Laparoscopic Ovarian Surgery

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INTRODUCTION

Most ovarian abnormalities can be managed laparoscopically. Ovarian pathology can occur at any time from fetal life to menopause. First laparoscopic salpingo-oophorectomy was performed by Semm in 1984. He reported his experience with a laparoscopic approach to oophorectomy and salpingo-oophorectomy.

Laparoscopy management may be an alternative in those cases where hysterectomy is being planned and a more conservative management of pain caused by adnexal disease can be performed. If necessary, even oophorectomy can be performed laparoscopically with a short hospital stay and recovery period at a later date.

LAPAROSCOPIC OVARIAN ANATOMY

The ovaries are seen clearly by laparoscope because of their whiteness and knobby texture **(Fig. 1)**. They may be seen more clearly if uterine manipulator is used and uterus is pushed towards anterior abdominal wall. Ovaries hang down in the laparoscopic field. A normal ovary is almond shaped and approximately 3 cm in diameter **(Fig. 2)**.

The ovarian ligaments run from the ovaries to the lateral border of the uterus. Ovary is attached to the pelvic sidewall with infundibulopelvic ligament, which carries ovarian artery **(Fig. 3)**. One of the common mistakes that a surgeon can land into is injury of the ureter during dissection of the infundibulopelvic ligament. If the uterus is deviated to the contralateral side with the help of uterine manipulator, infundibulopelvic ligament is spread out and a pelvic side wall triangle is created. The base of this triangle is the round ligament, the medial side

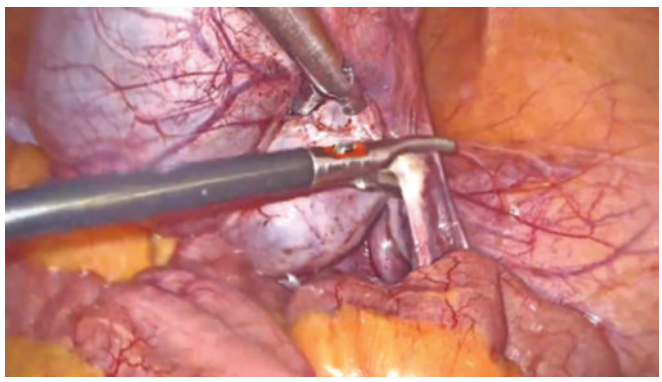


Fig. 1: Laparoscopic oophorectomy using bipolar.

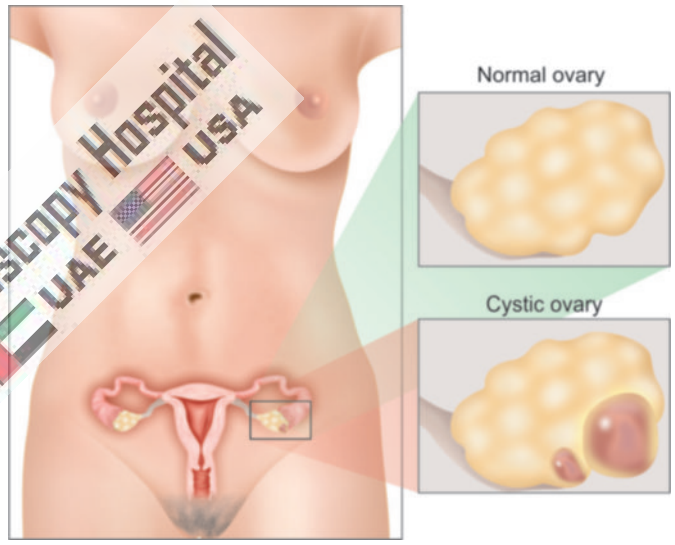


Fig. 2: Anatomy of ovary.

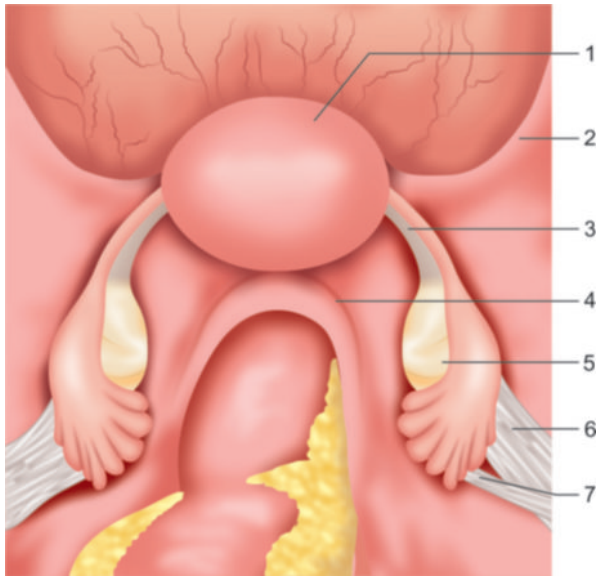


Fig. 3: Position of ovary: (1) Uterus; (2) Round ligament; (3) Utero-ovarian ligament (proper ovarian ligament); (4) Uterosacral ligament; (5) Ovary; (6) Suspensory ligament of the ovary; (7) Ureter.

is the infundibulopelvic ligament, and the lateral side is the external iliac artery. The apex of this triangle is the point at which the infundibulopelvic ligament crosses the external iliac artery.

The ovarian arteries arise from the aorta to descend lateral to the ureter and genitofemoral nerve. The artery and accompanying vein cross over the external and internal iliac vessels to enter the pelvis. The left ovarian vein joins the left renal vein and right ovarian vein joins the inferior vena cava.

LAPAROSCOPIC MANAGEMENT OF OVARIAN CYST

Ovarian cysts are sacs filled with fluid or a semisolid material that develops on or within the ovary. Surgery is indicated if the growth is larger than 4 inch (10 cm), complex, growing, persistent, solid and irregularly shaped, on both ovaries, or causes pain or other symptoms.

Laparoscopic management of ovarian cyst depends on the patient's age, pelvic examination, sonographic images, and serum markers. When surgery is indicated for benign ovarian disease, preservation of ovarian tissue via cystectomy or enucleation of a solid tumor from the ovary is generally preferable to complete oophorectomy. When the ovary cannot be salvaged or insufficient viable tissue remains after attempts at conservation, oophorectomy is usually performed. A large, solid, fixed, or irregular adnexal mass accompanied by ascites is suspicious for malignancy. Cul-de-sac nodularity, ascites, cystic adnexal structures, and fixed adnexae occur with endometriosis and sometimes ovarian malignancy. Before selecting any case for laparoscopy, CA-125, which is an ovarian cancer marker, should be estimated, that may help to identify cancerous cysts in older women. Although ovarian neoplasms can occur at any age, the risk of malignancy is highest during prepuberty and menopause. Malignancy is not the only concern in managing an ovarian cyst. Patients who wish to preserve their reproductive organs should have the least aggressive therapy. In a postmenopausal patient whose family has a history of ovarian cancer, CA-125 levels may help to detect it in the early stages. However, surgeon should keep in mind that many benign gynecologic disorders are also associated with elevated CA-125 levels, including fibroid uterus, endometriosis, and salpingitis that could lead to unnecessary concern and intervention.

Because the risk of malignancy is relatively low in young women, preoperative evaluation should include a history and physical examination. Pelvic ultrasound should be performed to evaluate both ovaries to rule out bilateral endometriomas or teratoma. Removing cysts in a specimen bag reduces both operating time and spillage. Controlled intraperitoneal spillage of benign cyst contents (e.g., cystic teratoma) does not increase postoperative morbidity as long as the spillage is aspirated, and the peritoneal cavity is lavaged. A solid adnexal mass that is small enough to be removed intact via colpotomy or via a laparoscopic bag can be managed with laparoscopy. Solid masses can also be mobilized via laparoscopic technique and then removed through a minilaparotomy incision or morcellated inside a specimen bag.

Hormone levels [such as luteinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol, and testosterone] may be checked to evaluate for associated hormonal conditions. The persistent ovarian cysts must be treated surgically, and evolving laparoscopic technology has enabled endoscopic management of most of them. Although most are benign, the possibility of malignancy usually requires a laparotomy using a midline incision.

Oral contraceptives have been prescribed for some small cystic adnexal masses in reproductive-aged women on the assumption that decreasing gonadotropin stimulation to a functional cyst will hasten its resolution. Either danazol (800 mg/day) or oral contraceptive pills with 50 pg estrogen are advised for any cyst suspected of being functional.

Crossing the true brim of pelvis the following important tubular structures are found. The round ligament of the uterus, the infundibulopelvic ligament which contains the gonadal vessels and the ureter. The ovaries and fallopian tube are found between the round ligament and the infundibulopelvic ligament.

Patient Position

Patient should be in steep Trendelenburg's and lithotomy position. One assistant should remain between the legs of patient to do uterine manipulation whenever required.

Port Position

Port position should be in accordance with baseball diamond concept. If the cyst is of right side, one port should be in left iliac fossa and another in right hypochondrium **(Fig. 4)**.

Operative Procedure

After access, the pelvis and upper abdomen are examined, and the cyst contents should be aspirated. Once the capsule is opened, the interior of the capsule is examined and

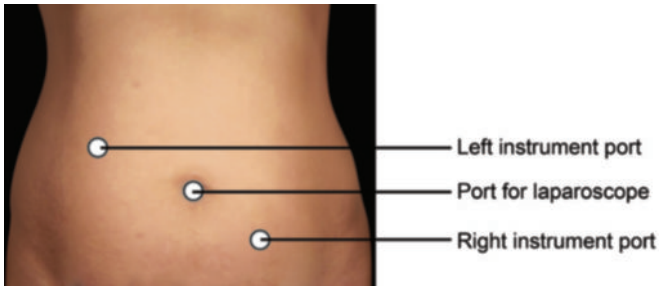


Fig. 4: Port position for right-sided ovarian surgery.

suspicious areas should be sent for biopsy. The entire cyst capsule must be removed to search for an early carcinoma. Whether to perform oophorectomy or cystectomy depends on the patient's age and characteristics of the mass.

Ovarian Cystectomy

Medical management of endometriomas has proven ineffective, and nowadays either laparotomy or operative laparoscopy is necessary. Laparoscopic ovarian cystectomy removes the cyst with minimal trauma to the residual ovarian tissue. Laparotomy for ovarian cystectomy is not a good procedure because of increased risk of ovarian adhesion formation. Three methods to manage such cysts are drainage, excision, and thermal coagulation. By excising the unruptured cyst, histopathologic examination is more complete and the risk of recurrence is minimized, but laparoscopic removal of intact cyst is very difficult and aspiration is recommended for functional cysts, which are diagnosed laparoscopically. Many cysts get ruptured during their manipulation despite a delicate technique.

Thermal ablation does not destroy the entire cyst wall, and the underlying ovarian cortex can be damaged by the heat. Therefore, excision of entire cyst wall with the help of blunt stripping and sharp dissection by scissors are recommended.

The removal of small cyst is possible without aspirating it. A careful dissection should be performed to strip out ovarian cortex with inner cystic layer and it can be extracted safely transferring in the endobag **(Figs. 5A to F)**.

The removal of a cyst 10 cm or larger is difficult laparoscopically. Aspiration before removal of large cysts is practical and can be accomplished using an 18 gauge needle passed through the separate puncture of abdominal wall while stabilizing the cyst. The suction irrigation instrument can also be used to aspirate the content of the cyst **(Fig. 5G)**.

If gross characteristics of ovary look suspicious for malignancy, some gynecologists recommend peritoneal washing before puncturing an ovarian cyst, because any cyst may turn out to be malignant. The peritoneal fluid or washings should be sent for cytological examination.

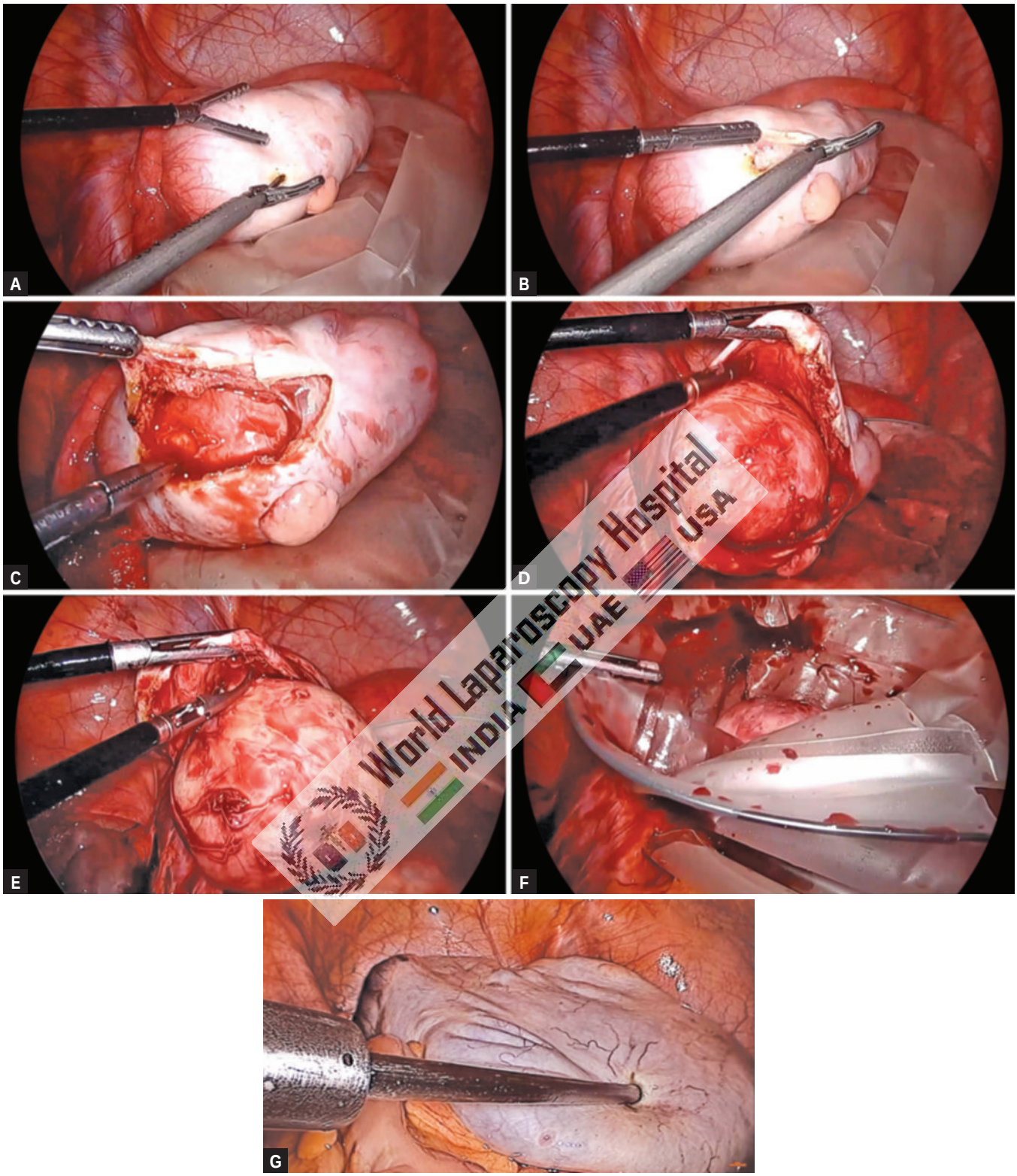
After aspiration capsule of cyst is stripped from the ovarian stroma using two grasping forceps and the suction-irrigator probe for traction and counter traction **(Fig. 6)**. The electrosurgery can be used at low power to seal blood vessels at the base of the capsule and at higher powers to vaporize small remnants of capsule. Bipolar forceps can also be used to control bleeding. The open jaw of bipolar can be touched to the oozing area and hemostasis can be achieved. Sometimes it is difficult to remove the capsule from the ovarian cortex so that injecting dilute vasopressin between the capsule and cortex facilitates the stripping procedure **(Fig. 7)**. If the cyst wall cannot be identified clearly, the edge of the ovarian incision can be "freshened" with scissors and the resulting clean edge reveals the two layers, outer layer will be ovarian and inner cystic. If this does not free the capsule, the base of the cyst is grasped and traction applied to the cyst with counter traction to the ovary. Sometime the complete cyst or portions of the wall may be densely adherent to the ovary, requiring sharp or electrosurgical dissection to completely free the cyst wall. Generally, when the cyst capsule is removed from the ovary, the contraction of the ovarian capsule provides significant hemostasis. Bleeding can occur at the base, particularly if the cyst was close to the hilum. Under these circumstances, a needle electrode or a fine bipolar forceps can be used to minimize thermal damage. Large cysts sometime need partial oophorectomy, to remove the distorted portion of the ovary, and the remaining cyst wall can be stripped from the ovarian stroma.

Teratoma often can be excised intact, but often the cyst ruptures. After extraction, if the ovarian edges overlap itself, the defect is left to heal without suturing because adhesions are more likely following the use of suture. In rare instances one or two fine, absorbable monofilament sutures may be needed to approximate the ovarian edges. The sutures are placed inside the ovary to decrease formation of adhesions.

Endometriomas

Ovarian endometriosis causes the adhesions between the ovarian surface and the broad ligament. As the ovary enlarges, endometriomas form. Sometime surface endometrial implants penetrate more deeply into the cyst wall, making excision more difficult. The degree of endometrial invasion of the cyst wall forms the basis for differentiating between these two subtypes and is characterized by the progressive difficulty in removing the cyst wall.

The least invasive and the technically simplest approach to endometriomas involve laparoscopic fenestration and removal of "chocolate" fluid without cystectomy or ablation of the cyst wall. However, fenestration and irrigation are associated with a 50% recurrence rate compared to 8% in the group with the capsule removed. Postoperatively, either danazol 800 mg/day or a gonadotropin-releasing hormone (GnRH) analog is used for 6–8 weeks. Large hematomas are associated with periovarian adhesions attaching them to the pelvic sidewall and the back of the uterus, and tend to rupture during separation. After mobilizing the ovary, the contents of the cyst are removed with the suction-irrigator probe and the cavity is irrigated. The inside of the cyst is evaluated and the portion of ovarian cortex involved with endometriosis is removed. Using the grasping forceps and the suction-irrigator probe, the cyst wall is grasped and separated from the ovarian stroma by traction and counter traction. Small blood vessels from the ovarian bed and bleeding from the ovarian hilum can be controlled with bipolar electrocoagulation.



Figs. 5A to G: (A to F) Ovarian cystectomy without aspirating the cyst and taking it in the endobag; (G) Ovarian cyst is aspirated for ovarian cystectomy.

The remaining ovarian tissue is approximated with low-power laser or electrosurgery to avoid adhesions. Low-power, continuous laser or bipolar coagulation applied to the inside wall of the redundant ovarian capsule causes it to invert, but excessive coagulation of the adjacent ovarian stroma must be avoided. Sutures, if needed, are placed inside the capsule and 4-0 polydioxanone sutures are preferred. Fewer sutures result in fewer adhesions.

The ability to diagnose and treat endometriosis at earlier stages may prevent its progression and invasion, reducing its adverse impact on health, quality of life, and fertility potential.

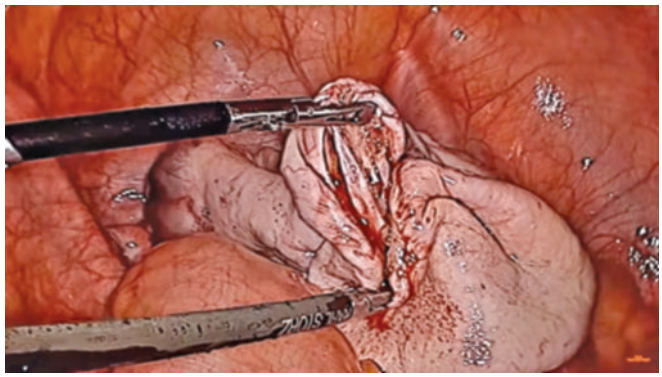


Fig. 6: Cystic wall is stripped out from ovarian cortex.

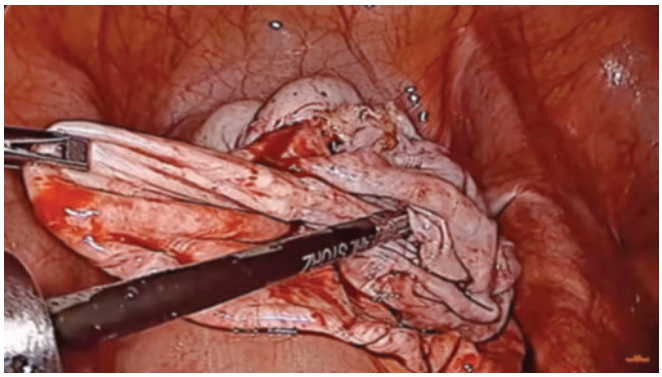


Fig. 7: Cyst is being separated from ovary.

Figs. 8A and B: Extraction of ovary.

Benign Cystic Teratoma

These germ cell tumors occur predominantly in young women. A cystic teratoma contains sebaceous material that is irritating to peritoneal surfaces and can cause chemical peritonitis and possible adhesions. The surgeon should avoid rupturing the cyst. If the cyst does get ruptured during excision, it is important to clean the body cavity of all sebaceous material and hair. If it ruptures at the time of excision, without spending much time, the suction-irrigator is placed in the cyst, the contents aspirated, and the cavity copiously irrigated. The interior of the cyst is inspected and its lining is grasped and removed from the ovary. The lining is removed from the pelvis through a 10 mm port. In case of intact cyst an endobag may be necessary **(Figs. 8A and B)**. A colpotomy can be made through which the cyst is pulled into it and then incised and drained and its capsule removed. These same procedures can be performed through a mini-laparotomy incision. The cyst wall is punctured and the contents rapidly aspirated. The wall is removed, placed in an endobag, and removed through the cul-de-sac or through one of the port wound. Following removal, it is critical to irrigate the pelvis copiously with 5–10 L of warm Ringer's lactate. The sebaceous material is less dense than water and shall float, facilitating removal. Occasionally, when the cyst is mainly solid, it should be removed intact without rupturing. The cyst wall should be sent for histopathological examination. The pelvis is irrigated with lactated Ringer's solution until all evidence of sebaceous material is removed because incomplete removal of this material can cause peritonitis. During irrigation, the ovarian stroma is inspected to verify hemostasis. If bleeding is present, bleeder points are controlled with a monopolar fulguration or bipolar forceps.

If the teratomas are greater than 8 cm, the ovary can be placed in the cul-de-sac adjacent to a colpotomy incision. Cyst is removed transvaginally which minimizes the risk of contamination of upper abdomen and port wound and maintains a minimally invasive approach. The vagina should be cleaned thoroughly and prepared with betadine before colpotomy. In elderly women or for those patients in whom the ovary and tube cannot be conserved, salpingo-oophorectomy should be considered. When the cyst wall is benign and the tissue is fragmented, it can be removed through a 10 mm suprapubic port. No tissue should be left in the pelvic cavity or on the abdominal wall. Contamination of the anterior abdominal wall should be avoided and if this happens, all tissue must be removed and the incision copiously irrigated and washed. Abdominal wall metastasis has been reported following contamination of the wall during laparoscopy for ovarian cancer.

LAPAROSCOPIC OOPHORECTOMY

Indications

The most common indications for oophorectomy are:

- Persistent localized pain despite previous lysis of adhesions or ablation of endometriosis
- Residual ovary syndrome
- Dysgenetic gonads
- Ovarian cysts greater than 5 cm
- Tubo-ovarian abscess
- Prophylactic therapy for advanced breast cancer
- Early ovarian cancer in young women

Contraindications

- Hemodynamic instability
- Uncorrected coagulopathy
- Severe cardiopulmonary disease
- Abdominal wall infection
- Multiple previous upper abdominal procedures
- Late pregnancy

Operative Procedure

The port position is shown in **Figure 9**. Properly placed uterine manipulator is important to get a good exposure of ovary and tube. It is sometime difficult to immobilize the ovary because of its smooth surface and finer texture. In case of difficulty in immobilizing the ovary, the uterine-ovarian ligament can be grasped by one of the atraumatic grasper to lift and isolate the ovary or the ovary can be wedged against the pelvic sidewall using the flattened edges of the opened or closed forceps. It is important to remember that overly aggressive manipulation can cause lacerations in the capsule, follicles, or cysts and result in bleeding. Before starting the procedure, it is important to observe the course of the ureter as it crosses the external iliac artery near the bifurcation of the common iliac artery at the pelvic brim. The left ureter can be more difficult to find because it is often covered by the base of the sigmoid mesocolon. If the ureter is difficult to identify transperitoneally it must be identified by retroperitoneal approach. If previous hysterectomy is done it is better to insert a vaginal probe or sponge stick through the vagina so that the surgeon can maintain orientation, particularly with procedures involving extensive adhesions. Many time anatomic landmarks are distorted by adhesions, endometriosis, or prior surgical extirpation. In those cases dissection should be started from the most normal area and then it should proceed toward the more distorted parts of the operative field. Attention should be given that complete ovary must be removed to prevent ovarian remnant syndrome or tumor development in a dysgenetic gonad. At the end of the procedure, the operative field is inspected and any clots are removed with a suction-irrigator or grasping forceps. Pedicles are inspected under water and with decreased pneumoperitoneum and any bleeding if present can be controlled with bipolar electrocoagulation.

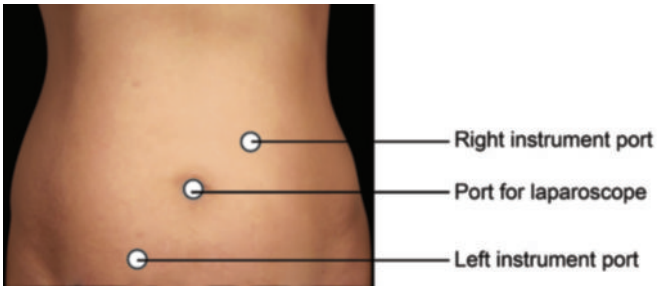


Fig. 9: Port position for laparoscopic left oophorectomy.

Dissection of the Infundibulopelvic Ligament

Three techniques have been described for managing the infundibulopelvic ligament:

1. Bipolar electrodesiccation
2. Suture ligation with pretied loop
3. Stapling

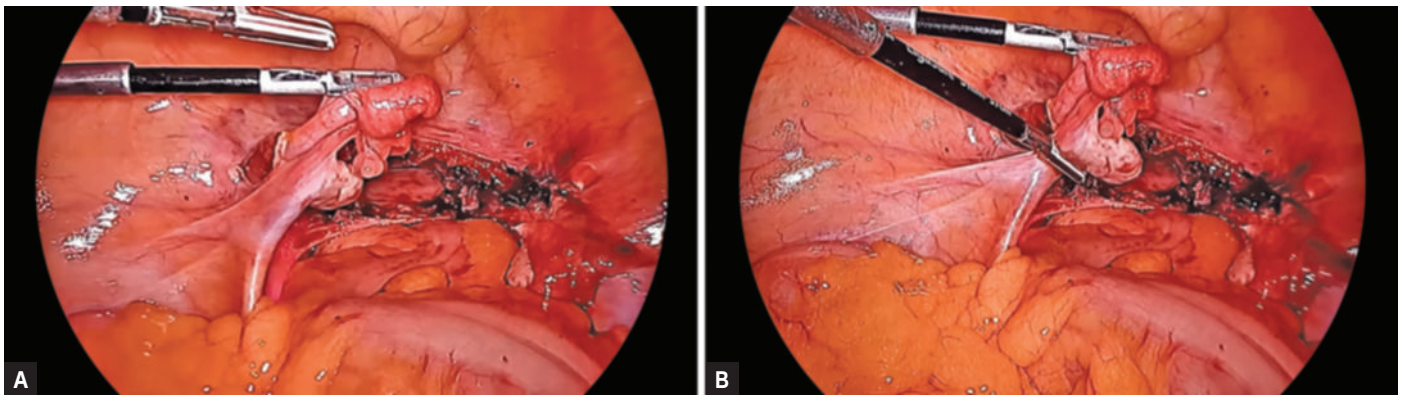
Patient cost for the linear stapler is approximately ₹ 4,500 and ₹ 250 for each pretied ligature. Considering these expenses bipolar electrosurgery is most economical way of dissection and it is preferable for hemostasis of the infundibulopelvic ligament.

Endoloop cannot be applied in the presence of adhesions and distorted anatomy. Sometime it is difficult to place endoloop sutures on large bunch of pedicles such as the mesovarium and infundibulopelvic ligament. If extracorporeal slip knot is applied over wide pedicle, the slipknot can loosen under the tension of the large pedicle. It may increase the risk of intraoperative hemorrhage. If the stump is large a piece of the ovary may get left in the pedicle, predisposing the patient to ovarian remnant syndrome.

Aside from cost, the linear stapling device has several other drawbacks. It needs to be introduced though a 12 mm trocar. Insertion of bigger trocar can lead to injury of the inferior epigastric artery and predispose the patient to a postoperative hernia. The linear stapler instrument is bulky and the operator must be careful to its proximity to the ureter, bowel, and bladder. If correct size staple is not selected the staples may dislodge and bleeding may start.

Salpingo-oophorectomy

If complete salpingo-oophorectomy is planned, the ovary and tube can be approached either from the infundibulopelvic or utero-ovarian ligament. Filmy adhesion limiting the mobilization of ovary should be dissected first. If ovarian cyst is found it should be aspirated and deflated, making removal of the ovary easier. The preferred approach is that dissection should begin with the infundibulo-ligament because it



Figs. 10A and B: Dissection at the level of infundibulopelvic ligament.

is easier and this approach becomes essential if prior hysterectomy has been performed. The lateral approach is also essential if the hemostasis from ovarian vessel is of primary consideration. The ovary is held with a grasping forceps and infundibulopelvic ligament is put under traction by pulling it up and medially **(Figs. 10A and B)**.

The infundibulopelvic ligament is desiccated with bipolar forceps and cut with scissors from lateral to medial.

It is important to use appropriate traction away from lateral pelvic wall to prevent excessive coagulation and damage to the lateral pelvic structures like ureter or vessels in triangle of doom.

Laparoscopic linear stapling and cutting device can also be used for salpingo-oophorectomy in selected cases. Laparoscopic extracorporeal Roeder's or Meltzer's knot can also be applied. Pretied loop are easy to use, but pedicle should not be wide. In cases of wide pedicel window can be created in midpoint of infundibulopelvic ligament and extracorporeal knot for continuous structure should be applied.

Dysgenic Gonads

Sometime dysgenic gonads can be found at the time of laparoscopy and require gonadectomy to prevent gonadoblastoma. The laparoscopic removal technique of dysgenic gonad is same as removing an ovary with adhesion to lateral pelvic wall. In these difficult cases hydrodissection is of utmost importance.

Ovarian Wedge Resection and Ovarian Drilling

Drilling of polycystic ovary is a common procedure performed laparoscopically. Polycystic disease of ovary has various manifestations, but its hallmark is chronic anovulation. Ovarian wedge resection is advocated for these enlarged ovaries. However, chances of returning to previous inoculators state are quite high after several months. There is also an increased risk of adhesion formation after laparoscopic ovarian wedge resection. Availability of ovulation inducing medicines like clomiphene citrate (CC) around 1970s has offered a nonsurgical management of this disease. Initially wedge resection of polycystic ovary was tried, but later laparoscopic ovarian drilling evolved to be simpler and associated with comparable rates of ovulation and conception.

Theoretically wedge resection of ovary and ovarian drilling work by reducing androgen production by ovarian stroma. Ideal patient of ovarian wedge resection or ovarian drilling are those women who fail to ovulate after 3–4 months treatment with CC.

The laparoscopic technique uses a 5 mm or 10 mm umbilical port for telescope and 5 mm port in left iliac fossa or suprapubic region. With the help of one atraumatic grasper one ovary is kept held by utero-ovarian ligament. At laparoscopy, multiple symmetrically placed holes are made over subcapsular follicular cystic stroma. Polycystic drilling generally does not bleed like physiological follicular cyst following incision. Each ovary is treated symmetrically and cysts are vaporized. The ovaries are irrigated and hemostasis is obtained by the help of bipolar forceps. If aspiration needle is used for monopolar drilling 30–40 watt current is used in a cutting mode. The power is activated just before touching the ovary and it should be penetrated at four to eight sites at a depth of 4 mm.

Ovarian Torsion

Adnexal torsion is a surgical emergency and if diagnosed early, the adnexae can be unwound and saved. It occurs most frequently if there is an adnexal lesion. It occurs generally in young women in whom preservation of ovary may be necessary. If diagnosis is delayed the adnexae may become gangrenous **(Fig. 11A)**.

If conservative treatment is planned the torted structure is straightened to assess the viability and even ovary that appears infarcted at laparotomy might regain normal color after untwisting. Causes of ovarian torsion include

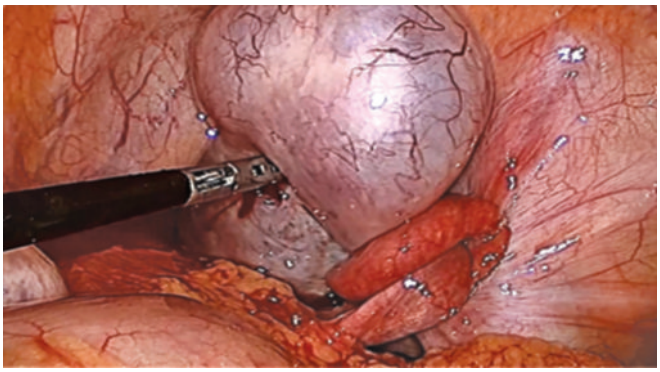


Fig. 11A: Torsion of ovary.

paraovarian cyst, functional and pathologic ovarian cyst, ovarian hyperstimulation, ectopic pregnancy, adhesions, and congenital malformations.

Ischemic structure is straightened gently with the atraumatic forceps to avoid additional adnexal damage. In women with ovarian hyperstimulation, the functional cyst should be drained before untwisting. The abnormalities contributing to torsion should be treated. It may be necessary to shorten the utero-ovarian ligament, if its length has contributed to ovarian torsion. A running suture of monofilament material is placed along the utero-ovarian ligament and tied to shorten it, limiting ovarian mobility.

After ovarian torsion if the ovary cannot be salvaged or insufficient viable tissue remains after attempts at conservation, oophorectomy is usually performed. Traditionally, less effort was made to preserve ovarian function in postmenopausal patients because of the thought that the ovary no longer functioned. In torted ovarian cyst if oophorectomy is required extracorporeal Mishra's knot also can be used **(Figs. 11B to I)**.

Ovarian Remnant Syndrome

In premenopausal women who had undergone bilateral oophorectomy, small piece of functional ovarian tissue can respond to hormonal stimulation with growth, cystic degeneration or hemorrhage and produce pain. Ovarian remnant remains because of dense adhesion and distorted anatomic relationship, which invariably worsen with subsequent operation. It is not unusual for these patients to have had previous attempt to excise an ovarian remnant. Complete removal of the ovarian tissue is preferred. Diagnosis is based on history and localization of pelvic pain. Although some patients have cystic adnexal structure or ill-defined fixed masses, others have normal pelvic findings. Vaginal ultrasound helps to locate the ovarian remnants. Low or borderline FSH levels in patients with documented bilateral oophorectomy are consistent with the presence of active ovarian tissue. Hormonal suppression, with oral contraceptives or GnRH agonist provides no relief in most patients. CC or human menopausal gonadotropin (hMG) may be used to increase the ovarian remnant size to confirm the diagnosis preoperatively or to aid in locating the tissue intraoperatively.

The anatomy of the retroperitoneal space should be identified when the ovarian remnant is adherent to the lateral pelvic wall. Space beneath the peritoneum is injected with Ringer's lactate solution and the peritoneum is opened close to the infundibulopelvic ligament or its remnant. Adhesions are lysed until the course of the major pelvic blood vessels and ureter can be traced and if necessary dissected. The ovarian blood supply is desiccated with bipolar forceps and ovarian tissue is excised and submitted for histological examination.

Paraovarian Cysts

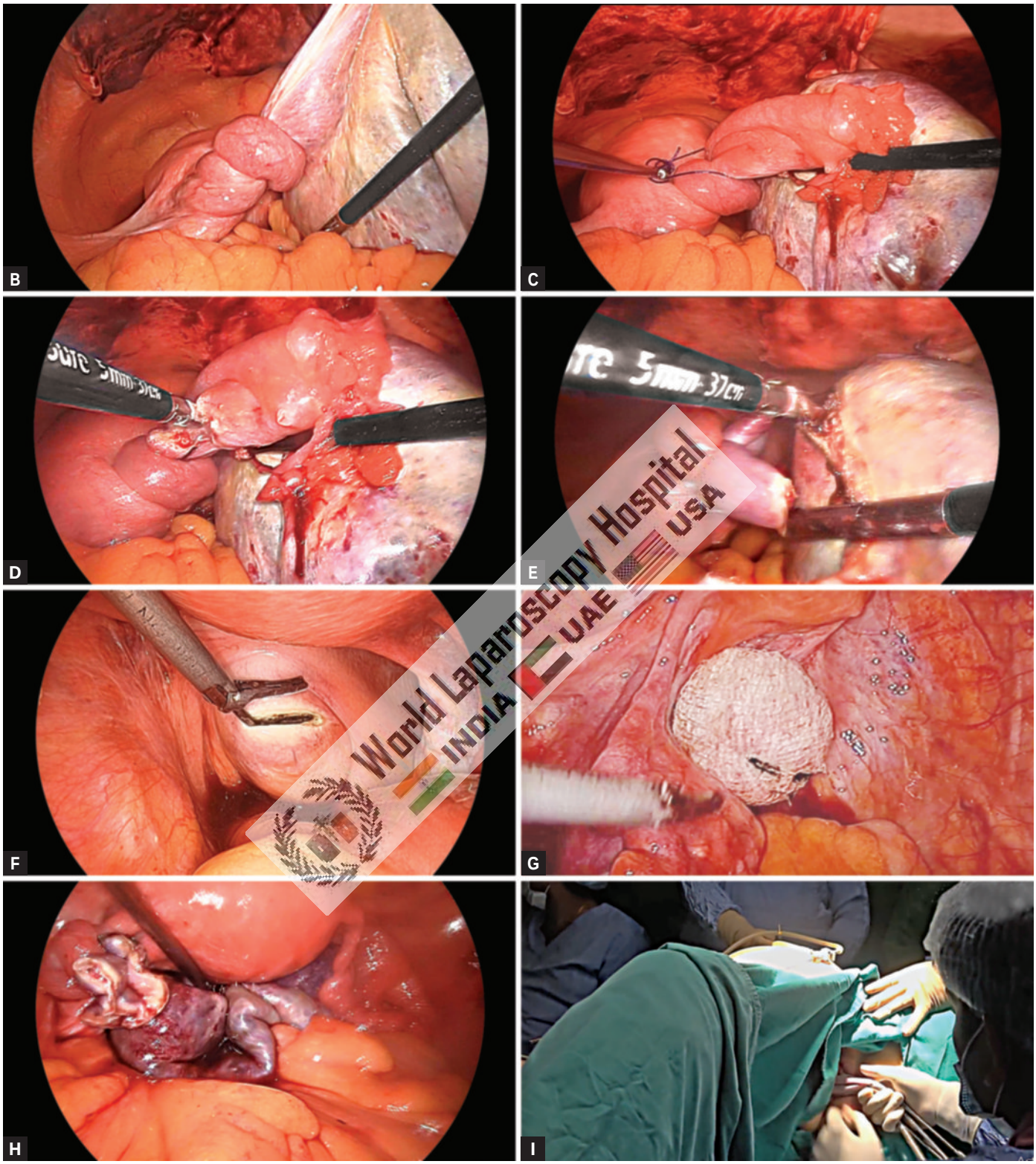
These cysts are most commonly found over the serosa surrounding the tubal fimbriae. Usually puncture with fine electrode is sufficient for these patients. Only 40–50 watt of cutting current is required for a fraction of second and cyst will burst. Sometime if these paraovarian cysts are large and intermingled with the serosa surrounding the fimbriae may be attached with lateral pelvic wall. In these cases, opening of peritoneum is necessary for hydrodissection. Once the cyst will leave the pelvic wall; using scissors, laser or electrode, it can be dissected nicely.

Ovarian Drilling for Polycystic Ovarian Disease

Although ovarian drilling is a controversial surgery it is performed some times when medical management of polycystic ovarian disease (PCOD) fails. Ovarian drilling, also known as multiperforation or laparoscopic ovarian diathermy, is a surgical technique of puncturing the membranes surrounding the ovary with a laser beam or a surgical needle using minimally invasive laparoscopic procedures. Women with polycystic ovarian syndrome (PCOS) usually have ovaries with a thick outer layer. The ovaries make more testosterone. High testosterone levels can lead to irregular menstrual periods, acne, and extra body hair.

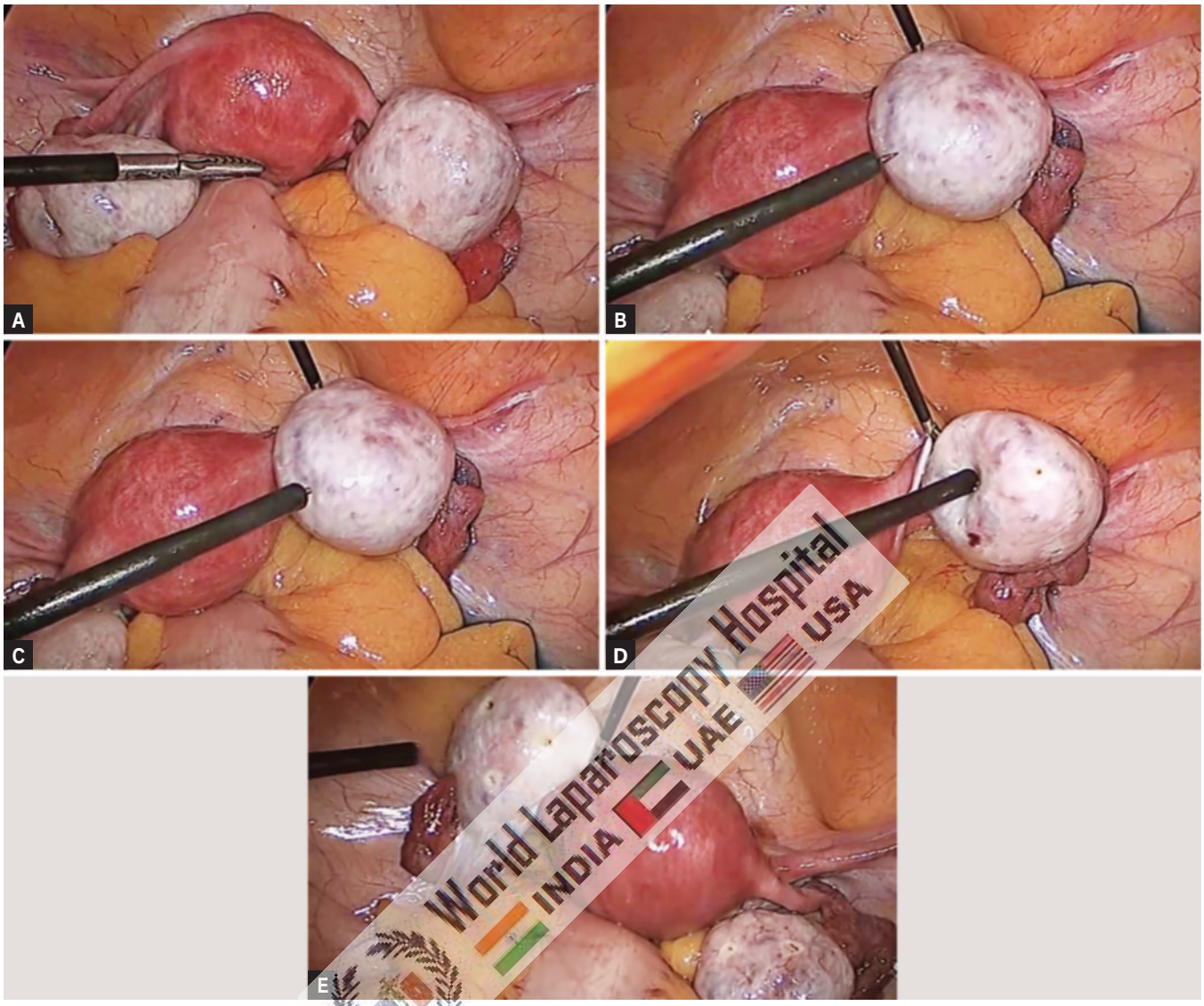
Ovarian drilling works by breaking through the thick outer surface and lowering the amount of testosterone made by the ovaries. This can help the ovaries release an egg each month and start regular monthly menstrual cycles. This may make it easier to get pregnant **(Figs. 12A to E)**.

In some of the studies, the long-term follow-up for ovarian drilling, which usually takes up to 36 months, showed a successful pregnancy rate of 60.4% and an increased pregnancy rate of 75%; however, some women got pregnant within only 12 months. PCOS is a frequent disorder, affecting approximately 5–10% of infertile women. It can represent more than 80% of cases of infertility due to anovulation. The main goal of treatment is the induction of mono-ovulatory cycles.



Figs. 11B to I: Oophorectomy and removal through colpotomy.

A pragmatic management of infertility in PCOS will allow most patients to conceive. Weight loss and clomiphene citrate are the first-line components of patients treatment before gonadotropins are used. However, during gonadotropin administration, there is a high risk of ovarian hyperstimulation and multiple pregnancies. So, surgery with laparoscopic ovarian drilling is often used before gonadotropins in order to obtain normal ovulatory cycles. The main benefits of ovarian drilling are shorter time to pregnancy and less need to ovulation induction drugs. The other advantages of this technique are more comfort, cost-effectiveness, and possibility to be performed ambulatory day care surgery.



Figs. **12A to E:** Polycystic ovary syndrome.

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