery. Endometrial ablation, which can be performed under local anesthesia, is also indicated when general anesthesia and coagulopathy are inadvisable.

7.2 Preoperative Preparation

Among the exclusion criteria for endometrial ablation are conditions of the endometrium or the uterine cavity suggesting the presence of neoplastic or pre-neoplastic lesions. Therefore, diagnostic hysteroscopy and an endometrial biopsy should be performed prior to putting the patient in for surgery.

Preoperative drug treatment of patients who are candidates for endometrial ablation is one of the cornerstones for the successful outcome of surgery. It is indeed well known that the thickness of the endometrium is noticeably variable during the different phases of the cycle and in pathological situations (dysfunctional-hyperplastic endometrium) (**Drawing 7.1**).

It is therefore necessary to obtain a homogeneous and possibly thin endometrium in order to be able to proceed to complete destruction of the mucosa itself (**Figs. 7.1, 7.2**). Both therapy with danazol and the administration of GnRH analogs for approx 2-3 months before the operation are sufficient to obtain correct endometrial preparation. *Tiufekchieva E. et al.* demonstrated how the use of GnRH analogs is directly correlated to reduced surgery time, an increased amenorrhoea rate and greater patient compliance. On the contrary, *Preutthipan S. et al.* recently published a retrospective study on patients with adenomyosis with dysmenorrhoea or menorrhagia, treated with endometrial ablation. Although some patients had been treated with GnRH analogs in preparation for the procedure and other had not, it was not possible to identify any significant difference in symptomatology between the two groups. The only statistically significant piece of data was the reduced surgery time and quantity of distension medium used in the patients treated with analogs.

Some authors recommend curettage or aspiration of the endometrium before surgery if it was not possible to submit the patient to an appropriate pharmacological therapy. According to other authors, an endometrial suppression treatment course is useful even in the postoperative phase.

7.3 Endometrial Ablation Technique

Right from the start, various methods have been used with differing success in order to totally destroy the endometrium (Figs. 7.3, 7.4). Regardless of which technique is employed, the following basic criteria must be met:

- Essentially the entire endometrium must be ablated; small foci of endometrial remnants may otherwise give rise to extensive endometrial re-epithelialization.
- The entire endometrial thickness must be ablated; it can vary greatly depending on the stage of the menstrual cycle (proliferative, secretory) and any concurrent pathology (atrophy, hyperplasia). To prevent immediate complications and induce scarring, ablation should not be carried too deep into the myometrium.
- Normally, the isthmic epithelium is spared in order to prevent formation of Asherman's syndrome (Fig. 7.5).
- Ideally, patients are followed up by keeping open the option of inspecting the uterine cavity via hysteroscopy.
- Hysteroscopy-guided techniques are currently considered superior to blind methods, because they are more effective, allow for detection of any type of intrauterine lesion, and permit histological evaluation of the sampled specimen.

Chemical and Radioactive Substances

These substances were used in the late 1960s through blind transcervical injection to create full adhesion of the walls of the cavity itself. For the most part, corrosive agents such as quinacrine, formaldehyde, oxalic acid or adhesives such as methylcyanoacrylate or silicone have been tested. This type of procedure has been abandoned because of the potential damage these substances could cause when passing the peritoneum and because of the poor results, often requiring multiple applications. While intracavitary radium applications did prove effective, the technique was subsequently abandoned because of the risks associated with the use of radioactive substances.

Cryosurgery was first proposed in 1987 by *Droegemüller* but its use never became widespread because of numerous technical difficulties.

High Frequency Radio Waves, such as **Bipolar Radiofrequency** (NovaSure®) or **Microwave** (Microwave Endometrial Ablation, MEA) have recently been proposed for endometrial ablation. However, these techniques are still considered experimental, and the drawback of the method is that the destroyed endometrial cells are lost for histological assessment.



7.3 Histological image of functional endometrial epithelium covering the virtual uterine cavity.



7.4 Histological image of the endometrium after treatment with GnRH analogue.



7.5 Using resection or coagulation, the epithelium in the isthmus region is spared to permit recolonization of the uterine cavity.



7.6 During resection, slices of endometrium are removed under hysteroscopic vision.

Resectoscopic Technique

The resectoscope offers two basic surgical modalities: resection and coagulation. Once the working element has been connected to the electrosurgical unit, which can be operated in uni- or bipolar mode, the endometrium can be resected in successive passes under direct hysteroscopic vision. Each pass of the U-shaped loop electrode removes a layer of tissue of approximately 3–5 mm (**Figs. 7.6– 7.11**).

This is the technique most commonly used in Europe. Its main advantage is that the resected tissue can be immediately sent for histopathologic examination.

A variant of the above method is electrocoagulation of the endometrium, which is also performed using the resectoscope under endoscopic vision. Instead of the loop, however, a roller-ball electrode is used. The distal tip of the roller ball electrode is shaped like a ball or a barrel. Systematic coagulation of the entire endometrium is performed with the roller ball electrode, which may be connected to the same electrosurgical unit employed with the loop. Electrocoagulation is considered to be more straightforward than loop resection because the endometrium is “coagulated away”, involving less risk of inadvertent excessive penetration of the myometrium (**Fig. 7.12**). A drawback of the technique is that it does not provide specimens suitable for postoperative histopathologic evaluation.

Many authors recommend initiating resection with a cutting loop and then coagulating the vascular bed as far as the uterotubal junction (**Figs. 7.13, 7.14**).

Laser Coagulation

Basically, the laser technique shares substantial similarities with electrosurgical coagulation (**Fig. 7.15**).

Coagulation of the endometrium may also be performed with a **Nd:YAG laser** probe introduced through the working channel of the operative hysteroscope. The technique is considerably time-consuming and more expensive compared to the application of electrosurgery.

Thermal ablation techniques using a **Hot Liquid Balloon** (ThermaCare®) or **Circulating Hot Water** (HydroThermAblato®) are techniques that essentially cause destruction of the endometrium in response to exposure to thermal energy which is transferred to the uterine cavity by a special device, e.g. a balloon, filled with a liquid medium circulating in it at about 90°C (ThermaCare®). An alternative to this variant is hot saline ablation, in which a saline solution is heated up to 90°C and delivered into the uterine cavity where it is allowed to take effect for 10 minutes. A drawback of thermal ablation techniques is the fact that specimens of the destroyed endometrium are unsuitable for histological evaluation and the special devices used in this technique do not allow for visual inspection during and after treatment. Several studies on thermal ablation techniques report a reduction in uterine bleeding varying from 22% to 81% and the rate of amenorrhea ranging between 23% and 58%. A second ablation is required in 5 to 11% of patients, and between 2 and 13% are treated by hysterectomy in the course of a second-look procedure.

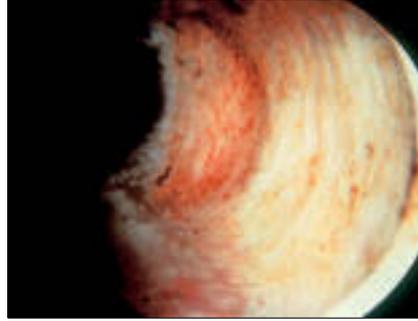
7.4 Results of Endometrial Ablation

Given the various techniques employed, it is difficult to compare the results of endometrial ablation based on retrospective case series found in medical journals. Moreover, there are many variables between the different authors, i.e. inconsistent experience, concomitant myoma, pharmacological pretreatment or lack thereof, and the extent and type of resection-ablation. All these factors make the reviews non-homogeneous. Nevertheless, the results show a success rate – in terms of symptom remission – ranging from 90 to 95%. In most cases, negative results increase by an additional 5% within one year after surgery, and remain stable thereafter.

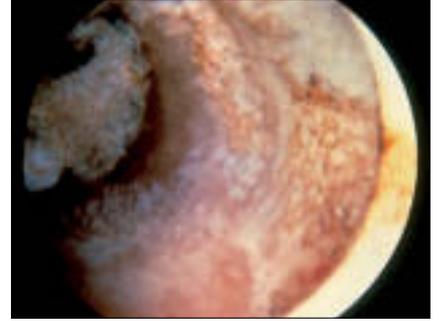
Following endometrial ablation, the uterine cavity is still amenable to examination in 80% of cases, although this percentage may be even higher depending on the method and type of technique employed (**Figs. 7.16, 7.17**). This is particularly useful in the follow-up treatment of patients.



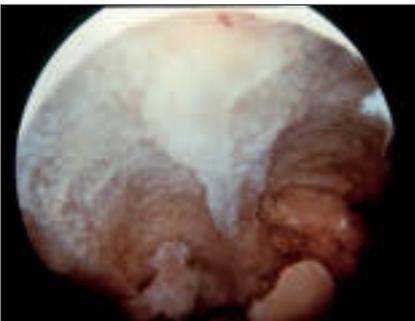
7.7 Resected endometrium should be collected for histologic evaluation.



7.8 The extent of resection is determined by the presence of endometrial glands. In the image, resection has been carried down to the fasciculated layer of the myometrium.



7.9 Glands are still present in the resection area.



7.10 Irregularities of the uterine wall after resection should be eliminated.



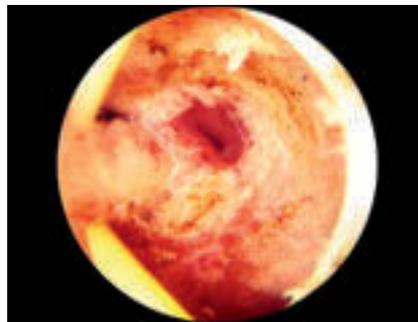
7.11 Irregularities are resected to create a homogeneous area.



7.12 Electrocoagulation with the rollerball poses an alternative, more straightforward modality, when compared with endometrial resection.



7.13 Rollerball electrocoagulation may also be used before or after endometrial resection to coagulate areas which are inaccessible to the loop, such as the fundus or the cornual areas.



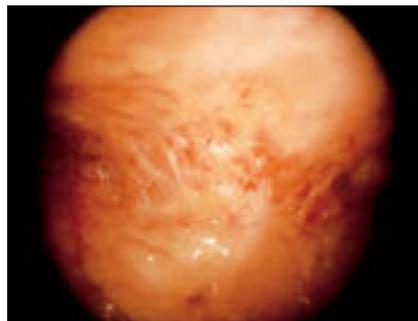
7.14 Coagulation of the cornual area must not affect the tubal orifice since electrical burns in this area may cause complications.



7.15 Nd:YAG laser coagulation using a special probe introduced into the channel of the operative hysteroscope.



7.16 Three months after superficial endometrial ablation, the uterine cavity is recolonized by endometrium originating from the cervical canal.



7.17 Signs of previous endometrial ablation can be identified by careful inspection.



7.18 Diagnosis of adenomyosis during diagnostic hysteroscopy is feasible only in selected cases.



7.19 In some instances, during polyp or myoma resection, adenomyotic foci can be identified.



7.20 Typical adenomyotic foci are located deep in the myometrium and can be detected during resection because of the presence of blood.

Patients undergoing endometrial ablation could theoretically develop adenocarcinoma in the area of persistent endometrium and remain asymptomatic for a long time. As such, in patients with elevated risk of endometrial hyperplasia (obese, diabetic, hypertensive, smoker, chronic ovulatory failure, family history) it is recommended to start therapy with progesterone or the insertion of a medicated IUD after endometrial ablation. For the same reason, combined hormone replacement therapy (estrogen + progesterone) is recommended in patients not at risk of endometrial carcinoma after endometrial ablation.

The most frequent causes of failure of endometrial ablation are:

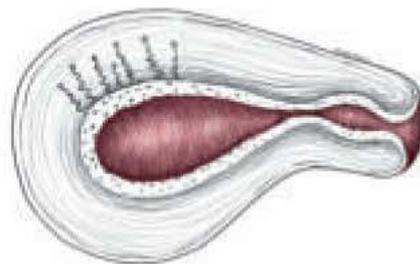
- The presence of adenomyosis. In our experience with hysterectomies performed after failure of endometrial ablation, profound adenomyosis (**Drawing 7.2**) was found in 89% of recurrences occurring after endometrial ablation (**Figs. 7.18–7.20**). Superficial or deep, diffuse or focal adenomyosis is essentially not a contraindication, but should rather be considered a major cause of failure.
- Uterine dimensions: if hysteroscopy demonstrates the size of the uterus to be larger than 12 cm, failure rate increases.
- Adequate premedication with GnRH analogues or with danazol significantly improves results (**Drawing 7.3**).
- Curettage, immediately prior to endometrial ablation, appears to have an adverse effect on the outcome of the procedure.

The experience of the surgeon seems to be an extremely important parameter that should be considered in evaluating the results of endometrial ablation.

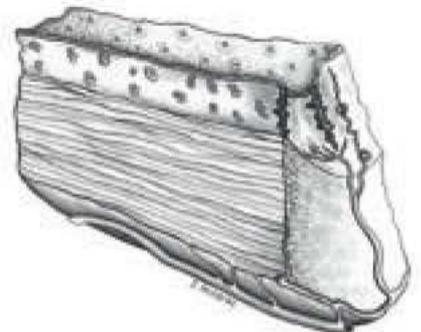
A recent meta-analysis investigating 21 randomized clinical trials reported the following results:

- The rate of amenorrhea at 1 year postsurgery was found to be 38%, increasing to 48% measured from 2-5 years after surgery.
- The rate of patient compliance was 88% and declined to 87% at 2-5 years postsurgery.
- The rate of second-look surgery after endometrial ablation was 25%, of whom 19% were treated with hysterectomy.

Finally, no differences between the various resectoscopic techniques could be demonstrated, even in those cases applying hybrid techniques of resection and coagulation.



7.2 Adenomyosis is characterized by the presence of endometrial glands located deep in the myometrium.



7.3 Following pharmacological pretreatment, the endometrium is evenly thin, which facilitates resection. The drawing also illustrates the relationship between the endometrium, myometrium, and their vessels.

8

Hysteroscopic Surgery of Uterine Malformations

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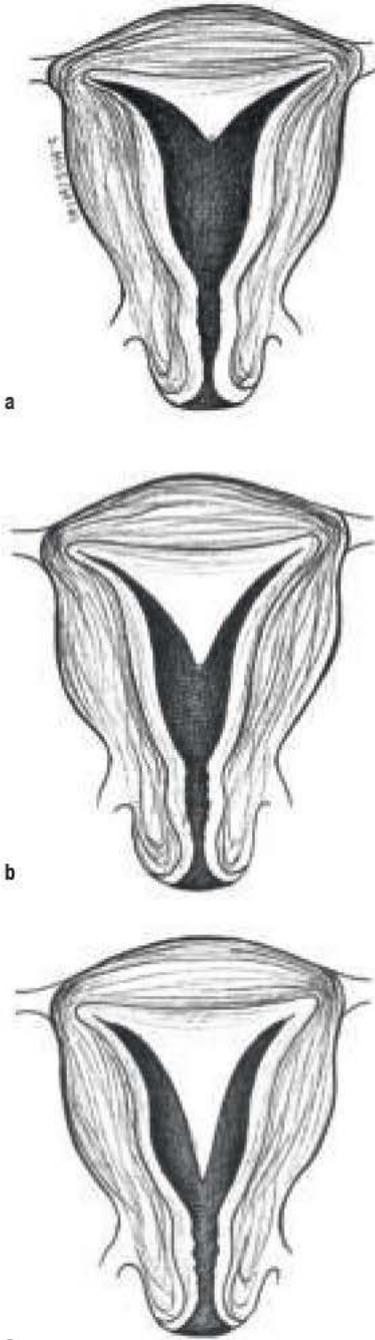
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8.0 Hysteroscopic Surgery of Uterine Malformations

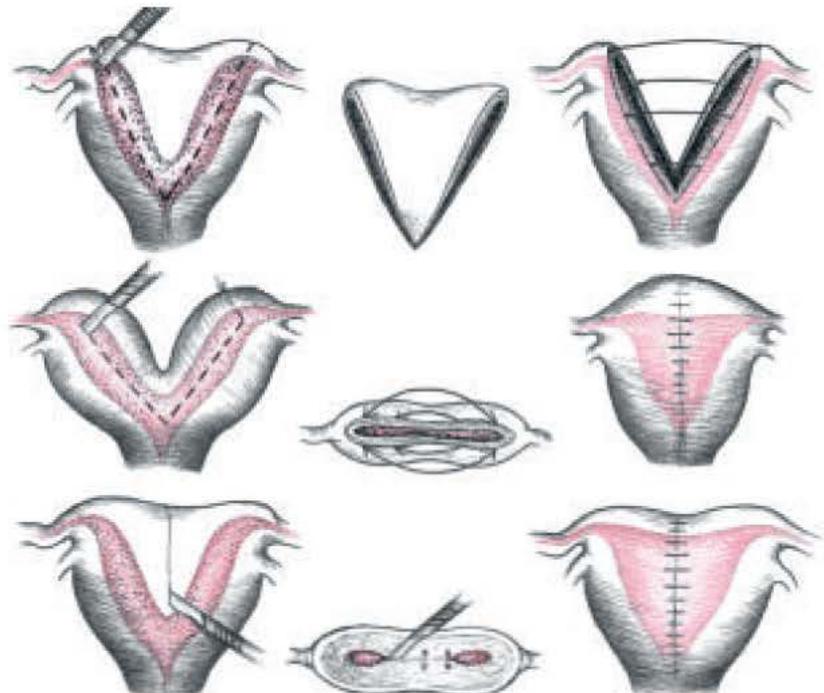
The classification of Müllerian malformations proposed by Buttram and Gibbons specifies six groups, of which groups IV and V include didelphys, bicornuate, and septate uterus and are particularly significant for fertility (**Drawing 8.1**). Uterine defects are risk factors affecting female fertility mainly by predisposing patients to complications during pregnancy. In general, women with Müllerian duct anomalies have no more difficulty in conceiving than normal women, whereas their gestational capacity may be compromised. Among the more common complications are miscarriage and premature delivery in 25% and 16% of patients, respectively. The presence of bicornuate or didelphys uteri is associated with an increase in preterm birth, but since quite a considerable number of women carry pregnancies to term without undergoing any intervention, therapy is not recommended to correct these malformations. *Galan et al.* suggest prophylactic cervical cerclage before implementing major surgery (**Drawing 8.2**). Septate uterus has been found to be associated with a high fetal loss rate, predominantly in the first half of pregnancy. *Buttram and Gibbons* reported on a pregnancy loss rate of 88% in patients with complete septate uterus, and of 70% in patients with incomplete septate uterus. *White* proposed that an increase in intrauterine pressure and a certain degree of cervical incompetence may account for premature births in patients with septate uterus. Many authors have proposed that miscarriages may be due to vascularization problems at the implantation site, especially if located in the septum itself. However, *De Cherney et al.* observed that spontaneously aborted fetuses often look perfectly normal and well nourished. *White* also suggested that the septate uterus may cause luteal-phase defects due to local vascular insufficiency and unrelated to hormonal defects. Conclusively, the septate uterus is the most common uterine malformation (40-60% of cases) presenting as total or partial variants, and results from failed resorption of the medial segments of the Müllerian ducts.

The arcuate uterus is considered a milder variant, typically characterized by a median depression of the uterine contour and a small fundal cleft.

It may therefore be concluded that “septate uteri are more prone to serious reproductive difficulty” and therefore almost always require surgical repair.



8.1 Arcuate uterus (a), incomplete septate uterus (b), complete septate uterus (c).



8.2 Various types of traditional laparotomic metroplasties have been proposed to treat septate uterus.

8.1 Indications and Preparation of the Patient

The “double” uterus is often discovered because of pregnancy complications such as recurrent miscarriage and premature birth, and in some cases of infertility. However, this malformation is almost always detected during diagnostic examination of the uterine cavity. HSG or hysteroscopy usually present an image of two hemi-cavities with a clear central division, i.e. the hystero-graph shows a typical Y-shape (**Figs. 8.1–8.3**). Though a distinction between septate and bicornuate uterus cannot be made with either of these imaging techniques, the information afforded is extremely useful for subsequent surgical management. A simple bimanual pelvic examination does not permit the conclusion of a definite differential diagnosis, unless it is performed under general anesthesia and very favorable anatomic conditions. Several authors proposed the use of ultrasound, both for diagnostic distinction between bicornuate and septate uterus, and also, as we shall see, for monitoring the endoscopic surgery (**Figs. 8.4–8.7**). Magnetic Resonance Imaging (MRI) is also advocated for diagnosing Müllerian duct anomalies. MRI permits the correct classification of malformations and identification of concurrent gynecologic disease.

Thus, laparoscopy continues to be the method of choice in that it affords a definite differential diagnosis and distinguishes between bicornuate and septate uterus (**Fig. 8.7**).



8.1 HSG image of a septate uterus: it is not possible to differentiate between the septate and bicornuate uterus.



8.2 Also diagnostic hysteroscopy does not permit differentiation between septate and bicornuate uterus.



8.3 Hysteroscopic image of suspected uterine septum to be confirmed with ultrasound scan.



8.4 Transversal ultrasound picture showing two distinct endometrial lines and a normal fundus.



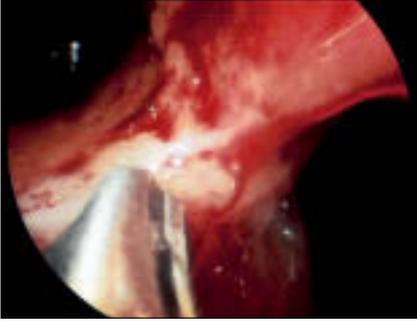
8.5 Doppler images may support ultrasound diagnosis.



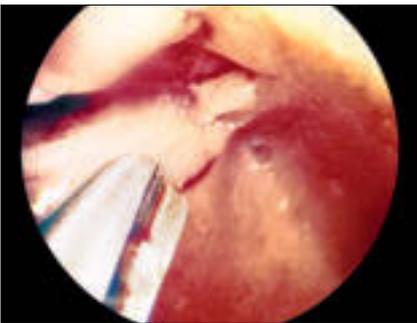
8.6 Pregnancy often implants in the septum: the poor vascularization of the septum is probably the cause of early miscarriage.



8.7 Laparoscopy is the method of choice to distinguish between bicornuate and septate uterus.



8.8 Scissors and CO₂ as the distension medium were used in the early days of uterine septum treatment.



8.9 There is a clear view only if there is no bleeding: in this case the tubal ostium is clearly visible.



8.10 Continuous flow irrigation is also recommended when scissors are used.

The technique should be performed in traditional fashion under general anesthesia; the image of two clearly separated uterine horns is definite evidence of bicornuate uterus, while the septate uterus is usually seen with normal external morphology, often with a slight increase in transverse diameter. In some cases, it may be possible to see a whitish triangle of tissue in the median area which is the septum itself. Laparoscopy is also extremely efficient both for completion of the diagnostic work-up of infertile patients and for monitoring the hysteroscopic examination. In conclusion, in cases in which the hystero-graphic and/or hysteroscopic inspection produce evidence suggestive of a “double uterus”, ultrasound should be used to provide a clearer definition of the pathology. In almost 90% of cases, the septate uterus can be distinguished from the bicornuate uterus based on the results of ultrasound investigation. In these cases, ultrasound should also be used for monitoring the surgery. Definite diagnosis in suspected cases should be achieved by means of laparoscopy, which may be performed directly before endoscopic surgery in order to confirm the earlier diagnosis and monitor the surgical intervention. Laparoscopy should be considered indicated in all patients with uterine malformations who are also infertile, since endometriosis, pelvic adhesions or other unexpected pelvic pathologies might be detected and, if necessary, treated.

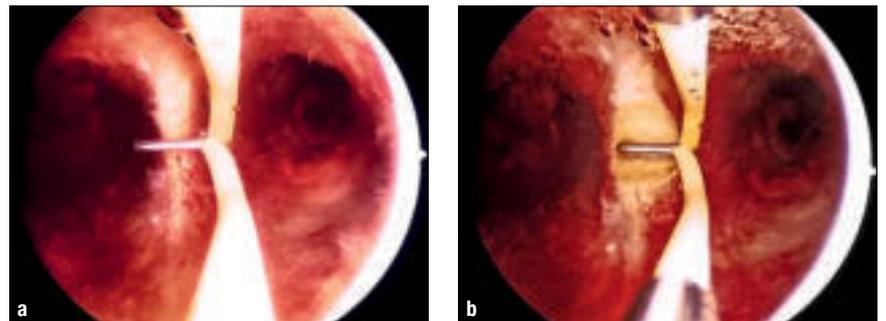
8.2 Surgical Technique

The endoscopic technique for the management of uterine septa was first proposed by *Edstrom* (1974), but the method has become widely used only in the last few years. Several different procedures have been adopted and yield more or less the same results. The basic concept involves hysteroscopic transcervical observation of the uterine septum followed by resection.

The sub-septate and septate uterus can be treated with office hysteroscopy techniques, in other words in an outpatient setting, without resorting to anesthesia and dilatation of the cervical canal. This type of surgery is considered level III or advanced and therefore requires the operator to have perfect knowledge of the technique.

Although numerous variants of this technique are known, an office hysteroscope is always used, through which the surgical instruments are inserted. In the past, it was suggested to introduce the scissors separately into the uterine cavity, passing them through the cervical canal in parallel to the hysteroscope. This was not successful, however. The miniaturized semi-rigid scissors, or the uni- or bipolar electrode seem to be the most suitable of the many instruments available for dissection of the septum (**Figs. 8.8–8.10**).

In more complicated cases, or where there is low patient compliance, true operative hysteroscopy is chosen using the resectoscope with needle electrodes of various size (**Figs. 8.11a, b**). The septate uterus really constitutes one of those pathologies which bridges office and operative surgical hysteroscopy, requiring careful attention in the choice of the most appropriate technique.



8.11 Resectoscope with cutting currents allows resection of uterine septum.

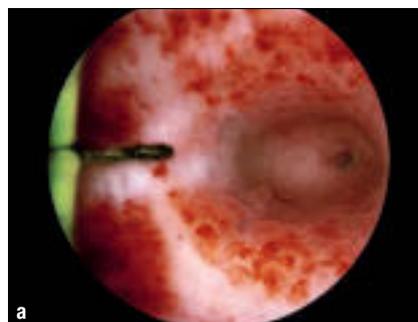
Regardless of the method used for resection, removal or destruction of the septum, the final goal is to produce a satisfactory uterine cavity. The most delicate part of the procedure is probably the decision of when to stop the resection in order to prevent damage to the myometrium and immediate complications, such as perforation, or more delayed difficulties, e.g. post-operative formation of synechiae. Nearly all authors agree in letting the tubal ostia be their guide in this decision-making step, i.e. they stop resecting when the ostia are clearly visible under panoramic view (Fig. 8.12a–c).

To this end, it is certainly convenient to carry out a precise pre-operative measurement of the septum using ultrasound. As the septum is easily distinguishable from the myometrium, it is possible to decide with great precision when to interrupt the resection by making use of successive intraoperative ultrasound monitoring (Fig. 8.13). In the presence of a very large septum, the view can be obstructed by tissue fragments which have already been excised, and possibly also by the presence of uterine bleeding. In the experience of many authors, this last eventuality can be avoided with a pre-operative therapy based on danazole or GnRH antagonists.

Complete septa also interesting the cervical canal are worthy of a particular mention (Fig. 8.14). Malformations of this nature are morphologically unhomogeneous, manifest as single or double cervixes and also with or without isthmic connection. In the case of complete utero/cervical septum with single cervix, we prefer to include it in cervical canal dissection. None of our patients treated in this way were found to have an open cervix during pregnancy.

8.3 Postoperative Care and Follow-up

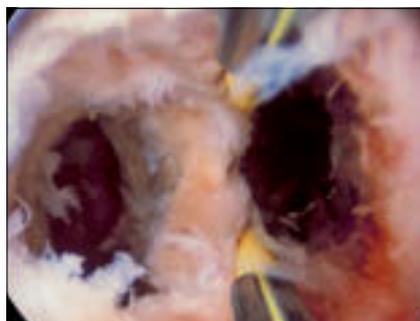
Most authors agree that a follow-up examination should be performed one to two months after the operation, depending on the type of postoperative management used. The inspection can be made either by HSG or hysteroscopy (Figs. 8.15–8.17).



8.12 The tubal ostia must be taken as reference for interruption of the resection and the septum is sectioned by scalpel under visual control.



8.13 Ultrasound monitoring can also be used in hysteroscopic surgery.



8.14 If the septum involves the complete cervical canal, resection is mandatory.



8.15 HSG can be used to check the outcome of the procedure.



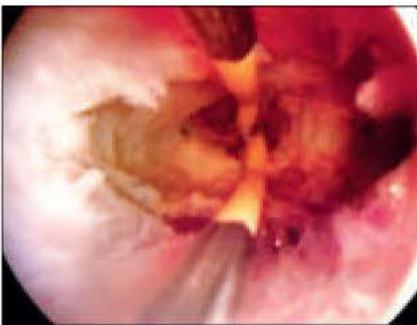
8.16 Hysteroscopy follow-up two months after surgery reveals the scar.



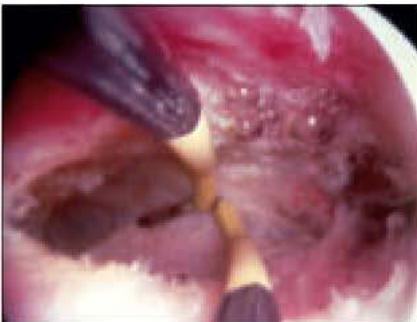
8.17 In traditional laparotomic metroplasty, the suture points are clearly visible on the fundus at the follow-up check.



8.18 DES patient with a T-shaped uterus.



8.19 Resection can be used to enlarge the uterine cavity.



8.20 Incision of the narrow lateral walls with the resectoscope.

The results published to date seem to indicate that it is possible to successfully perform hysteroscopy in almost all cases of septate and arcuate uterus. The full-term pregnancy rate obtained by various authors ranges from 70 to 80%.

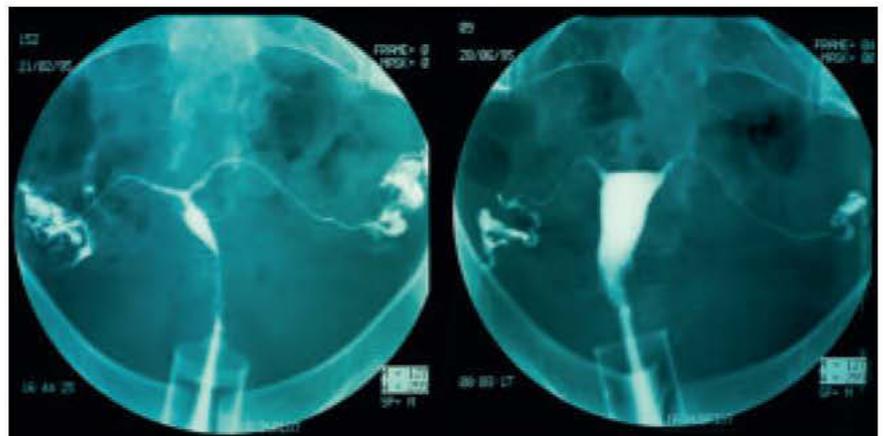
The main advantages of hysteroscopy in the management of septate and arcuate uterus are as follows:

- The operation may be performed as an office procedure without hospitalization of the patient
- No scar tissue remains on the abdominal and uterine walls
- There is a lower rate of intra- and postoperative morbidity compared to traditional surgery
- There is no reduction in the volume of the uterine cavity as is experienced in metroplasty according to *Te Linde and Jones*
- There is no need to wait to get pregnant after surgery
- Finally, normal vaginal delivery is possible, whereas laparotomic metroplasty requires cesarean section

In conclusion, it can be stated that hysteroscopic metroplasty is the treatment of choice for the management of septate and arcuate uterus. Surgery should be performed without delay in patients with a reproductive history of fetal loss during the first or second trimester. The results obtained in these patients are extremely favorable, though there remains a certain obstetric risk in some cases. Though there are clear reports of normal pregnancy in women with Müllerian defects, the very good results and the simplicity of hysteroscopic metroplasty convinced us of the usefulness of resection even in patients with septate uterus and no previous reproductive failure. Furthermore, there is still some discussion about the management of patients who are also affected by primary infertility. It is our opinion that whenever it is possible to identify other infertility factors, these should be treated either at the same time or following septate uterus surgery. In these cases, laparoscopy is indicated to improve the evaluation of the pelvic anatomy. Even in cases of unexplained infertility though, hysteroscopic management of uterine septa should be performed as a matter of principle, so that techniques of intrauterine insemination, GIFT, or IVF, which are often used in these patients, may be performed at a later date.

DES Patients

Patients exposed in utero to diethylstilbestrol have a T-shaped uterus. Infertility is the major symptom in these patients. Nagel and Malo and, more recently Hamou, reported an enlarged uterine cavity and improved pregnancy rate in patients with T-shaped uterus after incision of the narrow lateral walls using the resectoscope (Figs. 8.18–8.20). These results were surprisingly good considering that the dissection involves muscle rather than fibrous tissue as in patients with intrauterine adhesions (Fig. 8.21). High-dose estrogen therapy after surgery is recommended.



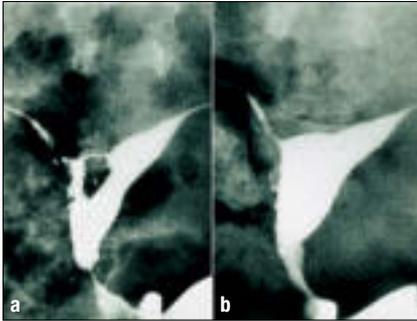
8.21 Pre- and postoperative HSG results provided evidence of an enlarged uterine cavity. Such findings were correlated with an improved pregnancy rate.

9

Treatment of Intrauterine Adhesions

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9.1 HSG image with filling defects related to intrauterine adhesions, before (a) and after (b) surgery.

9.0 Treatment of Intrauterine Adhesions

Asherman's syndrome, first described around 1920, is characterized by a decrease in fertility associated with menstrual disorders due to the presence of intrauterine synechiae of traumatic origin. The causal factor of Asherman's syndrome is the presence of scar tissue between the uterine walls, also known as "adhesions" or "synechiae". *Hamou* observed the presence of amenorrhoea in 30.4% and hypomenorrhoea in 32.6% of the patients with synechiae while *Levine* and *Neuwirth* found 40% amenorrhoea and 10% hypomenorrhoea in patients with the same type of pathology.

The correlation between synechiae and sterility has been thoroughly discussed, and this pathology can undoubtedly lead to sterility. In fact, *Taylor* observed "sterility" in 21.4% of the patients with synechiae and 3.2% ($p = 0.05$) of the controls. There have been numerous classifications – both topographic and morphological, i.e. that of *Sugimoto*, *Hamou* and *Toaff* – related both to symptoms and sterility.

9.1 Diagnosis

We have seen how the clinical history of these patients is characterized by menstrual disorders (hypo-amenorrhoea), sterility and a history of curettage and/or instrumental intrauterine surgery. Usually synechiae are diagnosed by hysterosalpingography (HSG) (**Fig. 9.1**). HSG presents filling defects, with irregular, splotchy images and clear edges and this remains constant in subsequent images. This is observed in all cases except for recent synechiae where laceration may occur during the course of the examination. It must be pointed out, however, that in approximately 40% of the cases, interpretation of the hysteroqram is vague or incorrect. Recently, diagnostic hysteroscopy has been proposed and used in the diagnosis of this pathology. Hysteroscopically, synechiae can be centrally or marginally located. As regards histology and morphology, synechiae can be classified as endometrial, myometrial and connective-fiber synechiae (**Figs. 9.2–9.4**).

In studying 192 patients with synechiae, *Sugimoto* found 59 cases of endometrial, 102 cases of myometrial and 31 cases of connective-fiber synechiae. In a study of 67 patients carried out at the Hôpital Tenon in Paris, the authors found 17 endometrial (**Fig. 9.5a–c**), 13 myometrial (**Fig. 9.6**), and 37 cases of connective-fiber synechiae (**Fig. 9.7**). As regards prognosis, to date it is felt important to identify the so-called severe forms, i.e. cases of connective-fiber synechiae, and in some cases myometrial synechiae, presenting multiple involvement of the uterine cavity and extending for at least 1/3 of its surface.

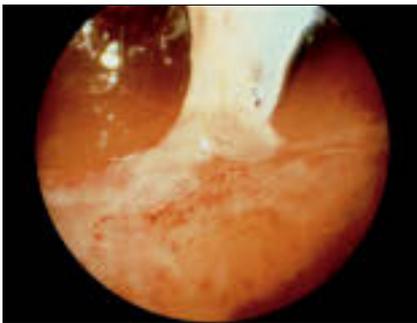
9.2 Treatment

Blind transvaginal surgery is still today the most common type of treatment. Procedures such as hysteroscopy, dilatation and curettage, Hegar's dilators or Metzenbaum scissors or metal curettes were employed to treat synechiae in the past and are still in use.

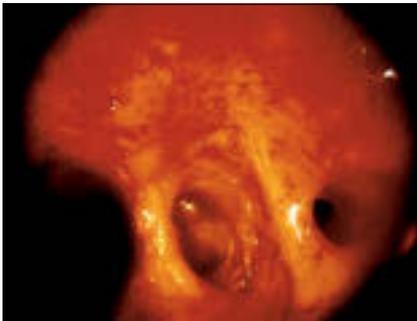
Office hysteroscopy can be used in practically all cases of intrauterine synechiae, except for some particular forms of total synechia in which hysteroscopic surgery should be associated with contemporary laparoscopic control.

Hysteroscopic treatment, in most cases, is carried out with semi-rigid scissors (**Fig. 9.8a–d**) or with mono- or bipolar electrodes. Use of the resectoscope, in particular cases, allows even the most serious cases to be dealt with (**Figs. 9.9–9.11**) and recreation of a cavity covered with the pharmacologically stimulated endometrium.

The results are certainly encouraging: in fact, in a group of 171 patients with synechiae, there was a high percentage of conception (66.6%) and full-term pregnancies (64.3%) after treatment. Other authors also report similar pregnancy rates: 41.2% *Sugimoto*, 51.3% *Hamou* and 55.3% *Lancet*.



9.2 Endometrial synechiae.



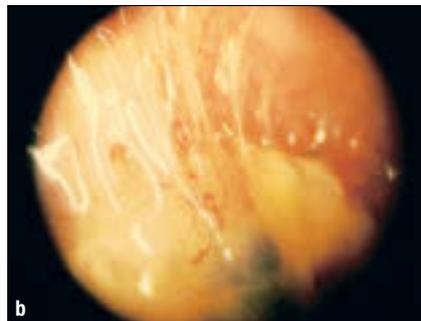
9.3 Myometrial synechiae.



9.4 Connective-fiber synechiae.



9.5 Endometrial synechiae often grow from abortive tissue and create filmy



adhesions which are easy to remove.



9.6 Myometrial synechiae are organized structures which require hysteroscopic removal.



9.7 Connective-fiber synechiae often change the normal morphology and structure of the uterine cavity.



9.8 For gradual removal of the adhesions, hysteroscopic treatment frequently makes use of scissors.



The objective is to restore the uterine cavity's normal architecture and to visually confirm that patency of the tubular ostia has been established.



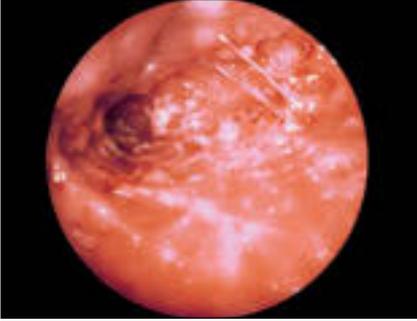
9.9 Even severe cases can be treated with the resectoscope.



9.10 The different types of tissue encountered during the resection can be visually assessed.



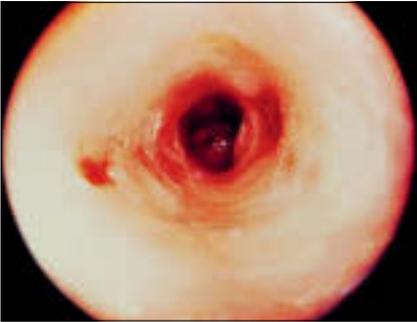
9.11 At the end of the resectoscopy, an ample sized uterine cavity has been created.



9.12 Hysteroscopic examination 3 months after surgery allows removal of small residual synechiae.



9.13 Successful treatment restores the uterine cavity to normal.



9.14 If complete synechiae recur, hysteroscopic vision is very poor and the uterus shows a tubular shape.

9.3 Post-operative Follow-up

Many authors suggest introducing an IUD immediately after dissection (Lippes Loop, CU ML 250) or a Foley catheter, or even a device specially designed to prevent the walls of the uterus from coming into contact: devices such as an inflatable *Neuwirth* balloon or the *Massouras* “duck foot”. Others suggest estrogen-progestin replacement therapy, with or without an intrauterine device, to facilitate regeneration of the endometrium in the scarred area. *Lancet* advises post-surgery administration of antibiotics and, in the case of pregnancy, prophylactic cerclage in week 12/13 because many of these patients have undergone multiple mechanical cervical dilatations and could be afflicted with cervical incontinence.

As regards controlling the outcome of surgery, *Lancet* advises performing an HSG immediately after the operation. Most authors, however, feel this procedure should be performed 2-3 months later, when the IUD is removed or replacement therapy is suspended. Still others suggest simply performing a control hysteroscopy at that time.

We personally consider insertion of an IUD and/or administration of conjugated equine estrogens, 0.625 mg every 8 hours for two months orally in order to prevent relapse extremely useful. A control hysteroscopy is advisable 3 months after surgery and can even be used to remove any small residual synechiae (**Figs. 9.12–9.14**). In practice, we only resort to cervical cerclage if cervical incontinence manifests.

9.4 Conclusions

Asherman’s syndrome is relatively common in patients with prior mechanical trauma of the uterine cavity and it certainly seems to be concurrent with menstrual disorders and sterility.

Both in diagnostics and treatment, hysteroscopy has permitted remarkable progress. Diagnostic hysteroscopy appears to complete the picture in cases of suspected endometrial thickening in HSG; it also permits accurate classification. Hysteroscopic treatment is certainly the approach of choice and has proved capable of eliminating symptoms in a large number of patients. Results are excellent in nearly all patients, with pregnancies ranging from 40 to 70%. The advantages of endoscopy vs. blind vaginal surgery are clearly evident, both in terms of safety and outcome.

10

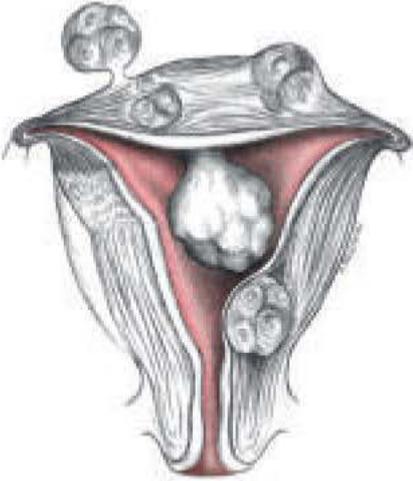
Hysteroscopic Myomectomy

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10.1 The location of leiomyomas is strictly correlated with symptomatology: the protruding part of an intracavitary myoma frequently manifests with bleeding.

Indications for Hysteroscopic Myomectomy

- Abnormal uterine bleeding
- Infertility (including asymptomatic cases)
- Candidates for HRT (including asymptomatic cases)

Table 1

10.0 Hysteroscopic Myomectomy

Uterine leiomyomas are some of the most frequent benign neoplasms encountered in gynecological practice. They occur in 20–30% of women of reproductive age and frequency increases toward the end of the reproductive period. Leiomyomas are considered monoclonal tumors originating from a single, genetically altered myometrial cell. Nevertheless, estrogen plays an important role in the etiopathogenesis of this tumor, essentially by affecting its growth. Hypermenorrhea with menorrhagia and abnormal uterine bleeding often accompanied by anemia is the most common cause for surgical removal of the leiomyoma. Symptoms are correlated more with the location than the size of the tumor except in extreme cases. Protrusion of the leiomyoma into the uterine cavity with anatomical distortion is associated with bleeding in almost all cases (**Drawing 10.1**). The incidence of leiomyomas in infertile patients is nearly twice that of the control population. Several hypotheses have been advanced to explain the correlation between leiomyoma and infertility including interference with embryo implantation or with the gamete transport capacity. Hysterectomy and laparotomic myomectomy used to be the treatment of choice in patients with intractable symptoms (bleeding, infertility). More conservative and less invasive techniques, such as hysteroscopic resection, are now being utilized.

10.1 Indications and Preparation of the Patient

Currently the main indications for hysteroscopic myomectomy in infertile patients or in candidates for hormone replacement therapy are the presence of abnormal uterine bleeding and submucous myomas, including asymptomatic cases (**Tab. 1**).

Classification of Intrauterine Myomas by the European Society of Hysteroscopy

- **Grade 0 (G0)** Myoma with development limited to the uterine cavity, pedunculated or with limited implant base (**Fig. 10.1**).
- **Grade 1 (G1)** Myoma with partial intramural development. Endocavitary component > 50%. Angle of protrusion between the myoma and uterine wall < 90° (**Fig. 10.2**).
- **Grade 2 (G2)** Myoma with predominantly intramural development. Endocavitary component < 50%. Angle of protrusion between the myoma and uterine wall > 90°, (**Figs. 10.3, 10.4**).

Table 2



10.1 Pedunculated leiomyoma.



10.2 Partially intramural myoma.



10.3 Myoma with predominantly intramural development.



10.4 Histological section of intramural leiomyoma.

As regards myoma dimensions and site, the classification proposed by the *European Society of Hysteroscopy* is currently the best guide for identifying the type of leiomyoma by the degree of intramural development and, thus, its hysteroscopic operability (**Tab. 2**).

Obviously, while even an inexperienced surgeon can handle G0, G2 requires a great deal of experience in hysteroscopic surgery. It is interesting to note that this classification makes no mention of myoma dimensions. In fact, it is clear that the operability depends on the intramural component of the myoma itself and, in particular, the free margin, i.e. the thickness of the myometrium remaining between the deep edge of the myoma and the serous peritoneum of the uterus.

Various authors set this safety margin at 0.5 – 1 cm. The angle proposed by *Donnez et al.* – between the myoma wall protruding into the uterine cavity and the endometrial wall – proves less accurate. In fact, the dimensions of the myoma have a marked effect on this angle. Indeed, despite an open angle of protrusion, small myomas can easily be removed because of their smaller intramural mass; the opposite holds true for large myomas with a relatively acute angle, even those reaching the myometrial serous membrane because of their very size.

Preoperative Diagnostic Assessment and GnRH Agonist Therapy for Preparation of Surgery

Preoperative diagnostic assessment consists of diagnostic hysteroscopy with endometrial biopsy and transvaginal ultrasound (TVU). Diagnostic hysteroscopy with CO₂ distension is fundamental for evaluation and localization of the leiomyoma and diagnosis of possible endometrial pathology (endometrial hyperplasia/neoplasia). Endometrial biopsy is carried out in all patients to exclude malignancy. TVU is useful to confirm the diagnosis and to assess the size and location of the tumor. Ultrasonography must indicate the extent of myomal intramural development and, particularly, the free margin. TVU has also proved useful in checking the condition of the remaining genital system.

Pre-operative GnRH agonist therapy can be used as adjunctive treatment of leiomyomas. Because of their transient effect, analogs should be used as preoperative treatment. This therapy results in a substantial reduction of tumor size and control of symptoms, such as menorrhagia and abnormal uterine bleeding. A combination of GnRH agonist analogs and hysteroscopic resection offers a very promising option in the treatment of submucous myomas. The reduction in volume significantly promotes the hysteroscopic management of larger myomas. GnRH analogs can also be used when the initial hysteroscopic attempt fails to completely remove the myoma. Shrinking of a persistent tumor, which is partially intramural, combined with the contractile activity of the uterine fibers, provokes protrusion in the uterine cavity. This allows the surgeon to remove the remaining segment in a second hysteroscopic intervention. As such, we suggest preparing all candidates for hysteroscopic myomectomy with an appropriate therapy consisting of 3-5 months of GnRH analogs. Only patients with intracavitary leiomyomas of < 2 cm should be excluded from pre-operative therapy with GnRH analogs (**Fig. 10.5**).

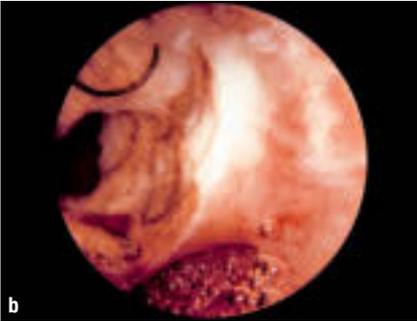
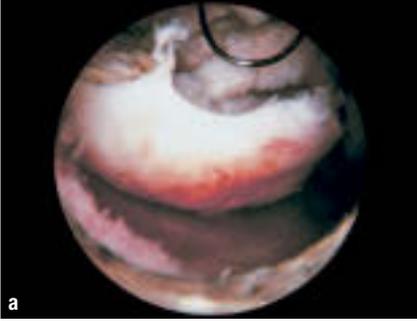
10.2 Operating Technique

Hysteroscopic surgery in general, and for leiomyomas in particular, has undergone a notable evolution in the last few years. Myomectomy can be performed with office hysteroscopy only in selected cases. Office techniques of myoma sectioning using a bipolar electrode with successive extraction have been described. Office myomectomy has, in any case, limits on the dimensions and development of the myoma in the thickness of the myometrium: it is possible to treat myomas with dimensions of less than 1.5-2 cm with prevalent endocavitary development G0-G1. The technique is based on the use of bipolar energy to divide the mass of the myoma into portions from the surface to the base. The fragments can then be removed with 5 Fr. mechanical instruments.

A technique has recently been developed called OPPluM (*Office Preparation of Partially Intramural Myomas*) for the preparation for surgery of myomas with prevalent intramural development with dimensions greater than 1.5 cm. Indeed, often when treating G2 myomas it is possible to remove only the endocavitary portion during the first surgical operation and then carry out the second operation at a future time such as to allow migration of the intramural part to the cavity. The OPPluM technique is performed during diagnostic evaluation and consists of making an incision in the endometrial mucosa and the pseudocapsule of the myoma with a bipolar electrode in the cleavage zone between the myoma and the pseudocapsule itself. This frees the myoma from its connective points, facilitating protrusion of the intramural component into the uterine cavity in the following months, allowing complete removal of the myoma in the course of a resectoscopic myomectomy.



10.5 Small pedunculated myomas should not be pre-treated with GnRH analogs before surgery.



10.7 A submucous myoma must be removed to the peduncle.

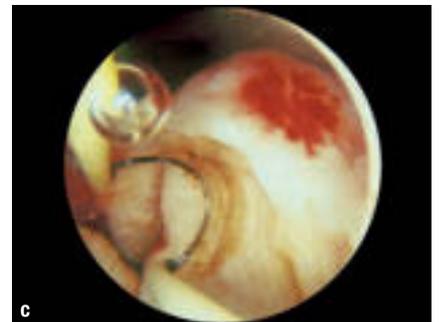
In all other cases it is preferable to use the mono- or bipolar resectoscope which has allowed the number of cases operable hysteroscopically to be notably increased.

As a rule, we use the Fr. 26 bipolar resectoscope for leiomyoma resections. Smaller resectoscopes are used in patients with a narrow uterine cavity or tight cervical canal. After the cervix has been dilated to 10 mm, the resectoscope with the electrosurgical working element is introduced to control the 90° cutting loop. The uterine cavity is distended with a glycine, sorbitol/mannitol or saline solution. Constant irrigation is maintained by a microprocessor-controlled suctionirrigation pump (HAMOU Endomat®, KARL STORZ Tuttlingen, Germany), which automatically controls flow rate and intrauterine pressure. The system also provides for constant aspiration. An electrosurgical unit supplies the energy required for the intrauterine resection.

Submucous Leiomyomas

Resection is performed by placing the electrical loop behind the myoma to be resected and retracting it toward the distal lens of the hysteroscope. The myoma is systematically shaved off with the resectoscope loop until the pedicle is reached or – if part of the tumor is embedded in the uterine wall – down to the level of the opposing endometrial surface (**Figs. 10.6a–c, 10.7a, b**). In the case of bipolar resector, the loop is clearly visible with its positive and negative poles (**Fig. 10.8**).

Leiomyomas look fairly white and thick and are distinguishable from polyps by their fascicular structure (**Fig. 10.9**). Furthermore, the capsule surrounding the myoma is often evident.



10.6 Large superficial vessels do not need to be coagulated before shaving.



10.8 Bipolar resectoscope, loop with positive and negative poles.



10.9 The polyps are distinguishable from myomas due to their softness and the presence of endometrial glands.

Intramural Leiomyomas

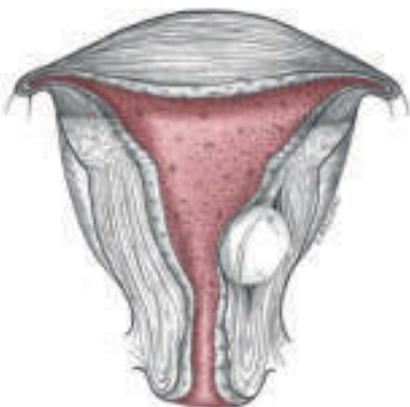
Technically speaking, intramural fibroids can be coagulated until fully dried, and then resected and removed with the resectoscope or using a cold-knife technique.

In practice, after having dissected the portion of the myoma protruding into the cavity, an attempt is made to remove the part nested deep in the myometrial wall. For this purpose *Mazzon et al.* recently proposed the cold-knife technique which consists of simple mechanical passage of the resectoscope scalpel along the capsule lining of the myoma, detaching it from the fibrous bridges that anchor it to the uterine wall, without any electrocoagulation. One great advantage of this method is that it spares the myometrial smooth muscle fiber surrounding the fibroid (**Drawings 10.2, 10.3a, b**). In fact, at least theoretically, lesioning the myometrial fiber bundles can lead to a reduction in, or even loss of, the contractile capacity and at the same time reduce the formation of fibrous scarring which could potentially transform into a “locus minoris resistentiae”. Some authors have hypothesized that an alteration in uterine contraction pacemakers could also negatively affect gamete transport and embryo implantation. Nevertheless, it is not always possible to correctly identify the cleavage plane and insert the cold-knife into the lining capsule to fully enucleate the myoma. In these cases the main risk is a significant extension of the time required for surgery, thus increasing the risk of complications, particularly those connected with intravasation. In such cases, the traditional “slicing” technique with a cutting loop is applied, carried out with utmost care to prevent damaging the smooth muscle fiber bundles (**Fig. 10.10**).

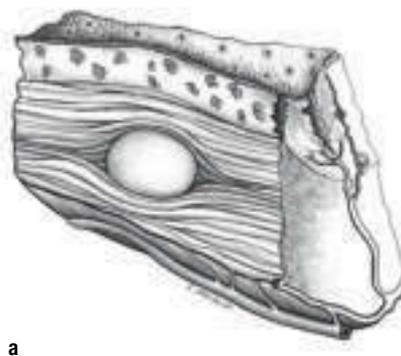
The operation can be considered complete when only myometrium can be seen throughout the entire surgical area. Complications, such as uterine perforation or bleeding, are related more to the surgeon’s skills than to the technique used. In the case that it is not possible to completely remove the intramural fibroma due to the presence of insufficient myometrial free margin (< 5mm) or due to technical difficulties, the fibroma can be treated in a second procedure (2-3 months later) thanks to the migration of the intramural component of the myoma into the uterine cavity. To some extent migration can be achieved during surgery itself through controlled variation of the endocavitary pressure (opening and closing the endouterine aspiration system) or by i.v. administration of uterotonic drugs (meterogolin, oxytocin) which cause contraction of the uterine smooth muscle fiber bundles. When surgery is complete, only rarely is it necessary to perform selective coagulation of any bleeding myometrial vessels. In the vast majority of cases myometrial contraction is sufficient to stop bleeding. In those extremely rare cases where bleeding persists even after IV administration of uterotonic drugs, it is best to insert a Foley catheter into the uterine cavity or perform intrauterine plugging.



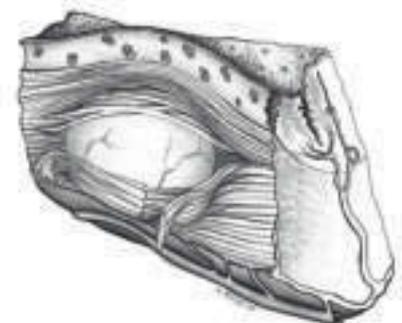
10.10 In some cases it is possible to recognize the capsule surrounding the myoma and the right cleavage plane which allows the preservation of the smooth muscle fibers.



10.2 Intramural leiomyomas can also protrude from the uterine cavity with anatomic change.



a



b

10.3 An advantage of the cold-knife technique lies in the possibility to spare the smooth muscular fibers of the myometrium which surround the fibroma.

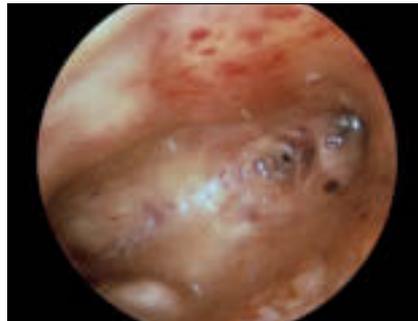
10.3 Postoperative Care and Follow-up

Postoperative drug therapy with GnRH analogs can be continued for 2–3 months if the intramural portion of the leiomyoma was not fully removed and a two-stage surgical treatment has been planned.

Intraoperative antibiotics are administered to all patients. The patient is always discharged on the same day surgery is performed. Cases requiring 24-hour observation before discharge are extremely rare, and normally involve intraoperative or postoperative hemorrhage.

Follow-up diagnostic hysteroscopy is generally performed 2–3 months after surgery (**Fig. 10.11**).

Any material removed during surgery must be subjected to histopathological testing (**Fig. 10.12**). The incidence of leiomyosarcoma is certainly low (< 0.5%), as reported by *Leibson et al.* in a review covering more than 1800 myomectomies or laparotomic hysterectomies. Nevertheless, recent data from case reports of leiomyosarcoma after hysteroscopic resection suggest caution.



10.11 Diagnostic hysteroscopy for follow-up purposes may show the presence of residual intramural myomas protruding into the uterine cavity.



10.12 Material removed during surgery must be collected and subjected to histopathological testing.

11

Hysteroscopic Fallopian Tube Catheterization

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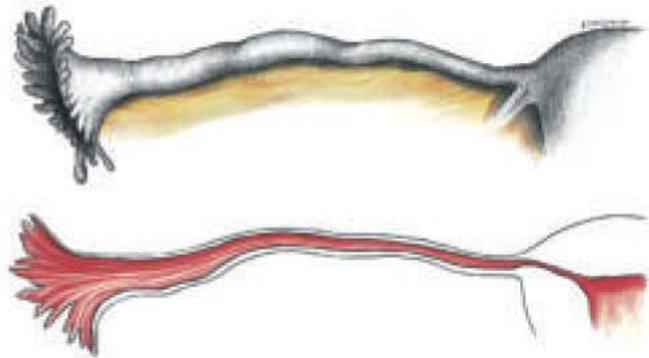
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11.0 Hysteroscopic Fallopian Tube Catheterization

For years it has been the dream of many endoscopists to travel upward through a transcervical approach and view the tubal ostia. Researchers have been motivated to pursue this aim for various reasons: the ability to occlude the tubal ostia for contraceptive purposes was perhaps the first goal leading to an evaluation of feasibility of a transcervical pathway. Years have passed since this initial research and numerous attempts were made with a wide range of techniques. This has given us a great deal of knowledge and made possible the current tubal catheterization technique which aims to eliminate occlusions or transfer gametes or embryos into the tubes.

11.1 Anatomy

The intramural portion of the tube is divided into two segments: a proximal segment, approx. 1 cm in length which follows a rectilinear path, and a 1.5-cm distal segment which is nearly always irregular and continuous with the isthmus portion. In 1962, *Sweeny* observed how the intramural portion of the tube is sinuous in at least 2/3 of cases and, therefore, proves quite difficult to catheterize (**Drawing 11.1**).



11.1 The intramural portion of the tube is sinuous and difficult to catheterize.

11.2 Indications

Current indications for catheterization of the tubes are essentially:

- Unblocking of the ostium and the proximal tract
- Application of intratubal devices such as reversible or irreversible contraception devices

11.3 Obstruction and Occlusion of the Tubal Ostium and/or Proximal Tract

Among the factors able to cause sterility, the fallopian tubes account for at least 30%-40% of cases. Among the various tubal pathologies, proximal obstruction and occlusion account for between 10% and 25% of the total. Recently, *Daly et al.* presented 3 cases of sterile women – with a diagnosis of bilateral tubal ostium obstruction and successfully treated with hysteroscopy – all of whom became pregnant within 3 months of surgery. Similarly, in a study by *Mencaglia et al.*, transcervical salpingoscopy, performed in 228 sterile patients, revealed a full 41 abnormalities in the right tubal ostium and 37 in the left. In 70% of the cases, the abnormality consisted of a stenotic orifice while 19% showed periorificial synechia or obstructive cornual polyps.

Obstructive lesions can stem from many different causes including inflammatory processes and endometriosis which leads to local fibrous stenosis. In 1954, *Rubin* was the first to introduce the concept, recently revived by *De Cherney*, of a possible differentiation between tubal obstruction and occlusion. Indeed, several authors have reported difficulties in identifying confirmed histopathological lesions as the cause of tubal occlusions in many of these patients, only confirming the presence of tubal plugs of exudate that simply obstruct the tube. Moreover, it must be recalled that surgical treatment of these lesions has often proved unsatisfactory. *Lavy et al.* reported a success rate of 56% after microsurgery. The observations of *Sulak et al.* on 18 patients with proximal tubal occlusion confirmed by numerous diagnostic techniques (HSG, chromosalpingoscopy, laparoscopy, transcervical methylene blue injection, as well as transfundal injection of a dye) are quite interesting. In all cases, these authors surgically resected the occluded tract followed by subsequent microsurgical anastomosis. The surgically sectioned portion of the tube was subjected to histopathological testing. Only in 7 patients was real anatomical-pathological occlusion found, whereas in the other cases the tubes appeared either totally normal or presented modest fibrotic or inflammatory lesions but were, nevertheless, patent. In particular, in 6 patients the authors detected the presence of some amorphous material comprised for the most part of inflammatory cells. This aggregate was most likely made up of a partially organized exudate which at some points presented actual calcifications. Therefore, it can be proposed that in some sterile patients there are some sort of “tubal plugs”. The real incidence of this pathology is difficult to quantify although approximately 50% of the women diagnosed as having proximal occlusion do in fact have an obstruction, with the other 50% having true anatomical pathological occlusions. On the other hand, it is well known that there is a significant percentage of spontaneous pregnancies after some diagnostic procedures which might be capable of removing these intrafallopian “plugs” by exerting pressure. After hysterosalpingography the rate of pregnancy, for example, is between 13% and 55%. Indeed, some authors have attributed therapeutic capacity even to simple tubal-uterine insufflation, with a pregnancy rate of 20–60%.

A traditional 2.9-mm diameter system with a 5-mm surgical sheath is normally used for the catheterization of the tubes.

Anesthesia is necessary in cases of proximal obstruction, in which simultaneous laparoscopic control is opportune.

The choice of catheter is very important. As regards the removal of proximal tubal obstructions, we use the *Novy* set (COOK), which consists of an external 9 Fr. catheter to reach the cornual zone, a 3 Fr. catheter to cannulate the orifice, and a guide wire to catheterize the tube (**Figs. 11.1, 11.2a–c**). The technique is that originally described by *Novy et al.* performed under fluoroscopic control.

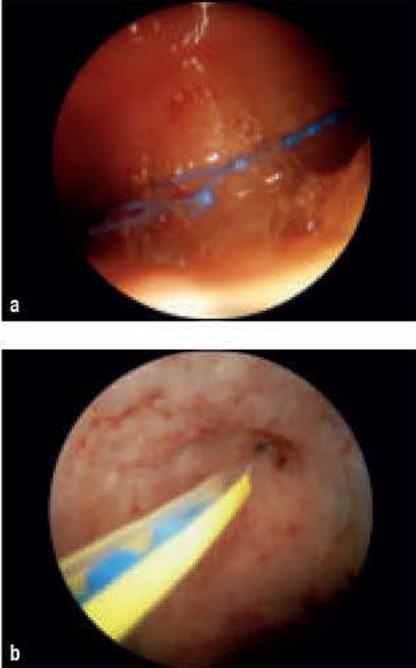
Confino et al., on the other hand, referred to their experience using a 4 Fr. angioplasty catheter hysteroscopically. The most characteristic aspect of this method consists in the introduction, after unblocking by a mandrin, of a balloon filled with a contrast medium, with the aim of provoking longer-lasting mechanical dilatation. *Deaton et al.*, finally, obtained recanalization in 7 out of 10 cases of cornual tubular occlusion using a urological catheter with a flexible mandrin.



11.1 Hysteroscopic vision of the tubal ostium.



11.2 It is possible to use various catheters under hysteroscopic control to eliminate the tubal occlusion.



11.3 Intratubal devices in surgical silicone.

What is more, they only observed a single tubular perforation under laparoscopic control, without even any particular consequences.

11.4 Application of Intratubal Devices for Reversible or Irreversible Sterilization

As an alternative to surgical methods of female sterilization by laparoscopy or mini-laparotomy, there has been some progress in the development of non-surgical techniques. Research has focused on transcervical methods in which tubal occlusion is obtained by chemical agents (phenol-based compounds, quinacrine or methylcyanoacrylate-MCA), cryotherapy, electrocautery, or tubal blocking devices. The use of improved hysteroscopes has facilitated the development of procedures in which the tubes can be occluded by intratubal placement of various type of plugs. All of the plugs that have been tested were designed to provide a reversible method of sterilization. Clinical trials with the P-block plug (a hydrogel co-polymerized device) were designed to block the isthmic portion of the uterotubal junction device, and a silicone device with metallic protrusions to prevent expulsion gave unsatisfactory results. The most widely tested tubal plug has been the catalyzed silicone polymer plug which is placed in the tubes through a specially designed dispenser. The silicone solidifies in the tube, forming a plug. Devices in surgical nylon (ITD) were tested at length (**Fig. 11.3**).

Currently, the most-used systems involve non-reversible fibrotic occlusion.

1. Essure

This is a titanium-dacron device known as Essure. The device consists of an expandible spiral of titanium and nickel with Dacron (PET) fibers passing through it. The device is 4 cm long and 0.8 mm in diameter (2.4 Fr.), 2 mm (6.4 Fr.) once opened. A 5 Fr. catheter allows the device to be placed through the operative sheath of the hysteroscope. Once the tube has been placed, the device initially remains fixed through the opening of the spiral. Then the dacron starts its foreign body action, leading to fibrosis which invades the myometrium towards the inside of the device, definitively obstructing the tube in less than 3 months. As such it is necessary to use another method of contraception in the first 3 months after insertion.

The follow-up uses a simple abdominal X-ray which allows evaluation of satisfactory placement of the device. In the case of suspect location (asymmetric, intraperitoneal or irregular position), it is necessary to carry out an HSG control.

2. Adiana

This is a porous silicone tubular device 3.5 mm long and 1.6 in diameter, fitted with 4 bipolar radio-frequency electrodes. The mechanism of action is a combination of thermal damage provoked by the bipolar electrodes and chronic phlogosis provoked by the material which is not absorbable even though it is biologically compatible. The follow-up must also be performed at three months in this case, however with HSG as silicone is X-ray transparent.

Among the non-reversible techniques, both Essure and Adiana are very effective due to their high possibility of bilateral placement, their absolute contraceptive efficacy and low complication rates. These techniques are taking on an alternative role to laparoscopic sterilization as they are performed in an outpatient setting with local anesthesia without access to the abdomen and as such are well tolerated and allow an immediate return to daily activities. The main disadvantage is the cost of the devices and the need for them to be inserted by expert hysteroscopists.

12

Hysteroscopic Removal of Foreign Bodies and IUDs

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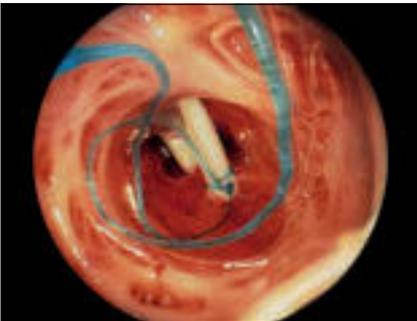
12.3 Embryoscopy 79



12.1 Normally positioned IUD in the uterine cavity.



12.2 Progesterone-containing IUD.



12.3 Dislocated IUD in the cervical canal.



12.4 IUD inserted without the presence of an intrauterine polyp having been diagnosed.

12.0 Hysteroscopic Removal of Foreign Bodies and IUDs

To date, the use of intrauterine contraceptive devices (IUDs) has played a very important role in family planning. Initial issues have been overcome with the development of increasingly sophisticated, user-friendly devices which have gained widespread acceptance and use by women. Their contraceptive safety has been significantly increased with the copper or progesterone-treated devices.

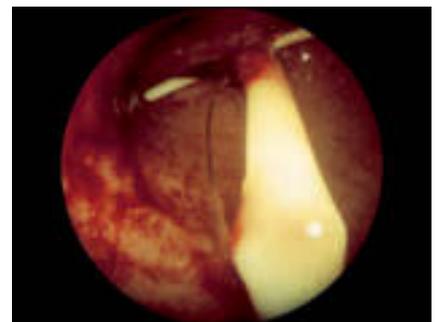
12.1 IUD Positioning

For all IUDs, precise positioning is the prerequisite for proper function. The IUD measurements must match the size of the uterine cavity so as to prevent the device from taking on an abnormal position which would result in pelvic pain and spotting (**Figs. 12.1–12.3**). Unknown intracavitary pathologies such as synechiae, polyps and submucous myomas could also result in their abnormal displacement (**Figs. 12.4, 12.5**), and necessitate their removal.

It must also be remembered that abnormal IUD displacement frequently causes the filaments to travel up the cervical canal and disappear from view of the speculum (**Fig. 12.6**). This leads to serious problems associated with any blind attempts to remove the IUD as it may no longer be located in the intracavitary space (**Fig. 12.7**). While the most common local contraindications for IUDs are well known, this is not the case for those associated with asymptomatic intracavitary pathologies for which clinical diagnosis is practically impossible. For this reason, we feel it best to check the integrity of the uterine cavity by hysteroscopy prior to inserting an IUD. Not only does endoscopy permit easy evaluation of the uterine cavity dimensions, but also allows for diagnosis of any intracavitary pathologies (synechiae, submucous myomas, endometrial polyps).



12.5 Presence of bone metaplasia in the uterine cavity.



12.6 The string of the IUD can move up to the cervical canal.

12.2 “Lost IUD”

The term “Lost IUD” is applied to those situations where the recovery filament is not visible from outside the cervix. The string may have ascended due to abnormal displacement, fragmentation of the device, perforation of the uterus or unnoticed expulsion of the IUD itself and, finally, the onset of a pregnancy (**Fig. 12.8**).

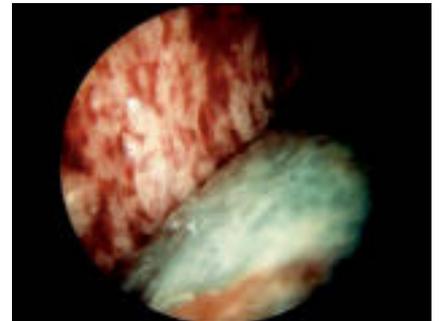
In our opinion, ultrasound is the imaging method of choice for the location of IUDs. It can also diagnose pregnancy because the gravid uterine cavity is enlarged and the string for IUD retrieval is no longer visible in the external os. In this case dilatation of the uterine cavity should proceed with great caution due to the increased permeability of the uterine walls. Often the gestational sac will press the IUD against the uterine wall (**Figs. 12.9–12.10a,b**). We believe that the IUD should definitely be removed, regardless of whether or not the pregnancy will be carried to term. Our experience is based on 45 patients who wanted to have children and whose IUDs were removed under hysteroscopic control. Only two pregnancies were lost within 2 days postoperatively, while the remaining pregnancies were successfully carried to term. Hysteroscopy is the method of choice for the removal of intact IUDs and IUD fragments, except in cases where the device has completely perforated through the uterine wall into the peritoneal cavity or an unnoticed expulsion has occurred.



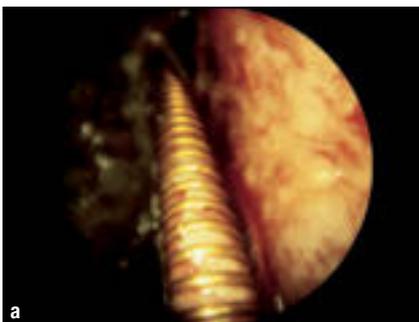
12.7 Partial translocation of IUD.



12.8 Ultrasound image showing an IUD misplaced in the cervical canal, and an intrauterine pregnancy.



12.9 Hysteroscopic view of a gestational sac in intrauterine pregnancy (8 weeks).



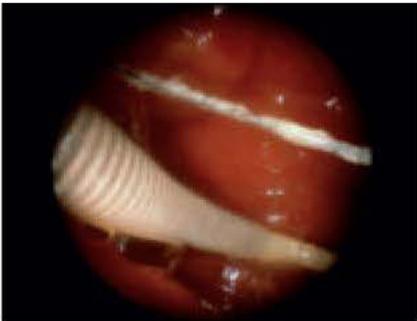
12.10 Often the IUD is pressed against the uterine wall by the gestational sac.



12.11 Translocation of the IUD to the peritoneum may be partial or complete. Laparoscopy is necessary to remove the IUD.



12.12 The IUD can be recovered by grasping the string or the body of the IUD with forceps.



12.13 Calcium concretions may be deposited on the IUD covering.

The IUD and/or fragments can be located and extracted by means of forceps, the procedure being performed on an outpatient basis without anesthesia or cervical canal dilatation (Figs. 12.11, 12.12).

Table 1 shows how we dealt with the lost IUD problem in a 140-patient case study. In 2 of the 3 cases not viewed with hysteroscopy, in which pelvic X-ray showed the IUD at Douglas level, the device was retrieved with laparoscopy in one and laparotomy in another; in the third case the IUD was not recovered, and had probably been expelled unnoticed by the patient. Correct integration of ultrasound with hysteroscopy and laparoscopy, except in exceptional cases, today allows precise location and recovery of IUDs with very limited physical and psychological discomfort to the patient.

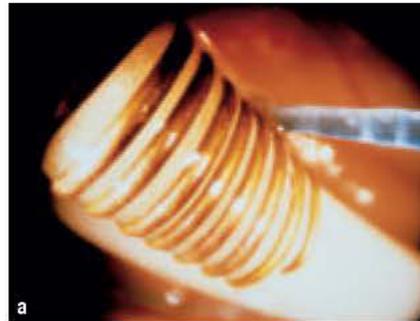
Hysteroscopy may also be useful in controlling the integrity of the IUD. After a long period of intrauterine insertion the covering material of the IUD may be damaged and need to be removed and replaced (Figs. 12.13–12.14a,b).

In conclusion, the use of hysteroscopy – performed in an outpatient setting without anesthesia and cervical canal dilatation – currently permits proper management of patients choosing IUDs as their means of contraception.

Used in preventive check-ups and, above all, in follow-up, hysteroscopy helps resolve many of the complications associated with this means of contraception.

140 Cases of “Lost IUD”	visible	not visible
Ultrasonography	132 (94.3%)	8 (5.7%)
Hysteroscopy (incl. recovery)	134 (95.7%)	6 (4.3%)

Table 1



12.14 IUD covering can be damaged after long period of insertion.



12.3 Embryoscopy

Transcervical embryoscopy via hysteroscopy has been proposed for miscarriages to view the gestational sac and obtain embryotrophoblastic material for cytogenetic exam. Indeed, cytogenetic analysis of the embryotrophoblastic material removed via curettage has a risk of contamination which varies from 30 to 80%. It is therefore performed in patients with retained miscarriage between the 4th and 13th week of gestation. Performance is simple with the classic office hysteroscopy technique; the uterine cavity is distended with physiological saline, the presence of any alterations of the cavity itself is picked out, then the embryo is evaluated after dissection of the membrane before performing a selective biopsy (with grasping forceps) of the embryo for cytogenetic study. *T. Philipp* offered a study of 272 cases of miscarriage in which it was possible to correctly view the fetus in 233 and perform cytogenetic evaluation in 221 (**Figs. 12.15–12.18**).

The technique is still considered experimental.



12.15 Exencephaly in 8-week embryo.



12.16 Exophthalmus in fetus with osteochondrodysplasia.



12.17 Extra-embryonic heart in 4-week embryo.



12.18 Rigid folding.

13

Complications of Diagnostic and Surgical Hysteroscopy

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13.0 Complications of Diagnostic and Surgical Hysteroscopy

Diagnostic and surgical hysteroscopic techniques have become established as primary techniques in gynecological practice and completely revolutionized the therapeutic approach to endocavitary pathology. Hysteroscopy is considered a minimally invasive procedure with low incidence of complications. *Ozturk et al.* report a complication rate of 0.86% in a retrospective study of 580 hysteroscopies, the most common being wrong ways and perforations.

As in all operating techniques, potential complications should always be taken into account. However, in endoscopic surgery complications are not only related to the surgeon's skills and the clinical care exercised, but also to the use of the operating instruments. The surgical risk may be higher if certain instruments are not available.

It is beyond the scope of this chapter to consider all potential complications of anesthesia. The potential complications of an endoscopic operation include intra- and postoperative complications.

13.1 Intraoperative Complications

Complications which may arise during the endoscopic operation may include

- Pain and vasovagal crisis
- Trauma
- Hemorrhage
- Complications related to the distension media
- Thermal damage caused by the electric current
- Infection

Pain and vasovagal crisis

Pain is an immediate intraoperative complication in the case where no form of anesthesia is used. The risk of vasovagal crisis is strictly related to the pain. The pain is principally caused by excessive distension of the uterine cavity and by passage of the instrument through the cervical canal. Some factors relating to the patient may favor the onset of this symptom: chronic PID, nulliparity, menopause, anxiety. The invention of instruments increasingly reduced in diameter (microhysteroscopes with 2.9-mm optics with 3.5-mm single-flow external diagnostic sheaths), and the use of dedicated irrigation and suction systems have noticeably reduced the incidence of such complications. The pain can be relieved with common analgesics, while the vasovagal syndrome is blocked with the use of atropine.

Traumas

The most frequent traumas in the course of hysteroscopic examination are wrong ways, uterine and cervical perforation, and laceration of the cervix. Documented cases in medical journals indicate that cervical and uterine perforations during hysteroscopy have a variable incidence of between 1 and 9%. Cases of laceration or perforation may present during cervical dilatation for resectoscopy. Generally, this type of complication is correlated with operator inexperience and the difficulty of the treated pathology, with greater incidence for operative hysteroscopy compared to diagnostic. Surgical techniques which carry a risk of uterine perforation are metroplasty, myomectomy, and endometrial resection/ablation. Pre-existing conditions include tight cervical stenosis, hyper-anteverted or hyper-retroverted uterus, atrophic post-menopausal uterus, uterine hypoplasia, and endometrial carcinoma. In almost all cases, a purely mechanical perforation of the uterus or the cervical canal does not have serious consequences. In such an eventuality, it will be necessary to suspend or postpone the hysteroscopic exam or procedure, except for a directional error in the approach to the cervical canal, which can be brought back to the correct path via the uterine cavity (**Fig. 13.1**). The patient must then be monitored with ultrasound for several hours so as to exclude the presence of hemorrhaging. They must be administered prophylactic antibiotics and IV oxytocin.

A perforation induced by the resectoscope electrode can cause serious complications and always requires diagnostic laparoscopy or exploratory laparotomy, so as to evaluate the possible presence of lesions in the intra-abdominal organs (intestine, bladder, omentum). If you consider that over 97% of all hysteroscopic surgery is performed with the resectoscope, it is clear that this type of complication must be subject to particular attention.

Perforation is diagnosed on the basis of direct hysteroscopic vision. Unexpected insufficient distension of the uterine cavity or hemorrhaging must always give cause to suspect a possible perforation. The persistence of severe pelvic pain, nausea, vomiting, and fever must lead the surgeon to suspect a perforation in the first instance.

The presence of abdominal pain, fever, leucocytosis, and peritonitis in the days following the procedure must be interpreted as an indication of a uterine perforation and as such of an intestinal lesion.

Hemorrhage

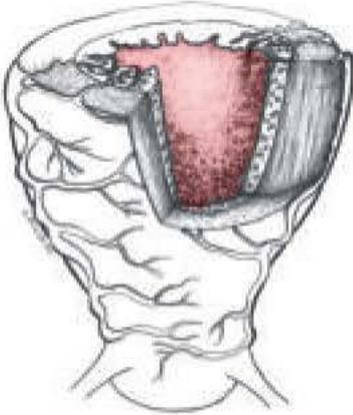
Hemorrhagic complications, such as unstoppable bleeding, can arise during the course of any hysteroscopic procedure and in particular during the removal of a submucous myoma or an endometrial resection/ablation. This type of complication principally depends on the experience and ability of the surgeon, and the use of an incorrect instrument. Light venous bleeding is generally stopped by an increase in the pressure of the distension media (average intracavitary pressure of 70 mmHg). In post-op, this type of bleeding can manifest as a slow trickle from the external genitalia. In case of substantial bleeding, it is advisable to reduce the pressure of the distension medium in order to identify the area which is bleeding. Normally, it is almost always possible to control venous and arterial bleeding by resorting to bipolar coagulation and/or IV administration of oxytocin to stimulate uterine contractions. Some authors suggest the use of special vasopressin sponges to insert directly into the uterine cavity; this practice is not recommended due to the unpredictable massive systemic absorption of vasopressin through the myometrium, with serious systemic consequences.

If the bleeding is such as to obscure the operating field, the procedure must be suspended and it may be necessary to insert a Foley catheter into the uterine cavity to stop the hemorrhage. The Foley catheter is generally filled with 5 cc of physiological saline. If the bleeding does not stop, the distension must be gradually increased, 1 cc at a time – indeed, sudden distension may rupture the uterus. The catheter must remain in the cavity for at least 6 h and must necessarily be removed after 24 h. Before removing the catheter it must be emptied and held in situ for 1-2 hours in order to verify that the bleeding has stopped. If bleeding does not stop, the patient must be prepared for hysterectomy. Today there are numerous shaped balloons available, but the Foley catheter remains preferable inasmuch as it is a sterile device which is always available.

Bleeding of the uterine cervix can be caused by tenaculum trauma, dilatation of the cervical canal, or by the insertion of the hysteroscope into the uterine cavity. This complication has almost disappeared in diagnostic hysteroscopy, thanks to the vaginoscopic approach and entrance of the instrument into the cervical canal under visual control.

Complications connected to the distension medium

Distension media for hysteroscopic surgery must be non-conducting if unipolar current is used; using the resectoscope inside the cavity, unipolar current is indeed applied which comes into direct anatomical contact with the intestine and bladder. It is therefore important to use non-electrolytic low-viscosity solutions for distension of the uterine cavity (glycine, sorbitol-mannitol) in order to avoid propagating the electrical current with consequent thermal damage.



13.1 Section of the uterine wall with myometrium, endometrium, and vessels.

The use of excessive quantities of non-electrolytic low-viscosity solution can cause an overload of liquid during the surgical procedure (**Figs. 13.2, 13.3**). Similarly, a rapid passage too of large quantities of distension medium directly into the vessels can cause liquid overload, electrolyte alteration and metabolic imbalance. The use of isotonic liquids, such as saline solution which can be used with bipolar-current instruments, does not generally result in electrolyte alteration, but it does not prevent the risk of circulatory overload. This must absolutely be avoided, in that it can cause serious damage to the central nervous system, acute pulmonary edema, and acute renal insufficiency, or "intrasation syndrome". The pathogenesis consists of an increase in central arterial and venous pressure (in response to the hypervolemia). This results in reduction of the hematocrit and onset of resulting hyponatremia (< 136 mEq/l). The signs of excessive liquid absorption are: appearance of pale urine, tissutal edema, increase in cardiac output with ventricular overload, variations of pulse oximetry and ventilatory parameters, variations in body temperature. The symptoms are respiratory (dyspnea, pulmonary edema), and neurological (headache, nausea, vomiting, agitation, convulsions). Lab exams show hypoprotidemia, hyponatremia, hemodilution. The causes which can provoke intravasation syndrome are the use of high intrauterine pressures (> 80 mmHg), the opening of consistent caliber myometrial vessels (myomectomy, resection/ablation of the endometrium, metroplasty), length of the procedure. Some authors indicate that if the myometrial vessels are sections (vessel caliber 400-500 microns) intravasation on the order of 9 ml/min occurs (**Fig. 13.4**). Severing vessels of larger dimensions (> 1 mm) can cause massive intravasation (400 ml/min with gravity infusion systems, 250 ml/min with electronically controlled irrigation and suction pump) (**Drawing 13.1**). It is therefore fundamental to carefully monitor the duration of the procedure (approx. 30 min) and the quantity of distension fluid used. Use of an electronically controlled irrigation and suction pump (ENDOMAT® sec. HAMOU) is essential for insuring constant control of intrauterine pressure, liquid flow, suction/irrigation pressure and the difference between the quantity of liquid supplied and that recovered. *Kim et al.* evaluated hyponatremia in patients who had undergone hysteroscopic surgery with the resectoscope, and highlighted a greater risk in hysteroscopic myomectomies.

Prevention methods for liquid overload syndrome

Prevention is based on the use of distension pressures of 60-75 mmHg and monitoring of the quantity of liquid introduced and recovered (liquid balance). The maximum inflow/outflow discrepancy volume after which the surgeon must evaluate blood electrolytes (especially sodium) is: 1.5 liters for saline solution, 1 liter for Sorbitol, and 1.5 liters for Glycine.

1. Locoregional anesthesia to keep the patient awake
2. Bipolar electric system with physiological solution for distension of the uterine cavity
3. Maintain distension pressure between 70 and 90 mmHg.
4. Work quickly to reduce surgery time
5. The difference between the injected and recovered liquid must be at most 1 liter – 1.5 liters for saline.
6. Collaboration with the anesthetist
7. Continuous communication with the patient to identify any signals early, such as coughs, thoracic pressure or loss of consciousness

As regards the management of intravasation syndrome, it is recommended to:

1. Immediately suspend the operation at the appearance of the first symptoms
2. Use parenteral furosemide (20-40 mg)
3. In case of specific symptomatology, increase natremia 1.5 to 2 mEq / l every 2 hours. It is not suitable to suddenly raise sodium levels as this could generate major neurological complications (pontine degeneration). Natremia must be brought back to a minimum of 135 mEq / l. To this end, we suggest 3% hypertonic sodium chloride solution, called anti-shock solution, containing 513 mEq per liter and is 3.33 times more osmotic than physiological solution.
4. Avoid IV administration of other liquids, if necessary only lactated Ringer's solution.
5. Laboratory exams every 2 hours (hemoglobin, hematocrit, proteins and Na⁺, Cl⁻, and K⁺ ions).

CO₂ as a distension medium has today been almost completely abandoned due to the difficulty of the hysteroscopic technique and complications related to its use. Cases of CO₂ gas embolisms, and alterations to heart sounds due to the CO₂ used during hysteroscopic exams have been described in the literature. With currently used flow rates ranging between 30 and 90 cc/min, there are no significant variations in PCO₂, PO₂ and PH levels. Distension with CO₂ should be avoided in patients with pulmonary hypertension.

Episodes of gaseous embolisms have also been described using liquid distension media. This is due to air contained in the filling circuits and resectoscope which could accidentally penetrate the wide uterine vessels. To prevent this complication, it is wise to prime the irrigation circuits before introducing the resectoscope into the cavity.

Diffusion of neoplastic cells

The passage of the liquid distension medium through the peritoneal cavity through the tubal ostia could allow the passage of endometrial neoplastic cells. In reality, there are not a lot of data in medical journals to support such a hypothesis. A way to prevent such a supposed complication could be the use of distension pressures of < 70 mmHg, values corresponding to the opening pressure of the tubal ostia.

Thermal damage caused by the electrical current

Such complications are fundamentally common to electrosurgery's other fields of application. With unipolar current, lesions can occur in different areas from the target due to electron flow following mistaken activation of the instrument, insulation problems with the instrument, and the use of high power. It can indeed occur that when unipolar current passes from the positive pole through the tissue to the negative pole (the plate), mishaps can occur whereby the energy does not follow the planned route but rather flows through more conductive tissue offering a path of less impedance, missing the plate. In this case, lesions or areas of necrosis in distant areas can occur.

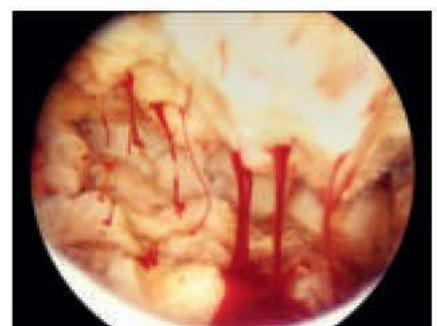
The use of bipolar current reduces this risk. Another complication is represented by distant thermal damage due to excessive heating of areas near to the treatment zone; this long-distance thermal damage usually manifests itself in post-op. To avoid thermal damage from electrical current, it is advisable to activate the loop only under direct visual control, and for brief periods. Modern HF electrosurgical units, specifically designed for endoscopic applications, should also be used. These devices are electronically controlled and generate a variable-intensity current depending on the tissue's resistance. The power is thus automatically regulated, so as to avoid possible complications from the diffusion of unipolar current.



13.1 Wrong direction.



13.2 Massive intravasation observed in HSG.



13.3 Section of myometrial vessels may cause massive intravasation.

13.2 Postoperative Complications

Postoperative complications are statistically less common, but more pernicious and dangerous since they can affect patients far away from the hospital, given that the majority of hysteroscopic operations are performed in an outpatient setting.

Cases of post-operative hemorrhage reported in medical literature have a low incidence. The authors have found only a single case of hematoma of the lateral uterine wall in the course of an endometrial ablation, probably due to the resection of a cervical branch of the uterine artery. Such a complication, which could have required a laparotomy, was resolved with drug therapy (antibiotics and oxytocin).

Thermal damage to the bowel has been reported as another complication. Frequently, such an incident occurs unnoticed during the operation. The symptoms, analogous to those of peritonitis, can manifest after several days. Presence of abdominal pain, fever, leukocytosis, and peritonitis in the days after surgery should be taken as evidence in the final diagnosis of the presence of bowel lesions. Adequate medical therapy can reduce the incidence of this type of complication to negligible levels.

Infections are rare complications: according to reports found in the literature, the incidence is 0.2 to 1% of all hysteroscopic operations. A correlation with protracted operating procedures due to repeated insertion of the resectoscope has been demonstrated. In general, fever and pelvic pain manifest within 72 hours of the hysteroscopic intervention. Therefore, this complication can be drastically reduced by the surgeon proceeding skillfully and rapidly and by prophylactic administration of antibiotics. Conversely, prophylactic antibiotics do not give any advantage in diagnostic hysteroscopy. The hysteroscopic exam should **not**, in any case, be performed in case of vaginal, cervical, uterine or pelvic infection. Theoretically, improper sterilization of equipment could lead to a risk of infection; this eventuality is completely avoidable if correct sterilization procedures are followed, however.

In conclusion, it can be affirmed that complications of hysteroscopic surgery usually are related to the experience of the surgeon, similarly to traditional surgery. Having the appropriate instruments available is an absolute requirement in order to reduce the incidence of complications, however. Without the proper equipment, the risk is significantly higher.

These considerations emphasize not only the necessity of acquiring valid experience in diagnostic hysteroscopy before proceeding with hysteroscopic surgery, but also the requirement of a training period in a training center before attempting difficult operating techniques. In conclusion, however, hysteroscopic surgery is considered a safe technique today.

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Acknowledgments

The authors are indebted to those who contributed to the preparation of this edition.

Betania ALLER (Caracas, Venezuela)

Denise De ANGELIS (Florence, Italy)

Yemile BEIRUTTI (Cumana, Venezuela)

Michela BENIGNA (Sassari, Italy)

Carlos BERMUDEZ (Caracas, Venezuela)

Priscila BRAGA RITT (Sao Paulo, Brazil)

Giada CARRI (Roma, Italy)

Yuddysay Ng (Caracas, Venezuela)

Adid CHEJIN (Barquisimeto, Venezuela)

Carlos ESCALONA (Barquisimeto, Venezuela)

Soraya FERNÁNDEZ (El Vigía, Venezuela)

Nelson GIL (Barquisimeto, Venezuela)

Giuliana GIUNTA (Catania, Italy)

Flávia HARUMI ARIMA (Sao Paulo, Brazil)

Liliana MEREU (Florence, Italy)

Fernanda de PAULA RODRIGUES
(Sao Paulo, Brazil)

Alessandro PONTIS (Cagliari, Italy)

Claudia PRASCIOLU (Cagliari, Italy)

Hebert QUINTERO (Maracaibo, Venezuela)

María S. VERNAZA (Cali, Colombia)

Basic Set for Diagnostic, Office and Operative Hysteroscopy

Recommended by Prof. Luca Mencaglia, M.D.,
Scientific Director of the Florence Center of
Oncology (CFO), Florence, Italy

Basic Set for Diagnostic and Operative Hysteroscopy

Recommended by Prof. Luca MENCAGLIA, M.D.

Scientific Director of the Florence Center of Oncology (CFO), Florence, Italy

Diagnostic Hysteroscopy:

BETTOCCHI® **Hysteroscope**, based on **HOPKINS® II Forward-Oblique Telescope 30°**, diameter 2.9 mm.

- 26120 BA **HOPKINS® II Forward-Oblique Telescope 30°**, diameter 2.9 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red
- 26153 BI BETTOCCHI® **Operating Sheath**, size 4.3 mm, with channel for semirigid 5 Fr. operating instruments, with 1 stopcock and 1 LUER-Lock adaptor, for use with CF Operating Sheath 26153 BO
- 26153 BO BETTOCCHI® **Continuous-Flow Operating Sheath**, size 5 mm, with 1 stopcock and 1 LUER-Lock adaptor, for use with Operating Sheath 26153 BI

Operative Hysteroscopy:

Bipolar Continuous-flow Resectoscope 26 Fr.:

- 26105 FA **HOPKINS® II Telescope 12°**, enlarged view, diameter 4 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: black
- 26040 EBH **Working Element Set**, bipolar, Cutting by means of a spring. Movable thumb support. In rest position the electrode tip is inside the sheath, including:
- Working element**, bipolar
 - 2x Cutting loop**, bipolar
 - Coagulation Electrode**, bipolar, pointed
 - HALF MOON Coagulation Electrode**, bipolar, ball end
 - High frequency cable**, bipolar
 - Protection tube**
- 26050 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 26 Fr., oblique beak, **rotatable** Inner Sheath 26050 XA with ceramic insulation, for use with Working Elements 26050 E, 26050 D, 26050 V, 26040 EB and 26050 EB, color code: yellow
- 26050 XA **Inner Sheath**, rotatable, with ceramic insulation, diameter 8 mm, for use with Resectoscope Sheath 26050 SL
- 26040 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 26 Fr., oblique beak, **fixed** inner sheath 26040 XA with ceramic insulation, for use with Working Elements 26050 E, 26050 D, 26050 V and 26050 EB, color code: yellow
- 26040 XA **Inner Sheath**, fixed, with ceramic insulation, diameter 8 mm, for use with Resectoscope Sheath 26040 SL

Basic Set for Diagnostic and Operative Hysteroscopy

Recommended by Prof. Luca MENCAGLIA, M.D.

Scientific Director of the Florence Center of Oncology (CFO), Florence, Italy

26050 SC **Resectoscope Sheath**, including connecting tubes for in- and outflow, 26 Fr., oblique beak, inner tube with ceramic insulation, **quick release lock**, for use with resectoscope working elements 26050 E, 26050 D, 26050 V, 26040 EB and 26040 DB, color code: yellow

26040 OC **Standard Obturator**, for use with Resectoscope Sheaths 26040 SL, 26050 SL and 26050 SC, color code: yellow

Bipolar Continuous-flow Resectoscope 22 Fr.:

26020 FA **HOPKINS® II Telescope 12°**, diameter 2.9 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: black

26055 EBH **Working Element Set, bipolar**, (Cutting by means of a spring. Movable thumb support. In resting position, the electrode tip is inside the sheath), including:

Working element, bipolar

2x Cutting loop, bipolar

Coagulation Electrode, bipolar, pointed

HALF MOON Coagulation Electrode, bipolar, ball end

High frequency cable, bipolar

Protection tube

Connector with tube

26055 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 22 Fr., oblique beak, **fixed** inner sheath 26055 XB with ceramic insulation, for use with working element 26055 E, color code: white

26055 XB **Inner Sheath**, fixed, with ceramic insulation, diameter 7 mm, for use with Resectoscope Sheath 26055 SL

26055 LD **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 22 Fr., oblique beak, **rotatable** sheath tube 26055 XE with ceramic insulation, for use with working element 26055 E, color code: white

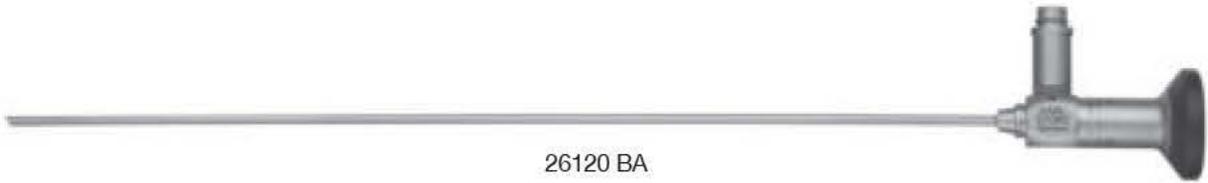
26055 XE **Inner Sheath**, rotating, with ceramic insulation, diameter 7 mm, for use with Resectoscope Sheath 26055 LD

26055 SC **Resectoscope Sheath**, including connecting tubes for in- and outflow, 22 Fr., oblique beak, inner tube with ceramic insulation, **quick release lock**, for use with resectoscope working element 26055 E color code: white

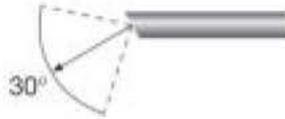
26055 CO **Standard Obturator**, for use with resectoscope sheaths 26055 SL/SC/LD color code: white

Basic Instrument Set for Diagnostic Office Hysteroscopy, diameter 5 mm

BETTOCCHI® Hysteroscopes based on a 2.9 mm telescope



26120 BA



26120 BA

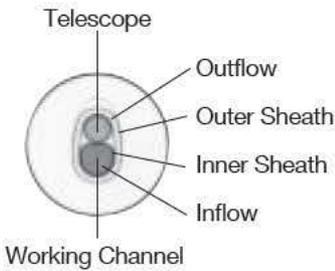
HOPKINS® II Forward-Oblique Telescope 30°, diameter 2.9 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red

With working channel



26153 BI

26153 BO



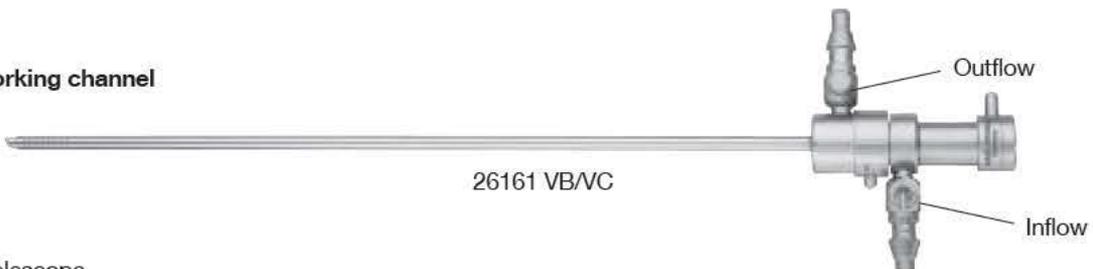
26153 BI

BETTOCCHI® Operating Sheath, size 4.3 mm, with channel for semirigid 5 Fr. operating instruments, with 1 stopcock and 1 LUER-Lock adaptor, for use with CF Operating Sheath 26153 BO

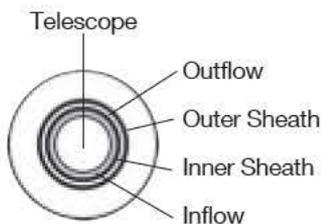
26153 BO

BETTOCCHI® Continuous-Flow Operating Sheath, size 5 mm, with 1 stopcock and 1 LUER-Lock adaptor, for use with Operating Sheath 26153 BI

Without working channel



26161 VB/VC



26161 VB

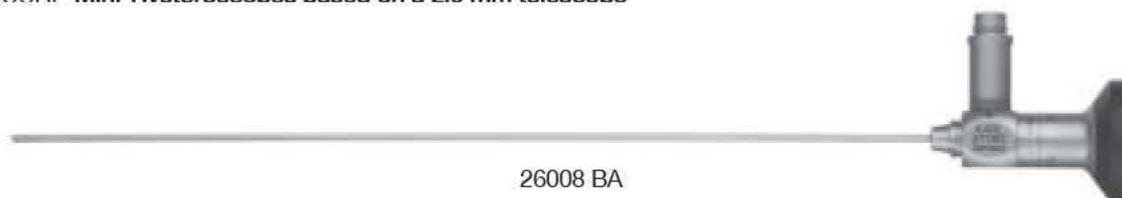
Examination Sheath, diameter 3.8 mm, with 1 LUER-Lock adaptor, for use with CF Examination Sheath 26161 VC

26161 VC

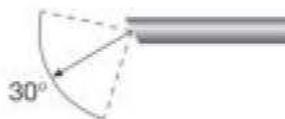
Continuous-Flow Examination Sheath, diameter 4.5 mm, with 1 LUER-Lock adaptor, for use with Examination Sheath 26161 VB and 26162 VB

Basic Instrument Set for Diagnostic Office Hysteroscopy, diameter 4 mm

BETTOCCHI® Mini-Hysteroscopes based on a 2.0 mm telescope



26008 BA

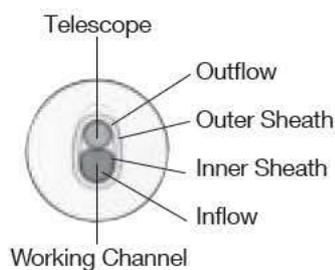


26008 BA **HOPKINS® II Forward-Oblique Telescope 30°**, diameter 2 mm, length 26 cm, **autoclavable**, fiber optic light transmission incorporated, color code: red

With working channel

26152 BI

26152 BO

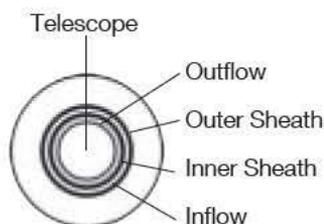


26152 BI **BETTOCCHI® Operating Sheath**, size 3.6 mm, with channel for semirigid 5 Fr. operating instruments, with 1 stopcock and 1 LUER-Lock adaptor, for use with CF Operating Sheath 26152 BO

26152 BO **BETTOCCHI® Continuous-Flow Operating Sheath**, size 4.2 mm, with 1 stopcock and 1 LUER-Lock adaptor, for use with Operating Sheath 26152 BI

Without working channel

26161 RN



26161 RN **Examination Sheath**, diameter 2.8 mm, with 1 stopcock and 1 LUER-Lock adaptor, for use with CF Examination Sheath 26161 R

26161 R **Continuous-Flow Examination Sheath**, diameter 3.6 mm, with 1 stopcock and 1 LUER-Lock adaptor, for use with Examination Sheaths 26161 RN and 26162 RN

BETTOCCHI® Integrated Office Hysteroscope (B.I.O.H.)™, diameter 4 mm ^{NEW}
based on an integrated 2.0 mm telescope



26252 BS

- 26252 BS **B.I.O.H.™ BETTOCCHI® Compact Hysteroscope, short handle,** size 4 mm, with channel for semirigid 5 Fr. operating instruments, with suction and irrigation valve for use of single or continuous Flow, including:
Outer Sheath
2x Suction and Irrigation Valve
Adapter Monobloc
Sealing for instrument ports (10 pcs.)

Alternative



26252 BL

- 26252 BL **B.I.O.H.™ BETTOCCHI® Compact Hysteroscope, long handle,** size 4 mm, with channel for semirigid 5 Fr. operating instruments, with suction and irrigation valve for use of single or continuous Flow, including:
Outer Sheath
2x Suction and Irrigation Valve
Adapter Monobloc
Sealing for instrument ports (10 pcs.)

Required accessories

- 39501 XC **Wire Tray**, for cleaning, sterilization and storage of one KARL STORZ B.I.O.H.™ Compact Hysteroscope
 26252 SP **Sealing Set for B.I.O.H.™ Compact Hysteroscope** (5 x Spare Sealing Caps, 3 x 10 Spare O-Rings for valve, 5 x O-Rings for sheath)

TROPHYscope – CAMPO Compact Hysteroscope ^{NEW}

based on an integrated 2.0 mm telescope

Without working channel



26008 BAC **TROPHYscope – CAMPO Compact Hysteroscope**, HOPKINS® II, 30°, size 2.9 mm, length 24 cm, with irrigation connection

26152 DA **Continuous-Flow Sheath**, size 3.7 mm, length 18 cm, with suction adaptor for use with 26008 BAC

With working channel

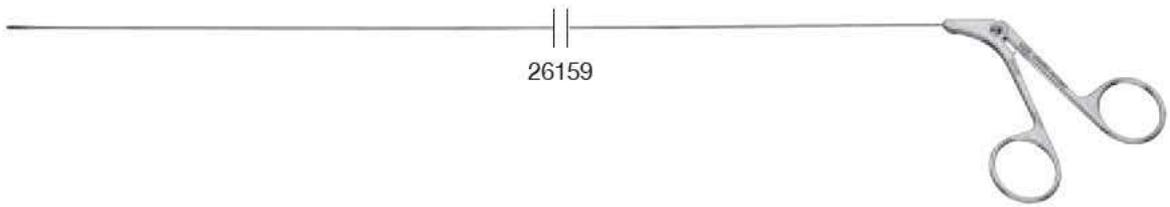


26008 BAC **TROPHYscope – CAMPO Compact Hysteroscope**, HOPKINS® II, 30°, size 2.9 mm, length 24 cm, with irrigation connection

26152 DB **Operating Sheath**, size 4.4 mm, length 16 cm, with working channel for semi-rigid 5 Fr. instruments, with suction connection, for use with 26008 BAC

Basic Instrument Set for Diagnostic Office Hysteroscopy

Mechanical Surgical Instruments, Length 34 cm, 5 Fr.



26159 EHW **Scissors**, semirigid, blunt, single action jaws, 5 Fr., length 34 cm



26159 SHW **Scissors**, semirigid, pointed, single action jaws, 5 Fr., length 34 cm



26159 UHW **Biopsy and Grasping Forceps**, semirigid, double action jaws, 5 Fr., length 34 cm



26159 H **HESSELING Tenaculum Grasping Forceps**, semirigid, double action jaws, 5 Fr., length 34 cm



26159 DHW **Punch**, semirigid, through-cutting, single action jaws, 5 Fr., length 34 cm



26159 BHW **Biopsy Spoon Forceps**, semirigid, double action jaws, 5 Fr., length 34 cm



26159 M **BETTOCCHI® Myoma Fixation Instrument**, semirigid, 5 Fr., length 34 cm



26159 G **BETTOCCHI® Palpation Probe**, semirigid, graduated, 5 Fr., length 34 cm

Bipolar Vaporisation Electrodes, Length 36 cm, 5 Fr.



26158 BE **Bipolar Vaporisation Electrode**, 5 Fr., 90 degree angled, with chamfer in handle



26159 BE **Bipolar Vaporization Electrode**, semirigid, 5 Fr., length 36 cm



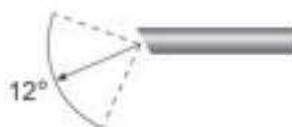
26159 GC **GORDTS/CAMPO Bipolar Ball Electrode**, semirigid, 5 Fr., length 36 cm

Basic Instrument Set for Operative Hysteroscopy, 26 Fr.

Resectoscopes for intrauterine HF-Surgery

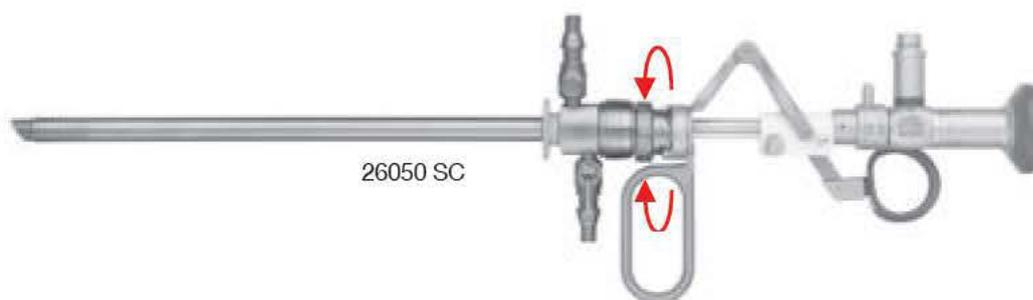


26105 FA



12°

26105 FA **HOPKINS® II Telescope 12°**, enlarged view, diameter 4 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: black



26050 SC

26050 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 26 Fr., oblique beak, **rotatable** Inner Sheath 26050 XA with ceramic insulation, for use with Working Elements 26050 E, 26050 D, 26050 V, 26040 EB and 26050 EB, color code: yellow

or

26040 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 26 Fr., oblique beak, **fixed** inner sheath 26040 XA with ceramic insulation, for use with Working Elements 26050 E, 26050 D, 26050 V and 26050 EB, color code: yellow

or

26050 SC **Resectoscope Sheath**, including connecting tubes for in- and outflow, 26 Fr., oblique beak, inner tube with ceramic insulation, **quick release lock**, for use with resectoscope working elements 26050 E, 26050 D, 26050 V, 26040 EB and 26040 DB, color code: yellow

26040 OC **Standard Obturator**, for use with Resectoscope Sheaths 26040 SL, 26050 SL and 26050 SC, color code: yellow

Basic Instrument Set for Operative Hysteroscopy, 26 Fr.

Bipolar Working Element Set



26040 EB

26040 EBH **Working Element Set**, bipolar,
Cutting by means of a spring. Movable thumb support.
In rest position the electrode tip is inside the sheath,
including:

- Working element**, bipolar
- 2x **Cutting loop**, bipolar
- Coagulation Electrode**, bipolar, pointed
- HALF MOON Coagulation Electrode**, bipolar, ball end
- High frequency cable**, bipolar
- Protection tube**

Bipolar Electrodes (24 Fr.), for use with 26040 EBH



26040 GP



26040 GP **Cutting Loop**, bipolar, large, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow



26040 BL **Coagulating Electrode**, bipolar, pointed, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow



26040 NB **HALF MOON Coagulation Electrode**, bipolar, ball-shaped, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow



26040 JB **Cutting Loop**, bipolar, straight, 24 Fr.,
for use with HOPKINS® II 26105 FA,
color code: yellow



280

280 **Protection Tube**, for sterilization and storage of
electrodes, curettes and knives

Basic Instrument Set for Operative Hysteroscopy, 26 Fr. Unipolar Working Element Set



- 26050 EG **Working Element Set**,
Cutting by means of a spring. Movable thumb ring.
In rest position the tip of the electrode is inside the sheath,
including:
Working Element
Cutting Loop, angled
Coagulating Electrode, ball end, diameter 3 mm
Coagulating Electrode, ball end, diameter 5 mm
Coagulating Needle Electrode, angled
2x **Unipolar High Frequency Cord**
Protection Tube

Unipolar Electrodes (24 Fr.), for use with 26050 EG

- | | | |
|-------------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------|
|  | 26050 G | Cutting Loop , unipolar, angled, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 J | Cutting Loop , unipolar, straight, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 N | Coagulating Electrode , unipolar, ball end, diameter 3 mm,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 NK | Coagulating Electrode , unipolar, ball end, diameter 5 mm,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 NX | Roller Electrode , unipolar, cylindrical, diameter 3 mm,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 NW | Roller Electrode , unipolar, cylindrical, diameter 5 mm,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 XH | Needle Electrode , unipolar, angled, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 GR | LOZZI Needle Electrode , unipolar, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |
|  | 26050 L | Coagulating Electrode , unipolar, pointed, 24 Fr.,
for use with HOPKINS® II Telescope 26105 FA,
color code: yellow |

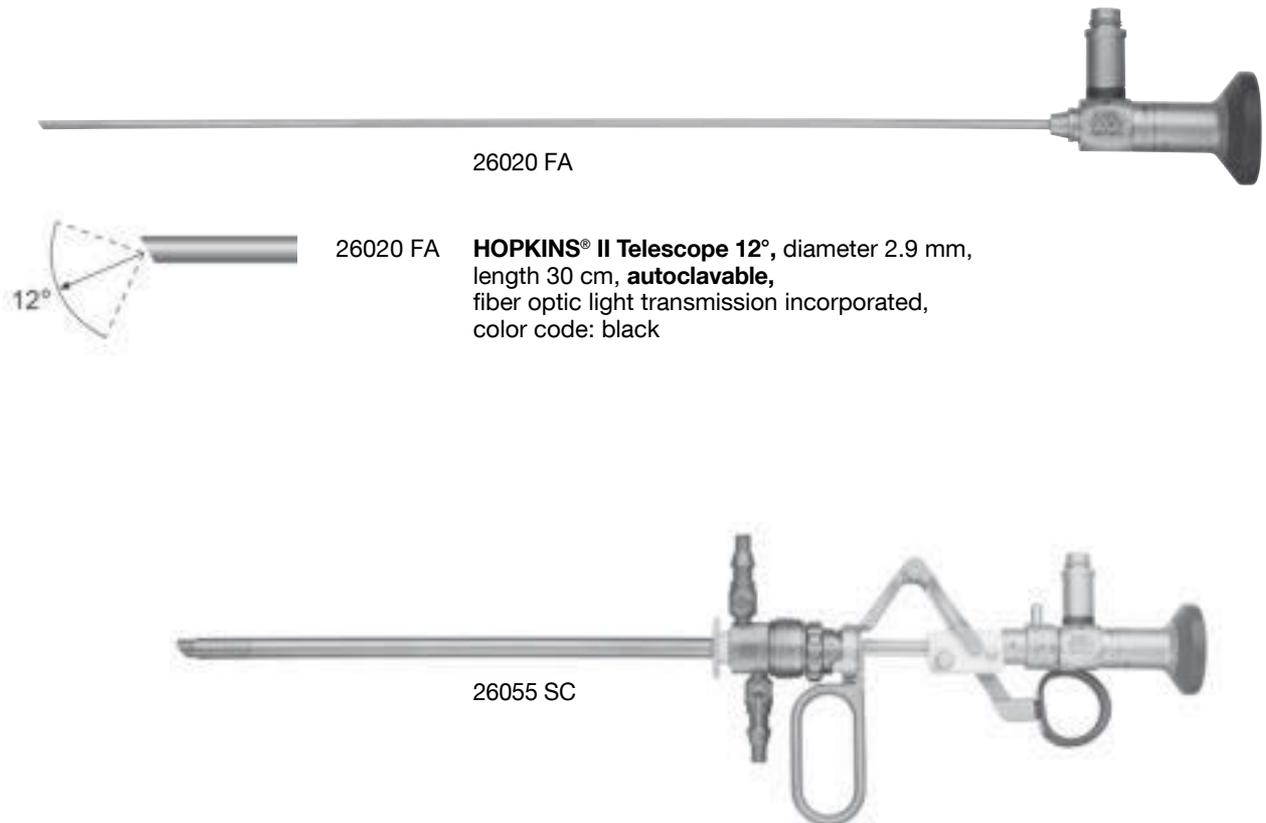


280

- 280 **Protection Tube**, for sterilization and storage of
electrodes, curettes and knives

Basic Instrument Set for Operative Hysteroscopy, 22 Fr.

Slender Resectoscopes for intrauterine HF-Surgery



26020 FA



26020 FA

HOPKINS® II Telescope 12°, diameter 2.9 mm, length 30 cm, **autoclavable**, fiber optic light transmission incorporated, color code: black

26055 SC

26055 SL **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 22 Fr., oblique beak, **fixed** inner sheath 26055 XB with ceramic insulation, for use with working element 26055 E, color code: white

or

26055 SC **Resectoscope Sheath**, including connecting tubes for in- and outflow, 22 Fr., oblique beak, inner tube with ceramic insulation, **quick release lock**, for use with resectoscope working element 26055 E color code: white

or

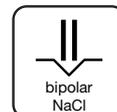
26055 LD **Resectoscope Sheath**, including connecting tube for in- and outflow, for continuous irrigation and suction, 22 Fr., oblique beak, **rotatable** sheath tube 26055 XE with ceramic insulation, for use with working element 26055 E, color code: white

26055 BO **Resectoscope Sheath**, with LUER-Lock stopcock, including connecting tube for inflow, 19 Fr., oblique beak, with Obturator 26055 CO, color code: white

26055 CO **Standard Obturator**, for use with resectoscope sheaths 26055 SL/SC/LD color code: white

Basic Instrument Set for Operative Hysteroscopy, 22 Fr. ^{NEW}

Bipolar Slender Working Element Set



26055 EBH

26055 EBH **Working Element Set**, bipolar,
(Cutting by means of a spring. Movable thumb support.
In resting position, the electrode tip is inside the sheath)
including:

Working element, bipolar
2x **Cutting loop**, bipolar
Coagulation Electrode, bipolar, pointed
HALF MOON Coagulation Electrode, bipolar, ball end
High frequency cable, bipolar
Protection tube
Connector with tube

Bipolar Electrodes (21 Fr.), for use with 26055 EBH



26055 GP **Cutting Loop**, bipolar, 21 Fr.,
for use with HOPKINS® II telescope 26020 FA,
color code: white



26055 NB **HALF MOON Coagulation Electrode**, bipolar, ball end, 21 Fr.,
for use with HOPKINS® II telescopes 26020 FA,
color code: white



26055 BL **Coagulation Electrode**, bipolar, pointed, 21 Fr.,
for use with HOPKINS® II telescopes 26020 FA,
color code: white



280

280 **Protection Tube**, for sterilization and storage of
electrodes, curettes and knives

Basic Instrument Set for Operative Hysteroscopy, 22 Fr.
Unipolar Slender Working Element Set



26055 ES **Working Element Set**, unipolar,
 (Cutting by means of a spring. Movable thumb support.
 In resting position, the electrode tip is inside the sheath)
 including:
Working Element
 2x **Cutting Loop**, angled
Coagulating Electrode, pointed
Coagulating Electrode, ball end, diameter 3 mm
 2x **High Frequency Cord**
Protecting Tube

Unipolar Electrodes (21 Fr.), for use with 26055 ES

-  26055 G **Cutting Loop**, angled
-  26055 H **Cutting Loop**, angled 25°
-  26055 N **Coagulating Electrode**, ball end, diameter 3 mm
-  26055 L **Coagulating Electrode**, pointed
-  26055 RK **Roller Electrode**, barrel end, diameter 3 mm
-  26055 SG **VaporCut® Electrode**
-  26055 JG **LIN Cutting Loop**, straight, wire diameter 0.8 mm



280

280 **Protection Tube**, for sterilization and storage of
 electrodes, curettes and knives

Unique benefits of the KARL STORZ TELE PACK X at a glance ^{NEW}



Crystal clear image

- 15" LCD monitor
- Rotatable image display
- 24 Bit color intensity for natural color rendition
- DVI video input for pristine picture quality
- DVI video output for connecting HD monitors

Easy control combined with highest safety

- Membrane keyboard approved for wiping disinfection
- Hot-Keys assuring fast and direct adjustment
- Arrow keys for intuitive control
- Pedal control available

Flexible storage possibilities

- SD card-slot allows high storage capacity
- USB-slot for external HDDs and flash drives
- Picture gallery for records
- Playback of saved videos
- Print-ready patient report documentation

Additional information

- Sturdy, portable casing
- Ergonomic design allows comfortable transport
- Universal power supply unit: 100–240 VAC, 50/60 Hz
- Measurement (H x W x D): 450 mm x 350 mm x 150 mm
- Weight: 7 kg

Natural illumination

- Hi-Lux 50 Watt high-performance light source
- Natural colour rendition close to sunlight with a colour temperature of 5700 K
- Up to 1000 hours lamp operating time

Ordering Information

200450 01-EN TELE PACK X

Endoscopic video unit for use with KARL STORZ TELECAM 1-Chip Camera Heads and KARL STORZ Video Endoscopes, incl. 50 W Hi-Lux Light Source, integrated Image Processing Module, 15" LCD TFT Display, USB/SD-Card Storage Module, Color System PAL/NTSC, power supply: 100–240 VAC, 50/60 Hz including power cable, USB flash drive, keyboard with touch pad, US-English character set

Unique benefits of the KARL STORZ TELE PACK X at a glance

Compatible camera heads

202120 40	PAL	TELECAM One-Chip Camera Head, autoclavable , with integrated Parfocal Zoom Lens , f = 14 – 28 mm (2x), 2 freely programmable camera head buttons, including plastic container for sterilization
202121 40	NTSC	
202120 30	PAL	TELECAM One-Chip Camera Head, with integrated Parfocal Zoom Lens , f = 25 – 50 mm (2x), 2 freely programmable camera head buttons
202121 30	NTSC	
202120 34	PAL	TELECAM C-Mount One-Chip Camera Head, 2 freely programmable camera head buttons
202121 34	NTSC	
202120 32	PAL	TELECAM-B Beamsplitter One-Chip Camera Head with 2 freely programmable camera head buttons and rotating CCD sensor , f = 25 mm
202121 32	NTSC	
202120 31	PAL	TELECAM-B Beamsplitter One-Chip Camera Head with 2 freely programmable camera head buttons and rotating CCD sensor , f = 30 mm
202620 30	PAL	DCI® II One-Chip Camera Head, f = 16 mm, with for use with DCI® HOPKINS® telescopes
202621 30	NTSC	

Compatible Video-Endoscopes

ENT		
11101 VP	PAL	Video Rhino-Laryngoscope
11101 VN	NTSC	
Pneumology		
11900 BP	PAL	Video Bronchoscope
11900 BN	NTSC	
Urology		
11272 VP	PAL	Video-Cysto-Urethroscope
11272 VN	NTSC	
11272 VPU	PAL	
11272 VNU	NTSC	

Unique benefits of the KARL STORZ TELE PACK X at a glance

Accessories

	<p>20 2000 43 C-Mount Lens, f = 38 mm 20 2000 42 C-Mount Lens, f = 30 mm 20 2301 41 C-Mount Lens, f = 25 mm 20 2301 45 C-Mount Lens, f = 12 mm</p>
	<p>81131021 Spare Lamp, 50 Watt</p>
	<p>200142 30 One-pedal-Footswitch, digital, two stage</p>
	<p>200143 30 Two-pedal Footswitch, one step</p>

Fiberscope adaptors for other manufacturers

 <p>29020 GM</p>  <p>29020 GN</p>	<p>29020 GM Adaptor for Machida fiberscopes</p> <p>29020 GN Adaptor for Olympus fiberscopes, new type</p>
 <p>29020 GO</p>  <p>29020 GP</p>	<p>29020 GO Adaptor for Olympus fiberscopes, old type</p> <p>29020 GP Adaptor for Pentax and Fujinon fiberscopes</p>

IMAGE 1 HUB™ HD

FULL HD Camera Control Unit



- Maximum resolution and the consistent use of the 16:9 aspect ratio guarantee FULL HD (High Definition)
- Endoscopic camera systems are equipped with three CCD chips that support the 16:9 input format as well as capturing images with a resolution of 1920 x 1080 pixels

The benefits of FULL HD (High Definition) for medical applications are:

- High input resolution of the camera head delivers more detail and depth of field with natural color rendition
- Using 16:9 format during image acquisition enlarges the field of view
- The 16:9 format of the widescreen monitor supports ergonomic viewing
- Enhanced color brilliance for optimal diagnosis
- Progressive scan technology provides a steady, flicker-free display and helps eliminate eyestrain and fatigue



22201011U1XX

22201011U1

IMAGE 1 HUB™ HD Camera Control Unit SCB

for use with IMAGE 1 FULL HD and IMAGE 1 standard one- and three-chip camera heads, max. resolution 1920 x 1080 pixels, with integrated **KARL STORZ-SCB** and digital Image Processing Module, color systems **PAL/NTSC**, power supply 100 – 240 VAC, 50/60 Hz

including:

Mains Cord

BNC/BNC Video Cable

S-Video (Y/C) Connecting Cable

Special RGBS Connecting Cable

2x Connecting Cable, for controlling peripheral units

DVI-D Connecting Cable

SCB Connecting Cable

Keyboard, with US English character set

22201011U102

IMAGE 1 HUB™ HD Camera Control Unit SCB, with SDI module

for use with IMAGE 1 FULL HD and IMAGE 1 standard one- and three-chip camera heads, max. resolution 1920 x 1080 pixels, **with integrated SDI (Serial Digital Interface) module**, **KARL STORZ-SCB** and digital Image Processing Module, color systems **PAL/NTSC**, power supply 100 – 240 VAC, 50/60 Hz

including:

Mains Cord

BNC/BNC Video Cable

S-Video (Y/C) Connecting Cable

Special RGBS Connecting Cable

2x Connecting Cable, for controlling peripheral units

DVI-D Connecting Cable

SCB Connecting Cable

Keyboard, with US English character set

IMAGE 1 HUB™ HD

FULL HD Camera Control Unit



222010 11U11X

222010 11U110 IMAGE 1 HUB™ HD Camera Control Unit SCB, with ICM module

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

Mains Cord

BNC/BNC Cable

S-Video (Y/C) Connecting Cable

Special RGBS Connecting Cable

2x **Connecting Cable**, for controlling peripheral units

DVI-D Connecting Cable

SCB Connecting Cable

Keyboard, with US English character set

2x **KARL STORZ USB Stick**, 4 GB

222010 11U112 IMAGE 1 HUB™ HD Camera Control Unit SCB, with SDI/ICM module

for use with IMAGE 1 FULL HD and IMAGE 1 standard one- and three-chip camera heads, max. resolution 1920 x 1080 pixels, **with integrated ICM (Image Capture Module) and SDI (Serial Digital Interface) modules, KARL STORZ-SCB** and integrated digital Image Processing Module, color systems **PAL/NTSC**, power supply 100 – 240 VAC, 50/60 Hz including:

including:

Mains Cord

BNC/BNC Video Cable

S-Video (Y/C) Connecting Cable

Special RGBS Connecting Cable

2x **Connecting Cable**, for controlling peripheral units

DVI-D Connecting Cable

SCB Connecting Cable

Keyboard, with US English character set

2x **KARL STORZ USB Stick**, 4 GB

Specifications:

Signal-to-noise ratio	IMAGE 1 HUB™ HD, three-chip camera systems ≥ 60 dB
AGC	Microprocessor-controlled
Video output	- FULL HD signal to DVI-D socket (2x) - SDI signal to BNC socket, (only IMAGE 1 HUB™ HD with SDI module (2x)) - RGBS signal to D-Sub socket - S-Video to 4-pin Mini-DIN socket (2x) - Composite signal to BNC socket
Input	Keyboard for title generator, 5-pin DIN socket

Control output/input	- KARL STORZ-SCB to 6-pin socket Mini-DIN socket (2x) - 3.5 mm stereo jack plug (ACC 1, ACC 2), - Serial port at RJ-11 - USB port (only IMAGE 1 HUB™ HD with ICM) (2x)
Dimensions w x h x d	305 x 89 x 335 mm
Weight	3.35 kg
Power supply	100–240 VAC, 50/60 Hz
Certified to:	IEC 601-1, 601-2-18, CSA 22.2 No. 601, UL 2601-1 and CE acc. to MDD, protection class 1/CF defibrillation-safe

IMAGE 1 HD

FULL HD Camera Control Unit



222020 11U1XX

222020 11U110 IMAGE 1 HD Camera Control Unit SCB, with ICM module

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

including:

Mains Cord

2x **Connecting Cable**, for controlling peripheral units

DVI-D Connecting Cable

SCB Connecting Cable

Keyboard, with US English character set

2x **KARL STORZ USB Stick**, 4 GB

222020 11U1 IMAGE 1 HD Camera Control Unit SCB

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

including:

Mains Cord

2x **SCB Connecting Cable**

DVI-D Connecting Cable

Connecting Cable, for controlling peripheral units

Keyboard, with US English character set

Specifications:

Signal-to-noise ratio	IMAGE 1 HD, three-chip camera systems ≥ 60 dB
AGC	Microprocessor-controlled
Video output	FULL HD Signal to DVI-D socket
Input	Keyboard for title generator, 5-pin DIN socket
Control output/input	- USB port (only IMAGE 1 HD with ICM) (2x) - Serial port at RJ-11 - 3.5 mm stereo jack plug (ACC 1, ACC 2) - KARL STORZ-SCB to 6-pin socket Mini-DIN socket (2x)

Dimensions w x h x d	305 x 89 x 335 mm
Weight	3.35 kg
Power supply	100–240 VAC, 50/60 Hz
Certified to	IEC 601-1, 601-2-18, CSA 22.2 No. 601, UL 2601-1 and CE acc. to MDD, protection class 1/CF defibrillation-safe

IMAGE 1 HUB™ HD

FULL HD Camera Heads



22220055-3

22220055-3 50 Hz 60 Hz IMAGE 1 H3-Z Three-Chip FULL HD Camera Head

max. resolution 1920 x 1080 pixels, progressive scan, soakable, gas- and plasma-sterilizable, with integrated Parfocal Zoom Lens, focal length $f = 15 - 31$ mm (2x), 2 freely programmable camera head buttons

Specifications:

IMAGE1 FULL HD Camera Heads	H3-Z
50 Hz	22220055-3 (50/60 Hz)
60 Hz	–
Image sensor	3x 1/8" CCD chip
Pixel output signal H x V	1920 x 1080
Dimensions (w x h x l)	39 x 49 x 114 mm
Weight	270 g
Optical interface	integrated Parfocal Zoom Lens, $f = 15-31$ mm (2x)
Min. sensitivity	F 1.4/1.17 Lux
Grip mechanism	standard eyepiece adaptor
Cable	non-detachable
Cable length	300 cm



22220056-3

NEW

22220056-3 50 Hz 60 Hz IMAGE 1 H3-P Three-Chip FULL HD Pendulum Camera Head

with pendulum system and fixed focus, max. resolution 1920 x 1080 pixels, progressive scan, soakable, gas- and plasma-sterilizable, focal length $f = 16$ mm, 2 freely programmable camera head buttons, for use with color systems **PAL/NTSC**

Specifications:

IMAGE1 FULL HD Camera Heads	H3-P
50/60 Hz	22220056-3 (PAL/NTSC)
Image sensor	3x 1/8" CCD chip
Pixel output signal H x V	1920 x 1080
Dimensions (w x h x l)	35 x 47 x 88 mm
Weight	226 g
Optical interface	pendulum system, fixed focus $f = 16$ mm
Min. sensitivity	F 1.4/1.17 Lux
Grip mechanism	standard eyepiece adaptor
Cable	non-detachable
Cable length	300 cm

For use with IMAGE 1 HUB™ HD Camera Control Unit SCB 22201011U1xx and IMAGE1 HD Camera Control Unit SCB 22202011U1xx

IMAGE 1 HUB™ HD ^{NEW}
FULL HD Camera Heads – autoclavable



22 2200 61-3

22 2200 61-3 50 Hz IMAGE 1 H3-ZA
60 Hz Three-Chip FULL HD Camera Head

autoclavable, max. resolution 1920 x 1080 pixels, progressive scan, soakable, gas- and plasma-sterilizable, with integrated Parfocal Zoom Lens, focal length f = 15 – 31 mm (2x), 2 freely programmable camera head buttons, for use with color systems **PAL/NTSC**



22 2200 60-3

22 2200 60-3 50 Hz IMAGE 1 H3-FA
60 Hz Three-Chip FULL HD Camera Head

autoclavable, max. resolution 1920 x 1080 pixels, progressive scan, soakable, gas- and plasma-sterilizable, **fixed focus**, focal length f = 17 mm, 2 freely programmable camera head buttons, for use with color systems **PAL/NTSC**

Specifications:

IMAGE 1 FULL HD Camera Heads	H3-ZA	H3-FA
50 Hz	22 2200 61-3 (50/60 Hz)	22 2200 60-3 (50/60 Hz)
Image sensor	3x 1/3" CCD chip	3x 1/3" CCD chip
Pixels output signal H x V	1920 x 1080	1920 x 1080
Dimensions (w x h x l)	39 x 49 x 100 mm	39 x 49 x 93 mm
Weight	299 g	261 g
Optical interface	integrated Parfocal Zoom Lens, f = 15-31 mm	fixed focus f = 17 mm
Min. sensitivity	F 1.4/1.17 Lux	F 1.4/1.17 Lux
Grip mechanism	standard eyepiece adaptor	standard eyepiece adaptor
Cable	non-detachable	non-detachable
Cable length	300 cm	300 cm

For use with IMAGE 1 HUB™ HD Camera Control Unit SCB 22 2010 11-1xx and IMAGE 1 HD Camera Control Unit SCB 22202011-1xx



39301 Z3TS Plastic Container for Sterilization and Storage of camera heads **IMAGE1 H3-Z, H3-ZA and H3-FA**, **autoclavable**, suitable for use with steam, gas and hydrogen peroxide sterilization, Sterrad® compatible, external dimensions (w x d x h): 385 x 255 x 75 mm

Please note: The instrument displayed is not included in the plastic container.

Only camera heads marked “autoclave” can be placed in the tray for steam sterilization.



NEW 39301 PHTS Plastic Container for Sterilization and Storage of camera heads **IMAGE1 H3-P and H3-ZI**, **autoclavable**, suitable for use with steam, gas and hydrogen peroxide sterilization, Sterrad® compatible, external dimensions (w x d x h): 385 x 255 x 75 mm

Please note: The instrument displayed is not included in the plastic container.

Only camera heads marked “autoclave” can be placed in the tray for steam sterilization.

KARL STORZ FULL HD Monitors ^{NEW}



9619 NB



9626 NB/NB-2

KARL STORZ HD and FULL HD Monitors	19"	26"	26"
Wall-mounted with VESA 100 adaption	9619 NB	9626 NB	9626 NB-2
Inputs:			
DVI-D	1x	1x	2x
Fiber Optic	optional	optional	optional
RGBS/VGA	1x	1x	2x
S-Video	1x	1x	2x
Composite/FBAS	1x	1x	2x
Outputs:			
DVI-D	●	●	●
S-Video	●	●	●
Composite/FBAS	●	●	●
Signal Format Display:			
4:3	●	●	●
5:4	●	●	●
16:9	●	●	●
Picture-in-Picture	●	●	●
PAL/NTSC compatible	●	●	●

The following accessories are included:

Mains Cord

External 24VDC Power Supply

Signal cables: DVI-D, BNC

Optional accessories:

9626 SF Pedestal, for 96XX monitor series

Specifications:

KARL STORZ FULL HD Monitors	19"	26"
Desktop with pedestal	optional	optional
Wall-mounted with 100 adaption	9619 NB	9626 NB/NB-2
Brightness	280 cd/m ²	400 cd/m ²
Max. viewing angle	178° vertical	178° vertical
Pixel distance	0.29 mm	0.30 mm
Reaction time	12 ms	12 ms
Contrast ratio	700:1	700:1
Mount	100 mm VESA	100 mm VESA
Weight	10 kg	14 kg
Rated power	120 W	120 W
Operating conditions	0–40°C	0–40°C
Storage	-20–60°C	-20–60°C
Rel. humidity	max. 80%	max. 80%
Dimensions w x h x d	469.5 x 416 x 75.5 mm	699 x 445.6 x 87.5 mm
Power supply	85–264 VAC	85–264 VAC

**KARL STORZ HD, HD WIDEVIEW™
and HD LED Backlight Monitors**



9524 NB, 9526 NBL, 9726 NB

	TFT Flat Screens		HD WIDEVIEW Monitors		
	15"	19"	24"	26"	
Wall-mounted with VESA 100 adaption	9515 NB	9519 NB	9524 NB	9526 NBL	9726 NB
Inputs:					
SDI	●	●	–	–	–
HD-SDI	●	●	●	●	●
3G-SDI	–	–	–	●	●
RGBS	●	●	●	●	●
S-Video	●	●	●	●	●
Composite/FBAS	●	●	●	●	●
SOG	–	●	●	●	●
DVI-D	●	●	●	●	●
Fiber Optic	–	–	–	–	●
VGA	●	●	●	●	●
Outputs:					
SDI	–	●	●	●	●
HD-SDI	–	●	●	●	●
3G-SDI	–	–	–	●	●
RGBS	–	●	●	●	●
S-Video	–	●	●	●	●
Composite/FBAS	–	●	●	●	●
DVI-D	–	●	●	●	●
Signal Format Display:					
4:3	●	●	●	●	●
5:4	–	●	●	●	●
16:9	–	–	●	●	●
16:10	–	–	●	–	–
Picture-in-Picture	–	●	●	●	●
PAL/NTSC compatible	●	●	●	●	●

The following accessories are included:

- Mains Cord
- External 24VDC Power Supply
- Signal cables

Optional accessories:

9526 SF Pedestal for 15", 19", 24" and 26" monitors from the 95XX- and 97XX-series

KARL STORZ HD, HD WIDEVIEW™ and HD LED Backlight Monitors



Specifications:

Wall-mounted with VESA 100 adaption	15"	19"	24"	26"	26"
	9515 NB	9519 NB	9524 NB	9526 NBL	9726 NB
Brightness	430 cd/m ²	300 cd/m ²	400 cd/m ²	400 cd/m ²	800 cd/m ²
Max. viewing angle	178° vertical	178° vertical	178° vertical	178° vertical	178° vertical
Pixel distance	0.297 mm	0.294 mm	0.270 mm	0.3 mm	0.3 mm
Reaction time	10–15 ms	10–16 ms	5–12 ms	8 ms	8 ms
Contrast ratio	500:1	600:1	1000:1	1000:1	1000:1
Mount	100 mm VESA	100 mm VESA	100 mm VESA	100 mm VESA	100 mm VESA
Weight	4.8 kg	6.8 kg	7.3 kg	7.3 kg	8.2 kg
Rated power	40 Watt	65 Watt	115 Watt	60 Watt	130 Watt
Operating conditions	0–40 °C	0–38 °C	0–40 °C	0–40 °C	0–40 °C
Storage	-20–60 °C	-20–60 °C	-20–60 °C	-20–60 °C	-20–60 °C
Rel. humidity	5–85%, non-condensing	5–85%, non-condensing	20–85%, non-condensing	20–85%, non-condensing	20–85%, non-condensing
Dimensions w x h x d	386 x 302 x 81 mm	465 x 400 x 98 mm	597 x 401 x 100 mm	73 x 418 x 88 mm	673 x 418 x 88 mm
Power supply	100–240 VAC	100–240 VAC	100–240 VAC	100–240 VAC	100–240 VAC

9515 NB ^{NEW} 15" Monitor

Wall-mounted with VESA 100 adaption, color systems **PAL/NTSC**, max. screen resolution 1024 x 768, power supply 100 – 240 VAC, 50/60 Hz

including:

Power Supply

Mains Cord

Signal cables: S-Video (Y/C), DVI-D

9519 NB 19" HD Monitor

Wall-mounted with VESA 100 adaption, color systems **PAL/NTSC**, max. screen resolution 1280 x 1024, power supply 100 – 240 VAC, 50/60 Hz

including:

Power Supply

Mains Cord

Signal cables: DVI-D, BNC

9524 NB 24" HD WIDEVIEW Monitor

Wall-mounted with VESA 100 adaption, color systems **PAL/NTSC**, max. screen resolution 1920 x 1200, image format 16:10, power supply 100 – 240 VAC, 50/60 Hz

including:

Power Supply

Mains Cord

Signal cables: DVI-D, BNC

LED Backlight Monitors ^{NEW}

9526 NBL 26" HD Monitor with LED Backlight

Wall-mounted with VESA 100 adaption, color systems **PAL/NTSC**, max. screen resolution 1920 x 1080, image format 16:10, power supply 100 – 240 VAC, 50/60 Hz

including:

Power Supply

Mains Cord

Signal cables: DVI-D, BNC

9726 NB 26" HD Monitor (Highbright with LED Backlight)

Wall-mounted with VESA 100 adaption, optical input, color systems **PAL/NTSC**, max. screen resolution 1920 x 1080, image format 16:10, power supply 100 – 240 VAC, 50/60 Hz

including:

Power Supply

Mains Cord

Signal cables: DVI-D, BNC

Cold Light Fountain XENON 300 SCB



- 20133101-1 Cold Light Fountain XENON 300 SCB**
with built-in antifog air-pump, and integrated
KARL STORZ Communication Bus System SCB
power supply:
100–125 VAC/220–240 VAC, 50/60 Hz
including:
Mains Cord
Silicone Tubing Set, autoclavable, length 250 cm
SCB Connecting Cord, length 100 cm
- 20133027 Spare Lamp Module XENON**
with heat sink, 300 watt, 15 volt
- 20133028 XENON Spare Lamp**, only,
300 watt, 15 volt

Fiber Optic Light Cable



- 495 NT Fiber Optic Light Cable**,
diameter 2.5 mm, length 180 cm
- 495 NL Same**, diameter 3.5 mm

HAMOU MICRO-HYSTEROFLATOR®

for Distension of the Cavum Uteri with CO₂ Insufflation,
Recommended System Configuration

Special features:

- Simple, fully automatic operation
- High degree of patient safety
- Clear, adjacent bar diagrams for set values and actual values allow easy monitoring of insufflation procedure
- Precision jog keys for precise preselection of values
- Optical and acoustic warning signals in case of patient overpressure
- Electrically controlled gas refill (i.e. caused by loss of gas while changing instruments)
- SCB model with connections to the KARL STORZ Communication Bus (KARL STORZ-SCB)



26431520-1

26431508-1 HAMOU MICRO-HYSTEROFLATOR®
with **KARL STORZ-SCB**,
power supply 100 – 240 VAC, 50/60 Hz
including:

Mains Cord

Silicone Tubing Set, sterilizable

Universal Wrench

SCB Connecting Cable, length 100 cm

* **CO₂/N₂O Gas Filter**, for single use, sterile,
package of 10

Specifications:

Gas Flow	Pressure in steps of 25 mmHg	Gas	Measuring/Control System	Power Supply
0-100 ml/min	0-200 (0-26600 Pa) mmHg	CO ₂	electronic	100-240 VAC, 50/60 Hz
Parameter Display	Dimensions w x h x d (mm)	Weight (kg)	Certified to	
- Gas bottle pressure gauge - Intrauterine pressure: 0-200 (0-26600 Pa) (mmHg) - Gas flow 0-100 ml/min - Gas load	305 x 164 x 233	6	IEC 601-1, CE acc. to MDD	



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

HAMOU ENDOMAT® with KARL STORZ SCB

Suction and Irrigation System



26331101-1 HAMOU ENDOMAT® SCB

with integrated SCB-module, power supply: 100 – 240 VAC, 50/60 Hz, system requirements: SCB control NEO system with integrated SCB control NEO software release 20090001-45, or higher

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

* This product is marketed by **mtp**.

For additional information, please apply to:



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

HYSTEROMAT E.A.S.I.™



26340001-1 **HYSTEROMAT E.A.S.I.™ Set**,
power supply 100 – 240 VAC, 50/60 Hz,
HYSTEROMAT E.A.S.I.™: SCB ready,
compatible from RUI Release 44,

including:

Mains Cord

SCB Connecting Cable, length 100 cm

* **Basic Tubing Set**, for single use

Recommended accessories:

* 031717-10 **IRRIGATION tubing set**, for single use,
sterile, package of 10, for use with
KARL STORZ HYSTEROMAT E.A.S.I.™

* 031217-10 **SUCTION tubing set**, for single use,
sterile, package of 10, for use with
KARL STORZ HYSTEROMAT E.A.S.I.™

Optional accessories:

26340330 **Two-Pedal Footswitch**, one-stage, digital,
for use with HYSTEROMAT E.A.S.I.™

* This product is marketed by **mtp**.

For additional information, please apply to:



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

AUTOCON® II 400 SCB



2053520x-12x **AUTOCON® II 400**
with KARL STORZ SCB
including:
Mains Cord
SCB Connecting Cable, length 100 cm

20535201-125 **AUTOCON® II 400 High End, Set, SCB**
power supply 220 - 240 VAC, 50/60 Hz,
HF connecting sockets:
Bipolar combination, Multifunction,
Unipolar 3-pin + Erbe Neutral electrode
combination 6.3 mm, jack and 2-pin,
System requirements: SCB R-UI Software
Release 20090001-43 or higher
including:
AUTOCON® II 400, with KARL STORZ SCB
Mains Cord
SCB Connecting Cable, length 100 cm

Equipment Cart



- 29005 DRB **Equipment cart,**
rides on 4 antistatic dual wheels,
2 equipped with locking brakes (rear),
3 fixed shelves, 1 with handles,
mains switch in vertical beam,
1 drawer unit with lock,
integrated cable conduits in both
vertical beams,
1 set of non-sliding stands for units,
double rear panel with integrated
electrical subdistributors with 12 sockets,
holder for power supplies,
potential earth connectors and cable
winding on the outside, 1 camera holder,
2 equipment rails sidewise,

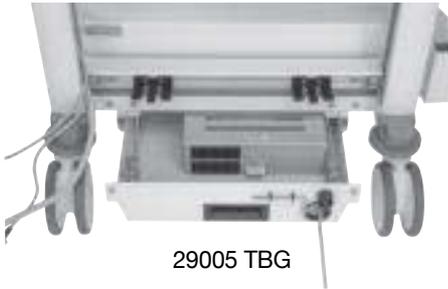
Dimensions:

*Equipment cart: 730 x 1490 x 716 mm (w x h x d),
shelf: 630 x 480 mm (w x d),
caster diameter: 150 mm*



- 29005 SZD **Monitor Swivel Arm,**
height and side adjustable,
can be turned to the left or the right side,
swivel range 180°, overhang 600 mm,
overhang from vertical beam 800 mm,
load capacity max. 14 kg,
with monitor fixation VESA 75/100,
for usage with equipment cart 29005 DRB

Recommended Accessories for Equipment Cart



29005 TBG

29005 TBG **Isolation Transformer**,
2000 VA, with 8 IEC- sockets,
8 potential earth connectors,
230 VAC (50/60 Hz)



29003 IW

29003 IW **Earth Leakage Monitor**,
for mounting at equipment cart,
for usage with isolation transformer
29005 TBG and 29003 TBK



29005 KKM

29005 KKM **Special Power Cord**,
length 100 cm,
with IEC- plug and socket,
with UL-approval,
for usage with isolation transformer
29005 TBG and 29003 TBK



29005 MZD

29005 MZD **Monitor Holding Arm**,
height and side adjustable,
swiveling and tilting,
centrally mountable, swivel range 190°,
overhang 300 mm,
load capacity max. 15 kg,
with monitor fixation VESA 75/100,
for usage with equipment cart 29005 DRB

Data Management and Documentation

KARL STORZ AIDA® compact NEO (HD/SD) Brilliance in documentation continues!

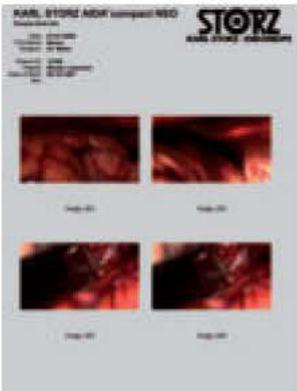
AIDA® compact NEO from KARL STORZ combines all the required functions for integrated and precise documentation of endoscopic procedures and open surgeries in a single system.



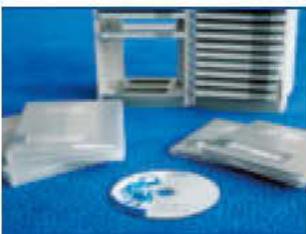
AIDA® compact NEO:
Voice control



AIDA® compact NEO:
Review screen



AIDA® compact NEO: Automatic creation of standard reports



AIDA® compact NEO:
Efficient archiving

Data Acquisition

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

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

Flexible post editing and data storage

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

Reliable storage of data

- Digital storage of all image, video and audio files on DVD, CD-ROM, USB stick, external/internal hard-drive or by archiving data to the hospital server via DICOM / H7
- Buffering ensures data backup if temporary storage is not possible
- Constant access to created image, video and audio files for medical documentation, patient records and for research and teaching purposes.

Efficient data archiving

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

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

Multisession and Multipatient

Efficient storage of data collected from multiple patients / multiple treatment sessions via DVD, CD-ROM or a USB stick.

Functions and capabilities

- Still images up to 1920 x 1080 can be taken with both systems (advanced/standard). Videos can be recorded at up to 1080p with the advanced version and up to 720p with the standard version (through HD-SDI)*
- Storage of audio files is available in both systems
- Includes DICOM/HL7 interface package
- Printing from the recording area (individual image with meta data)
- Burns DVDs, reads blue-ray
- AIDA® Restore Configuration supports the simple import and export of system settings
- Reference screen with new QuickView (favorite folder)
- Video settings (contrast, etc.) can be made separately for all channels
- GUI adjustment options
- Compressed DICOM
- Support of OR1™ CHECKLIST V1.1
- Improved support of 15" screens with OR1™ CHECKLIST installation
- Scalable watermark
- High-quality function and switching of image and video quality without going to settings
- Sterile, ergonomic operation via touch screen, camera head buttons, and/or foot switch
- Data export on DVD, CD ROM, or USB stick, multi-session and multi-patient network storage option
- Automated generation of standard reports
- Systems approved for use in the OR environment according to EN 60601-1
- Compatible with the KARL STORZ Communication Bus (SCB) and with KARL STORZ OR1™ AV NEO
- KARL STORZ AIDA® compact advanced/standard represents an attractive, digital alternative to video printers, video recorders, and dictation devices

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



20040912 KARL STORZ AIDA® compact NEO standard, documentation system for digital storage of still images, video sequences and audio files, power supply: 115/230 VAC, 50/60 Hz

20040913 KARL STORZ AIDA® compact NEO advanced, documentation system for digital storage of still images, video sequences and audio files power supply: 115/230 VAC, 50/60 Hz

Specifications:

Video Systems	- PAL - NTSC
Signal Inputs	- S-Video (Y/C) - Composite - RGBS – only in standard version - SDI - HD-SDI – only in standard version - DVI – only in standard version
Image Formats	- JPG - BMP

Video Formats	- MPEG2
Audio Formats	- WAV
Storage Media	- DVD+R - DVD+RW - DVD-R - DVD-RW - CD-R - CD-RW - USB stick

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