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We Pledge for Women's Health

Manual of

Endoscopy in Gynecology

Art of Keyhole Surgery

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CHAPTER

Equipment and Instruments for Gyne-endoscopy

Jyoti Mishra, Shakun Singh

INTRODUCTION

Endoscopy is a minimally invasive technique which has established its role in the last few decades. The technique demands expertise of the surgeon along with great dependency on instruments. Endovision system **(Fig. 1)** allows the surgeon to visualize the operating field on a monitor. Some of the deficiencies which one faces initially such as loss of depth perception, reduced tactile

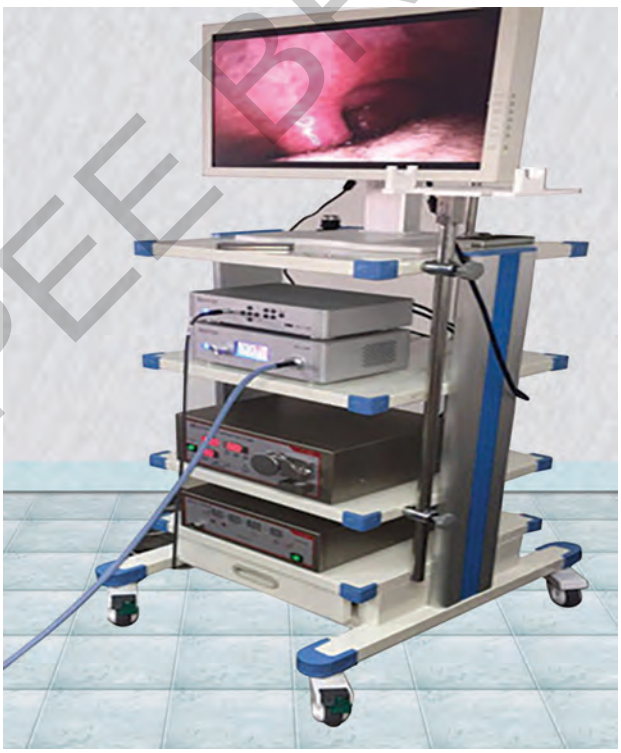

Fig. 1: Endovision system

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sensation, and improper hand eye coordination, can be overcome by magnification and angular view of telescope, long instrument and practice.

ENDOVISION SYSTEM

Laparoscope (Fig. 2)

Telescopes have a series of rod lenses in center with a rim of optical fibers on outer aspect. In pelvic surgery 10 mm and 5 mm telescopes are routinely used. Telescope of 5 mm transmits 10% lesser light then a 10 mm scope. Laparoscope can be 0°, 30° or 45°. Angled scope provides the ability to look into the deep spaces of pelvis, 30° giving the best view.

Video Camera (Fig. 3)

The criteria of a good camera are good resolution based on the number of lines or pixels and high quality of images. Laparoscopic video cameras are typically available in single-chip or three-chip configurations. Due to color

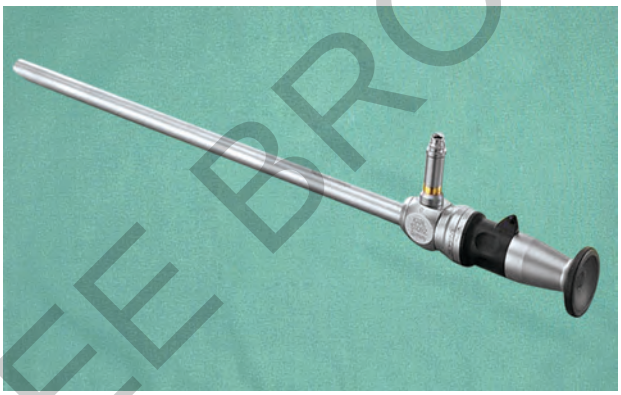

Fig. 2: Laparoscope

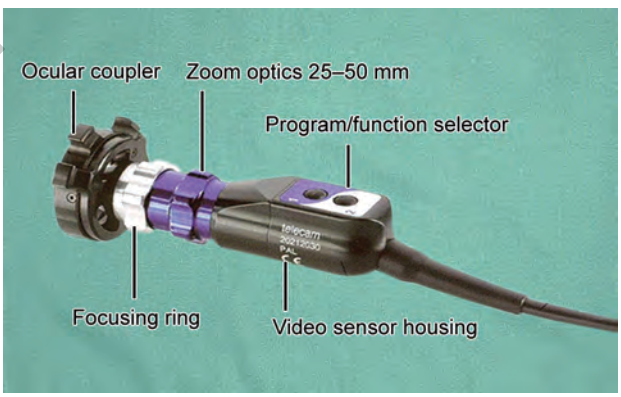

Fig. 3: Camera head

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interpolation of single-chip color camera, the user loses 30% of the resolution in case of fine details. The imaging system of a three-chip camera uses three separate charge-coupled devices (CCDs), each one receiving filtered red, green, or blue color, additive mixture of which can produce any color. Hence three-chip cameras, although more expensive, give a far better image then single chip.

Standard definition (SD) endoscopy system offers a 4:3 aspect ratio, 640 by 480 horizontal and vertical lines. The HD format provides a 16:9 aspect ratio, 1280 by 720 horizontal and vertical lines, which allows the user to distinguish finest structures. Prior to insertion into abdominal cavity white balance and focusing should be done.

Video Monitor

Medical monitors operate on principle of electronic horizontal linear scanning. Higher the line count, better the resolution and better the image quality. A ratio of 16:9 wide screen improves peripheral vision, image definition and colour brilliance.

Light Generator (Fig. 4)

Commonly used light sources are 250 watts halogen or 175–300 watts xenon light source. Xenon light source is more natural like daylight. A typical light source comprises of a lamp, heat filter, condensing lens, and manual or automatic intensity control circuit. LED light is white light with ability to work for 50,000 hours, in contrast to 500 working hours of traditional light sources.

Light Cable

It consists of fiber optic glass bundles diameter 3.5–6 mm and length 180–350 cm. It allows propagation of light by total internal reflection. Cables filled with



Fig. 4: Light generator

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fluid transmit more light but are less flexible. Fiber optic cables should be stored by folding in large loops and tight twisting should be avoided.

CO_2 Insufflators

It delivers CO_2 to the peritoneal cavity at a rate of 10–20 L/min to maintain a constant intra-abdominal pressure of 12–16 mm Hg. Intra-abdominal pressure can be preset before starting insufflation. Latest insufflators have gas heating, filtering, and humidifying system to maintain warm body core.

Electrosurgical Devices (Figs. 5 to 8)

Electrosurgical system is an essential part of endoscopy unit. It consists of a generator, cables, and hand instruments. Current used can be monopolar or

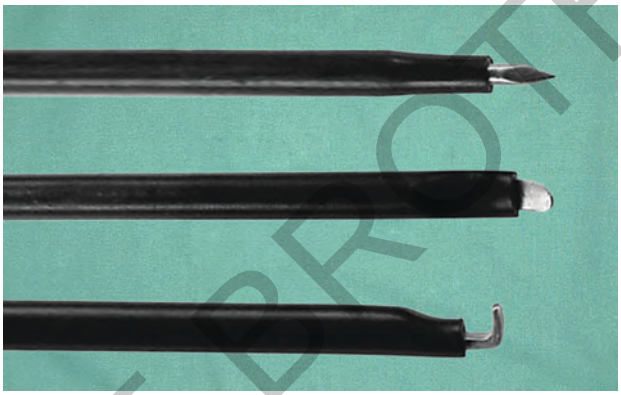

Fig. 5: Monopolar hand instruments—spatula and hook

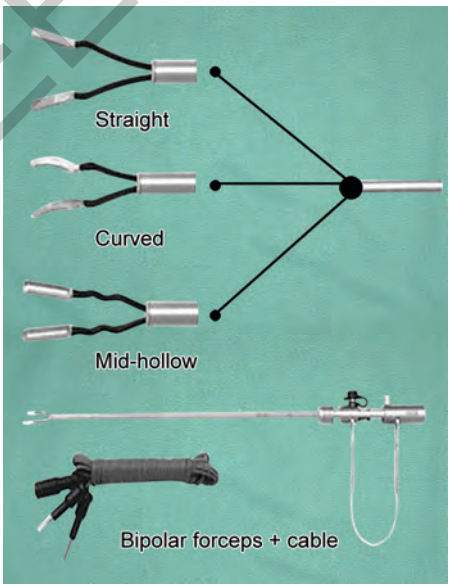

Fig. 6: Bipolar hand instrument and cable

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Fig. 7: Harmonic

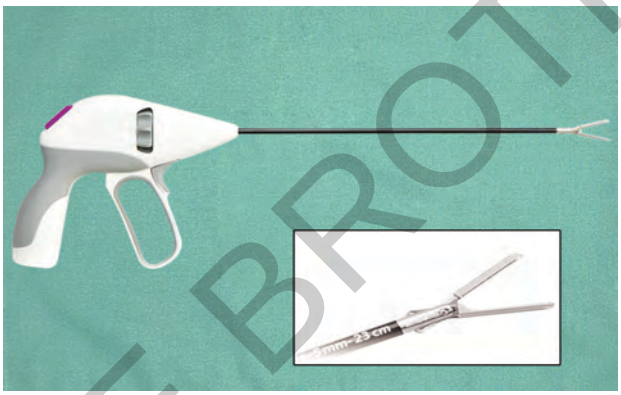

Fig. 8: LigaSure

bipolar. The basic difference is that in monopolar, the current passes from generator to the patient and then through the return plate to the generator. In bipolar, current passes only through the tissue within the jaws of the grasper. Hence the risk of current jumping to unintended areas and cautery burns is less with bipolar.

Monopolar hand instruments are hook, spatula, whereas bipolar is shaped like a grasper.

Newer devices are smart bipolar where the flow of current stops as the tissue resistance increases. Ultrasonic ace, (Harmonic) is another coagulating and cutting device which works on mechanical energy.

Veress Needle (Fig. 9)

It is used to create initial pneumoperitoneum before insertion of trocar. It has an outer hollow needle with a sharp beveled edge and inner, spring loaded retractable blunt obturator which comes forward once peritoneal cavity is entered. Needle patency adn spring action should always be checked before

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insertion. There are various tests available to check correct placement, out of which a low intra-abdominal pressure at the onset is most reliable.

Trocars (Fig. 10)

Trocars allow entry to intraperitoneal cavity once pneumoperitoneum is created. Most frequent sizes of trocars are 5 mm and 10 mm. Trocar can have either a blunt, pyramidal, or conical tip. Conical tips require a small incision, can pass through the tissues of abdominal wall by stretching rather than cutting, which leads to reduced patient discomfort and risk of hernia with shorter recovery time.

A gas-tight valve is located at the top of the trocar to allow instruments to be passed during a procedure without permitting the insufflated carbon dioxide escape, but require the use of both hands and can sometimes cause damage to instruments during insertion or removal if not fully opened. Trocars without a valve help in easy removal of tissue and avoid smudging of

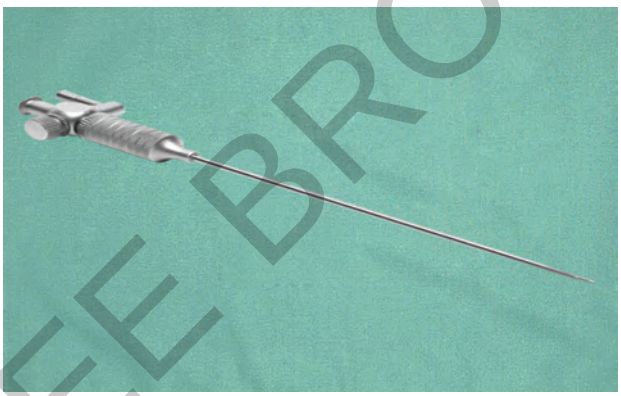

Fig. 9: Veress needle

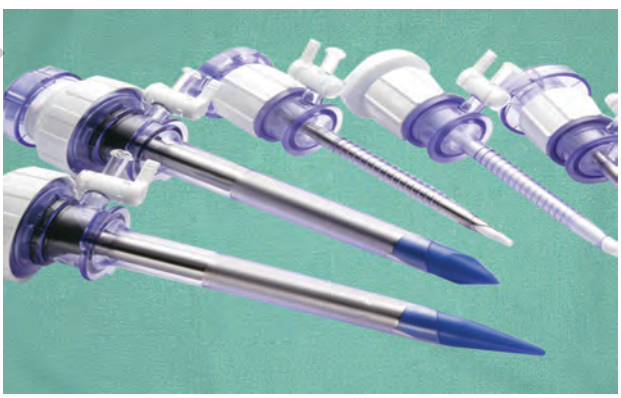

Fig. 10: Trocars

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telescope. Appropriate reducers are used when smaller instruments are used. Alternative technique is visually controlled entry by a visual 11 mm cannula and a 0° telescope that provide direct visualization of entry tract Optiview visual trocars.

Scissors and Graspers (Figs. 11 and 12)

Hand instruments can be dismantled into handle, insulated outer sheath and working insert. Handles can provide a 360° rotatory function. They are usually 36 cm in length. Standard scissors are straight, curved and hook type. Straight scissors are used for dividing tissues and cutting sutures. Curved scissors are used for fine dissection and hook type are used to transect duct, arteries or ligaments.



Fig. 11: Types of scissors



Fig. 12: Types of graspers

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Graspers commonly used in gynecological surgery are 5 mm in diameter. Specific design of distal tip may be traumatic or atraumatic, single action or double action. Handle may have a locking facility. Insulation of the instruments must be checked to prevent accidental electrical burns to other viscera.

Suction and Irrigation System (Fig. 13)

It is used for lavage of abdominal cavity and aspiration of clots to maintain vision in presence of blood, hydrodissection, aspiration of ovarian cyst contents. Attention should be paid to activate suction only when the tip is within the fluid, to prevent loss of pneumoperitoneum. Suction cannula should not be used to retract bowel, as it may cause perforation. Simple irrigation system is to suspend fluid from a stand and pressurize with a BP cuff.

Uterine Manipulator (Fig. 14)

They are used to manipulate uterus to expose the adnexa during laparoscopic gynecological procedures. Elevation of uterus helps in lateralizing the ureters and also delineates the margins for colpotomy.

Needle Holders (Fig. 15)

Laparoscopic suturing is a technically advanced skill, which involves very fine hand eye coordination. Needle holders come with a pistol, palm and finger grip, having seven locks for needle alignment. These may have curved tip or toothed end. One must select light weighed needle holders to avoid fatigue in long cases.

Morcellation (Fig. 16)

An electromechanical morcellator causes rapid removal of large specimen like fibroids or uterus in a piecemeal manner by a highly efficient motor and a cutting blade. One of the side ports is increased to accommodate 12–15 mm cannula. Trocar sleeve angular design protects surrounding tissue from blade

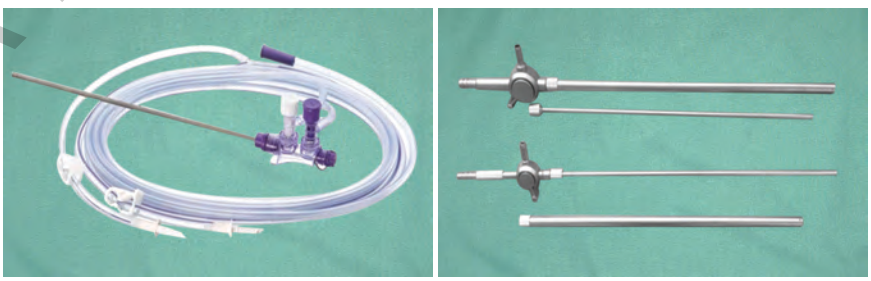

Fig. 13: Suction and irrigation system

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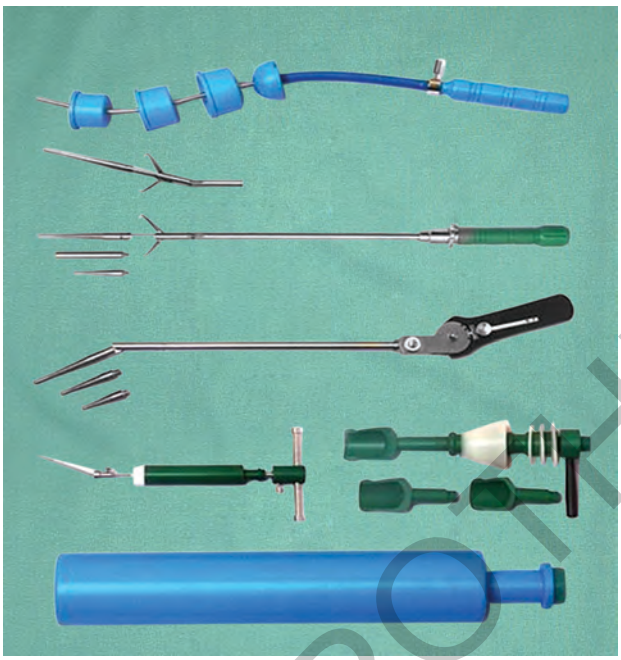

Fig. 14: Types of uterine manipulator

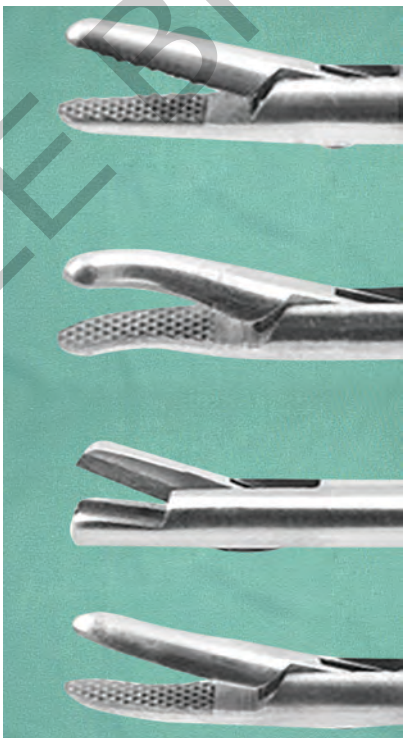

Fig. 15: Needle holders

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injury. Morcellation must be performed in a panoramic view, to avoid injury to neighboring organs.

Extraction Bags (Fig. 17)

These avoid dissemination (in case of endometriosis, malignant tumors, benign teratomas (chemical peritonitis). These are made of polyurethane and are strong enough to withstand pull of instruments while extracting and during morcellation. These can be rolled up in a sleeve and inserted through a 10 mm port.



Fig. 16: Morcellator



Fig. 17: Extraction bag

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Myoma Screw (Fig. 18)

It is used to give traction to myoma during myomectomy and to large uterus for manipulation purposes. Instruments where the screw is manufactured from the body, and not attached as a separate piece, last longer.

Hysteroscope

Commonly used hysteroscopes are 1.2, 2.5, and 4 mm diameter. The angel of view can be 0°, 12°, and 30° of which 30° is most commonly used.

Sheaths

One should use a continuous flow with inner and outer sheath to allow good visibility. Bettocchi scope uses a 2.9 mm hysteroscope with 3.6 mm inner and 4 mm outer sheath. Standard 4 mm hysteroscope needs a 5 mm diagnostic sheath.

It is better to use small diameter scopes in infertility clinics, where one can perform hysteroscopy without cervical dilatation.

Operating Hysteroscope (Fig. 19)

Consists of an operating sheath, channel for introducing 5 French (1.67 mm) operating instruments such as scissors, grasper, and biopsy forceps. Semi-rigid hand instruments are used for biopsy, polypectomy, and septum dissection.

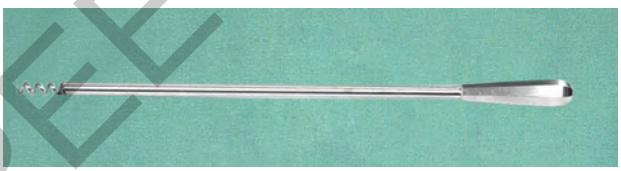

Fig. 18: Myoma screw

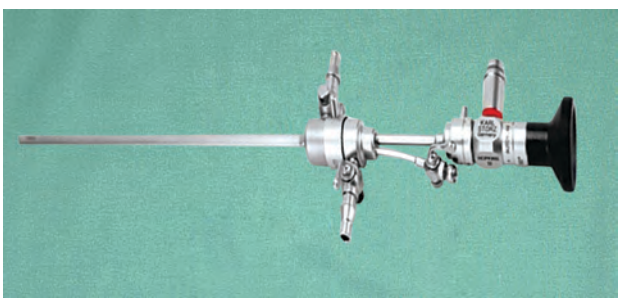

Fig. 19: Operating hysteroscope

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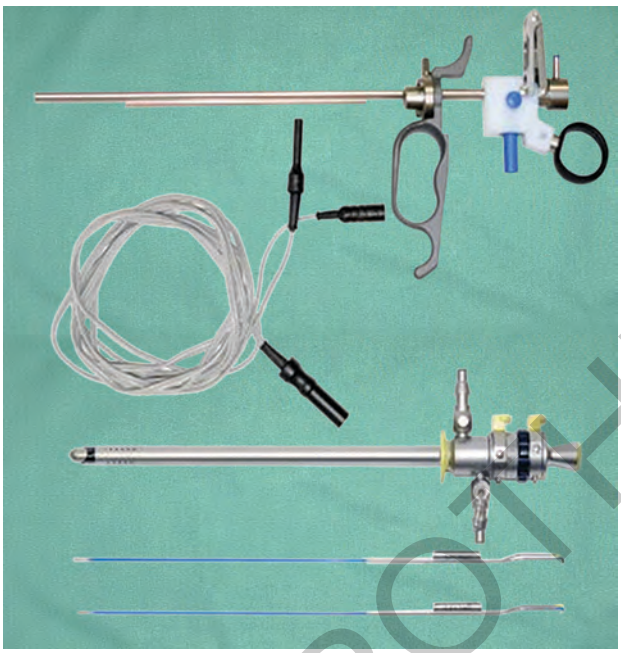

Fig. 20: Resectoscope

Resectoscope (Fig. 20)

Resectoscope has a diameter of 26 mm. It has an inner and outer sheath, working element and electrodes as loops, roller ball, and Collin's knife. A monopolar resectoscope should be used with glycine whereas a bipolar system can be used with saline, thus reducing the risk of fluid overload.

Distention System

Uterus is a muscular organ hence gravity is not enough to open the cavity. Hysteromat is an ideal system as it correctly maintains intrauterine pressure to around 70 mm Hg, thus preventing fluid overload and air embolism.

Hysteroscopic Morcellator

Hysteroscopic morcellator is newer device which involves mechanical energy for polyp removal. This device uses saline for distention and the entire tissue gets collection in suction bottle.

MAINTENANCE OF INSTRUMENTS

Instruments where most parts can be dismantled are better to allow complete cleaning. Ideal sterilization is through ethylene oxide. Many newer methods

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like STERRAD® uses hydrogen peroxide vapor and low-temperature gas plasma to sterilize most devices quickly with no toxic residues.

CONCLUSION

A successful endoscopy unit requires a good operation room setup, efficiently working instruments, and good surgical skills. Understanding the working of instruments and their upkeep is mandatory for the team. This not only helps in smooth surgery but also prevents catastrophe due to instrument failure during surgery.

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