

LAPAROSCOPY IN INFERTILITY

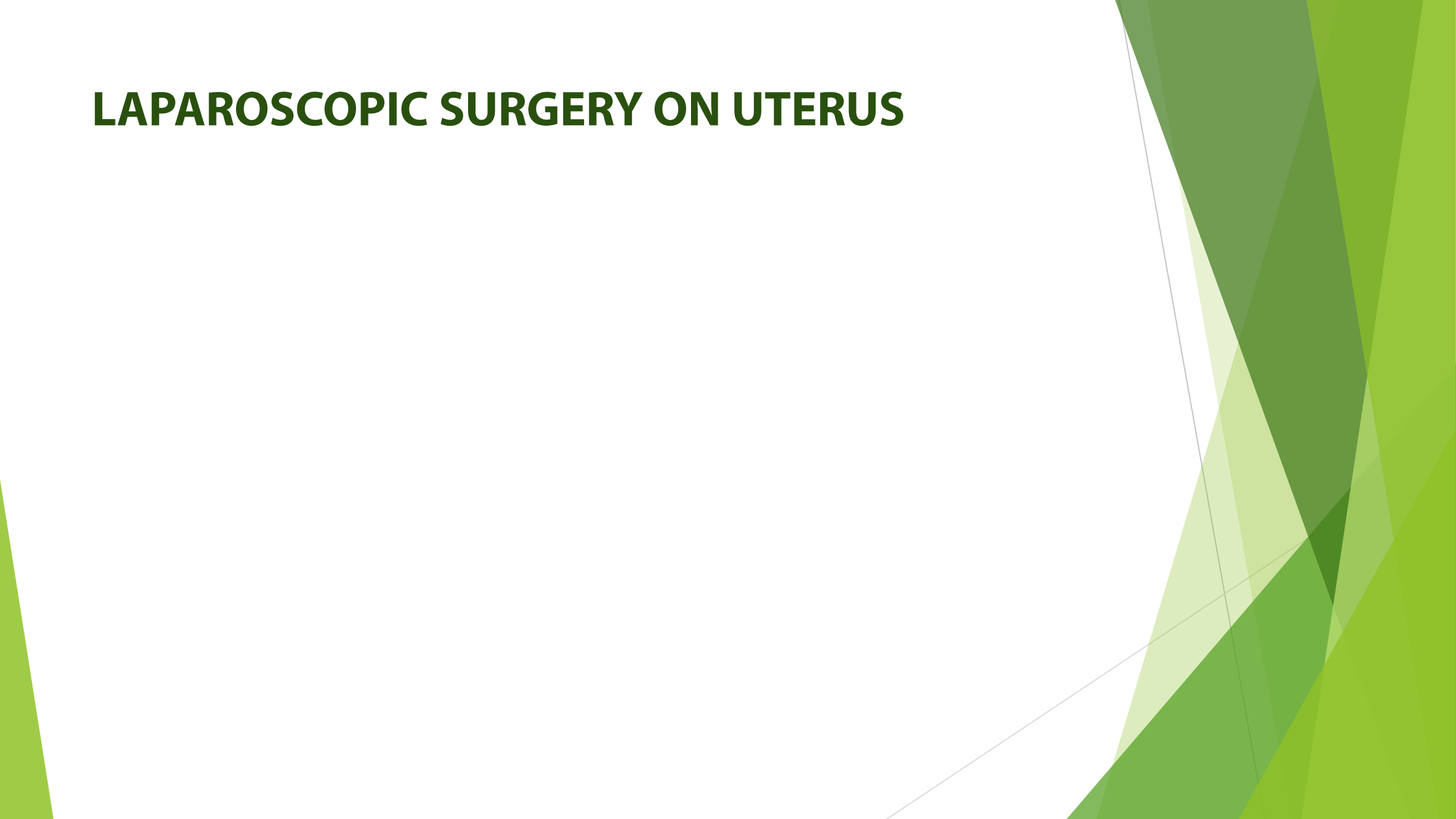
The background of the slide features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side and bottom of the frame, creating a modern, dynamic aesthetic. The main area of the slide is a plain, light gray.

- The advent of gynecologic endoscopy had begun in **1930s** with the development of diagnostic laparoscopy.

Recent years have witnessed increased sophistication of endoscopic instruments, many new advances in operating techniques and a marked increase in the **number** of procedures performed.

Nowadays, **when fertility surgery is indicated**, operative laparoscopy results in **outcomes better** than those from similar procedures performed via open laparotomy and is associated with a **shorter hospital** stay and much faster **recovery**. Currently laparoscopy is considered to be the **gold standard** as it provides not only **a panoramic and magnified view** of the pelvic and abdominal organs but also the opportunity to **perform extensive surgery**.

LAPAROSCOPIC SURGERY ON UTERUS



Uterine fibroids are the most **common benign tumors** occurring **in reproductive** age group having a rising trend with age until the time of **menopause**.

A large percentage of them remain undiagnosed since many are **asymptomatic** and are only detected when a woman approaches for infertility. **The relationship between infertility** and uterine fibroids is well **known**.

However, the effect of location and **size of fibroids** is not clear. It has been proved that the removal of **submucosal fibroids** improves fertility but removal of **subserosal fibroids** has no impact on **fertility**. Great uncertainties exist about the effect of intramural fibroids on fertility.

Benecke et al. have suggested that intramural fibroids should be removed if they are close to the endometrium (< 1 cm) and larger than **20 mm**.

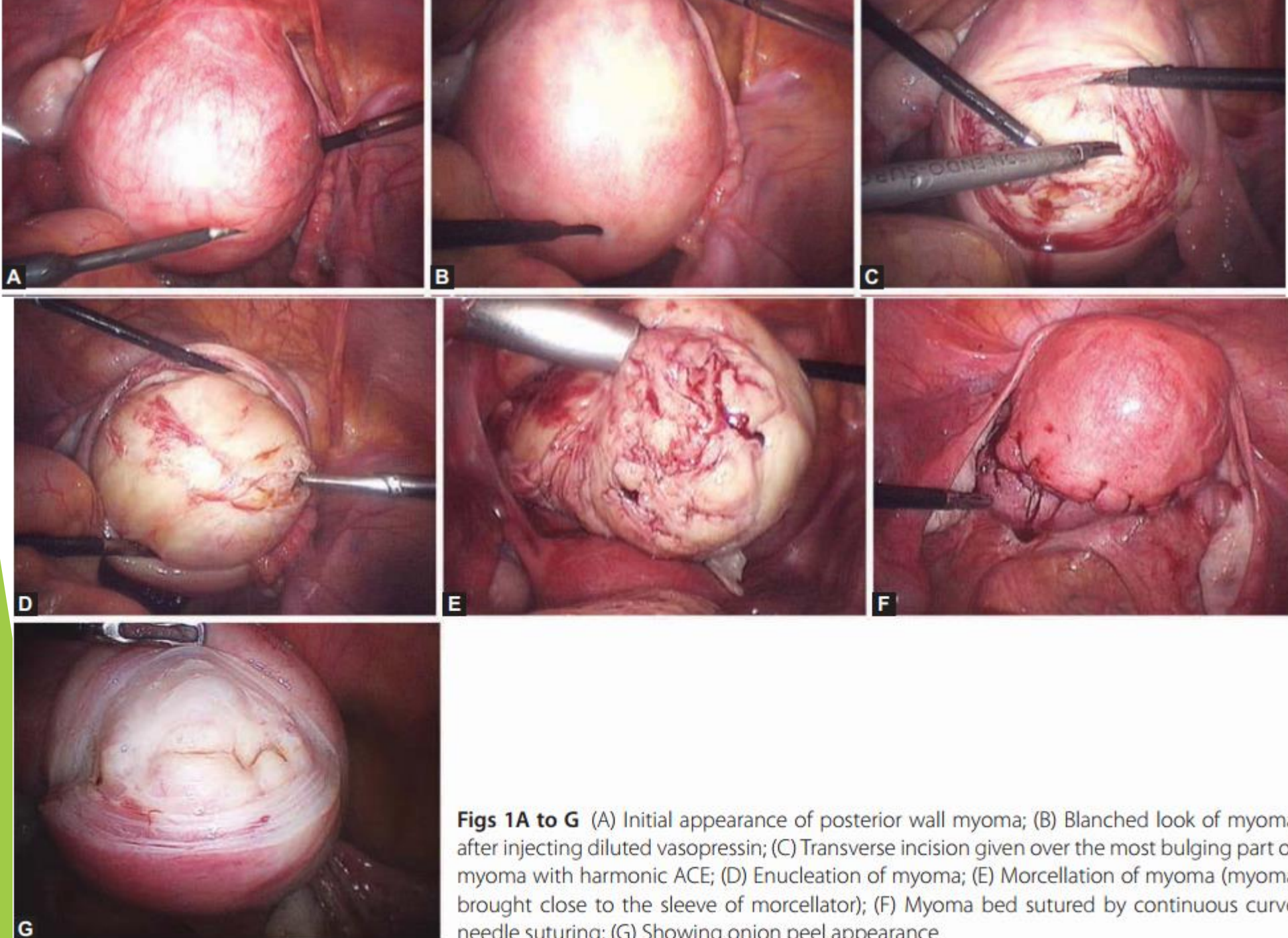
Recently there is an increasing demand for minimal access surgery for treatment of fibroids.

Laparoscopic

myomectomy, which was first described in 1979, exclusively for subserous fibroids and then for intramural fibroids in 1990s, has now become a common surgical procedure and has absolutely revolutionized gynec surgery.

Use of laparoscopic route for myomectomy poses two main challenges:

- (1) bloodless enucleation of myoma
- (2) a perfect suture to obtain a good quality scar in future with least adhesions



Future Pregnancy Rates

In our series, almost 60 percent of pregnancy rates with no antepartum or intrapartum complications have been achieved with **multiple layer** closure with several patients **delivering normally**.

When uterine cavity has been opened, a special note should be made and these patients are better delivered by **cesarean section**

Advantages Over Open Myomectomy

- Reduced postoperative pain.
- Shorter hospitalization.
- Quicker recovery.
- Reduced febrile morbidity and blood loss.
- Risk of postop adhesion formation is much less.
- Better for cosmetic reasons due to absence of scar formation.
- Age has no impact, hence can be offered to females of all age groups.
- The procedure is very safe and effective when performed by an experienced surgeon.
- There is also a decreased incidence of ileus, thromboembolic phenomenon and fistula formation

Uterine Rupture—A Major Concern

In the past, uterine rupture in subsequent pregnancies was a major concern.

Risk factors for uterine rupture after laparoscopic myomectomy can be:

- An **intramural hematoma** at the point of incision.
- Tissue necrosis because of **thermal damage** leading to defective scar formation.
- An incorrect **approximation of incision edges** leading to healing by secondary intention.

However, avoiding excessive **thermal damage**, adequate uterine repair by using **multiple layer closure** and a **single knot** in myoma bed, the risk seems to be very less with an extremely low failure rate and good results in terms of pregnancy outcome.

LAPAROSCOPIC TUBAL SURGERY



Tubotubal Reanastomosis by Laparoscopic Microsurgery

Tubal sterilization is currently the most popular form of birth control in India and is an everyday procedure.

It constitutes an important part of our National Family Planning Programme.

But due to unforeseen reasons, women may seek for **reversal of sterilization**.

Nowadays laparoscopic microsurgery is considered the **gold standard—derived** from solid research and unchallenged dogma. Only surgeons who are very facile with laparoscopic **suturing** and who have extensive training in conventional tubal microsurgery should attempt this procedure

The Evolution of Microsurgery

It was first introduced by Holmgren in 1921 for otosclerosis. In infertility, microsurgery was first used by Swolin in 1967,7 who proposed it for **adhesiolysis and neosalpingostomy**. A decade later, microsuturing was introduced and Winston (1977)⁸ and Gomel (1977)⁹ separately published their first series of microsurgical **reversal of sterilization**.

Indications for Laparoscopic Tubal Anastomosis

- Reversal of sterilization.
- Mid tubal block secondary to pathology.
- Tubal occlusion secondary to ectopic pregnancy treatment.
- Salpingitis isthmica nodosa (SIN).
- Failed tubal cannulation for proximal block.
- Failed previous macrosurgical sterilization reversal.
- Tubal transposition for unicornuate uterus, discrepant tubo-ovarian anatomy.

Contraindications

- Final tubal length is less than 4 cm.
- Significant tubo-ovarian adhesions.
- Stage 3 to 4 endometriosis.
- there is more than a mild male factor.

Pregnancy Rates after Tubal Anastomosis

When considering tubal anastomosis, **woman's age** is the most important prognostic factor.

In women younger than **40 years** of age, the cumulative intrauterine pregnancy rates at 2 years is 70 percent, compared with more than **90 percent** after microsurgical **reversal of tubal sterilization**.

Even in **women 40 to 45 years** old, cumulative intrauterine pregnancy rates of **41.7 to 70.6 percent** have been reported

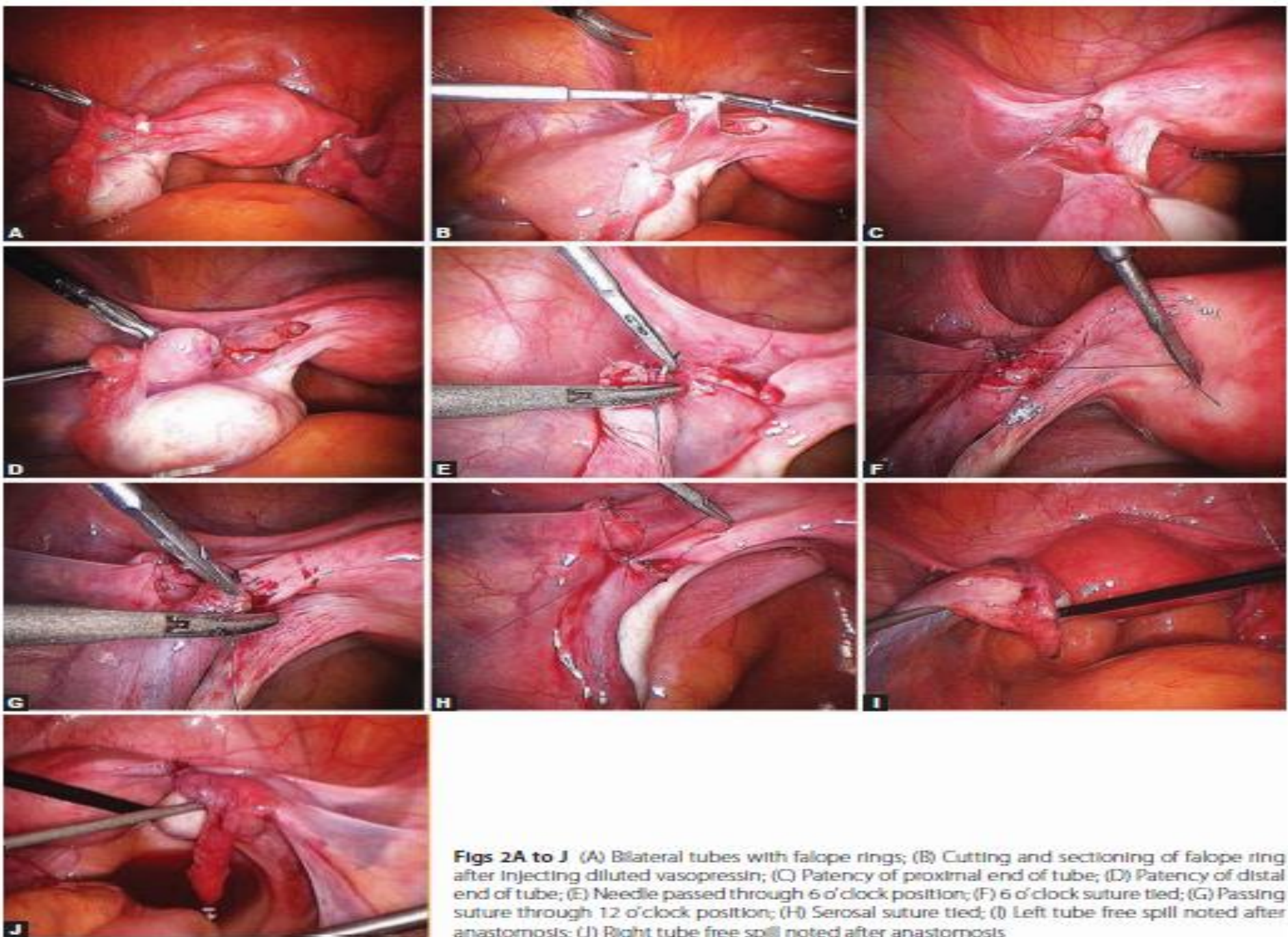
Tubal Surgeries for Infertility

Tubal disease accounts for 25 to 35 percent of female factor infertility, with more than half of the cases due to salpingitis.

There are several surgical options for achieving patency in obstructed Fallopian tubes, depending on the location of the blockage.

Though hysterosalpingography is the standard first-line test to evaluate tubal patency, but studies have shown that 60 percent of patients in whom HSG showed proximal tubal blockage, repeat HSG 1 month later showed tubal patency.

Therefore, hysterosalpingography is considered the gold standard for determining the tubal patency.



Figs 2A to J (A) Bilateral tubes with falope rings; (B) Cutting and sectioning of falope ring after injecting diluted vasopressin; (C) Patency of proximal end of tube; (D) Patency of distal end of tube; (E) Needle passed through 6 o'clock position; (F) 6 o'clock suture tied; (G) Passing suture through 12 o'clock position; (H) Serosal suture tied; (I) Left tube free spill noted after anastomosis; (J) Right tube free spill noted after anastomosis

General Considerations before any Tubal Surgery

- Age of the patient.
- Ovarian reserve.
- Prior fertility.
- Number of children desired.
- Site and extent of tubal disease.
- Presence of other infertility factors.
- Experience of the surgeon especially in laparoscopic microsurgery.
- Success rates of IVF after tubal surgery.
- Semen analysis.

The ideal candidate for tubal surgery is young, has no other significant infertility factors and has tubal anatomy that is amenable to repair.

Surgery for Proximal Tubal Disease

Proximal tubal blockage accounts for **10 to 25** percent of tubal disease. It can be due to:

- **Obstruction** resulting from **plugs of mucus** and **amorphous debris**.
- **Spasm** of the uterotubal ostium.
- **Occlusion** from fibrosis due to **SIN**, **PID** or **endometriosis**.

A meta-analysis of studies treating patients with bilateral proximal tubal occlusion showed that the obstruction is relieved in about **85** percent of the tubes with **tubal cannulation** and that about half of the patients conceive.

The meta-analysis also concluded that **ongoing pregnancy** rates are higher with **hysteroscopic cannulation**, although **tubal patency** rates are similar with fluoroscopic and hysteroscopic techniques.

In the setting of failed **tubal cannulation**, microsurgery may be considered if **IVF is not an option**.

Surgery for Distal Tubal Disease

Decision to repair or remove Fallopian tubes is made intraoperatively.

It includes hydrosalpinges and fimbria phimosi.

Hydrosalpinges are **completely occluded** and fimbrial agglutination, by **adhesions** results in a **narrow phimotic** tubal opening.

Both conditions can be due to:

- PID.
- Peritonitis of any cause.
- Previous surgery leading to tubal damage.

Good prognosis is associated with patients who have:

- No more than limited filmy adnexal adhesions.
- Mildly dilated (< 3 cm) tubes with thin and pliable walls.
- A lush endosalpinx with preservation of mucosal folds.

Although **IVF is preferred** over salpingostomy for mild hydrosalpinges in older women and for those with male factor or other infertility factors, salpingostomy before IVF may improve the subsequent likelihood of success of IVF while still giving the patient the option to attempt spontaneous conception. Tuboplasty is **not appropriate** for women with **severe disease** or with both **proximal and distal occlusions**.

Patients with poor prognosis hydrosalpinges are better served by salpingectomy followed by IVF. Postoperative reocclusion may occur, necessitating an additional surgical procedure

Neosalpingostomy

Neosalpingostomy is an operation, which attempts to recreate **new ostia** when the tube has a **hydrosalpinx** or to say that when there is **complete obstruction** and original fimbria have **completely disappeared** or **buried beneath adhesions**, then neosalpingostomy is carried out.



Figs 3A to F (A) Initial appearance of hydrosalpinx; (B) Appearance of normal fimbria after cruciate incision; (C) Passing the suture through 12 o'clock position; (D) Passing the suture through fimbria; (E) Final appearance after tubal reconstruction; (F) Chromopertubation at the end of procedure

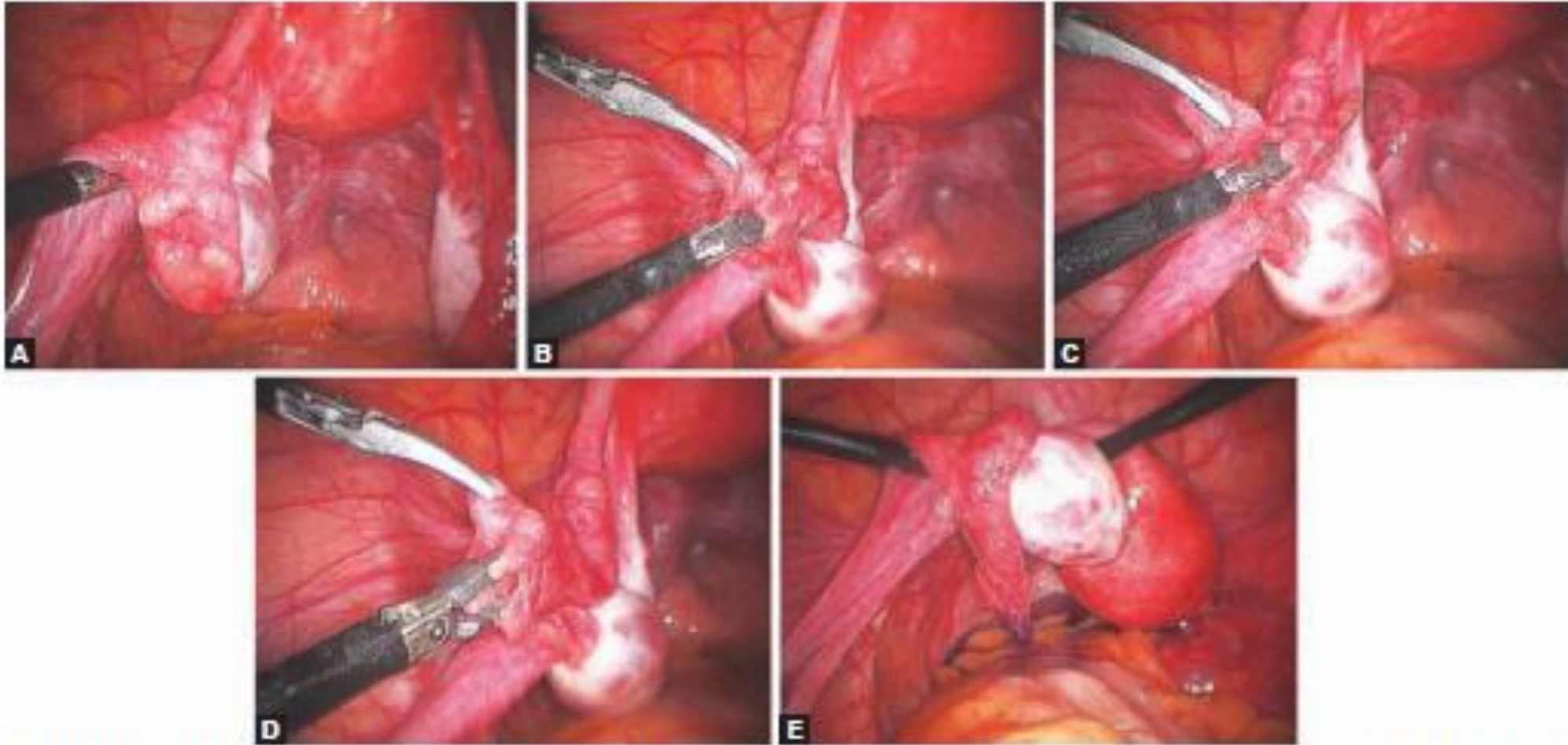
Fimbrioplasty

Fimbrioplasty refers to reconstruction of existent fimbriae in a partially or completely occluded oviduct.

In majority of such cases, periadnexal adhesions are also present in which salpingo-ovariolysis is carried out first.

Stenosis or obstruction may be the result of agglutination of the fimbriae giving a phimotic appearance to the terminal end.

In other cases, the agglutinated fimbrial end is also covered by a fibrous layer that may cause complete occlusion.

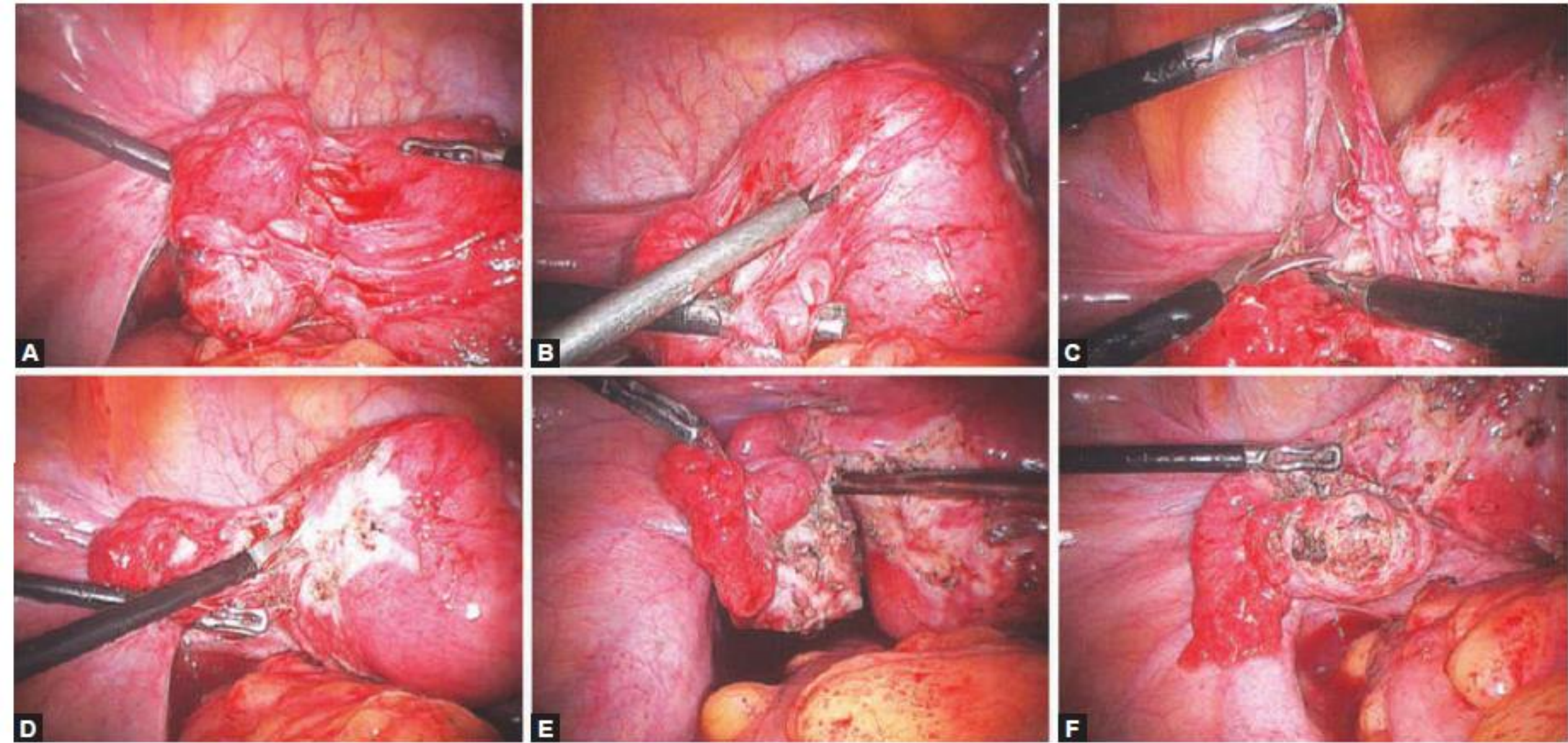


Figs 4A to E (A) Tube showing fimbrial agglutination; (B) Introducing a curved atraumatic grasper in the ampullary segment of tube in closed position; (C) Opening the jaws of the atraumatic grasper inside the ampullary end; (D) Taking out the grasper in an open jaw position; (E) Free spill of dye noted at end

Salpingo-ovariolysis

Salpingo-ovariolysis tubo-ovarian adhesions are common.

Most often, they are fine in isthmic portion and dense in ampullary region and most often causes stenosis in the fimbrial region.



Figs 5A to F (A) Dense tubo-ovarian adhesion; (B) Micro bipolar being used for prophylactic coagulation before sectioning the adhesion; (C) Adhesion put on a stretch and divided; (D) A sharp scissor used for division of adhesion; (E) Normal tubo-ovarian relationships restored with good fimbrial end noted and free spill of dye seen; (F) Normal tubo-ovarian relationship

Adhesion Prevention

After adhesiolysis, the concern of adhesion reformation is genuine.

The chance of moderate and severe adhesion reformation after laparoscopic salpingo-ovariolysis was 40.2 percent.

It has been claimed that second look laparoscopy with adhesiolysis following pelvic reproductive surgery may increase the intrauterine pregnancy rate and decrease the ectopic pregnancy rate

Management of Hydrosalpinx

Numerous studies have shown that hydrosalpinges have a detrimental effect on IVF success rates. Two meta-analysis of these studies noted that the pregnancy, implantation and delivery rates were approximately 50 percent lower and that the spontaneous abortion rate was higher in the presence of hydrosalpinges

RCTs comparing pregnancy rates and outcomes with IVF for women with hydrosalpinges, with or without prior laparoscopic salpingectomy, reported that salpingectomy restores the rates of pregnancy and live births to levels similar to those of women without hydrosalpinx.

salpingectomy for bilateral hydrosalpinges yielded higher IVF pregnancy rates than for unilateral hydrosalpinges.

ENDOMETRIOSIS

Endometriosis occurs in 6 to 22 percent of women of reproductive age undergoing tubal ligation, 15 to 80 percent of women with chronic pelvic pain, and 21 to 65 percent of women evaluated because of infertility. Fecundity in normal couples is about 15 to 20 percent and decreases with age and is about 2 to 10 percent in women with untreated endometriosis and infertility.

Symptoms often do not correlate well with stage of endometriosis. Endometriosis has a variety of appearances and forms including the classic “powderburn” lesions, red lesions, white lesions, peritoneal retractions, and endometriotic cysts or “chocolate cysts”. Endometriosis may also be associated with scar tissue and adhesions.

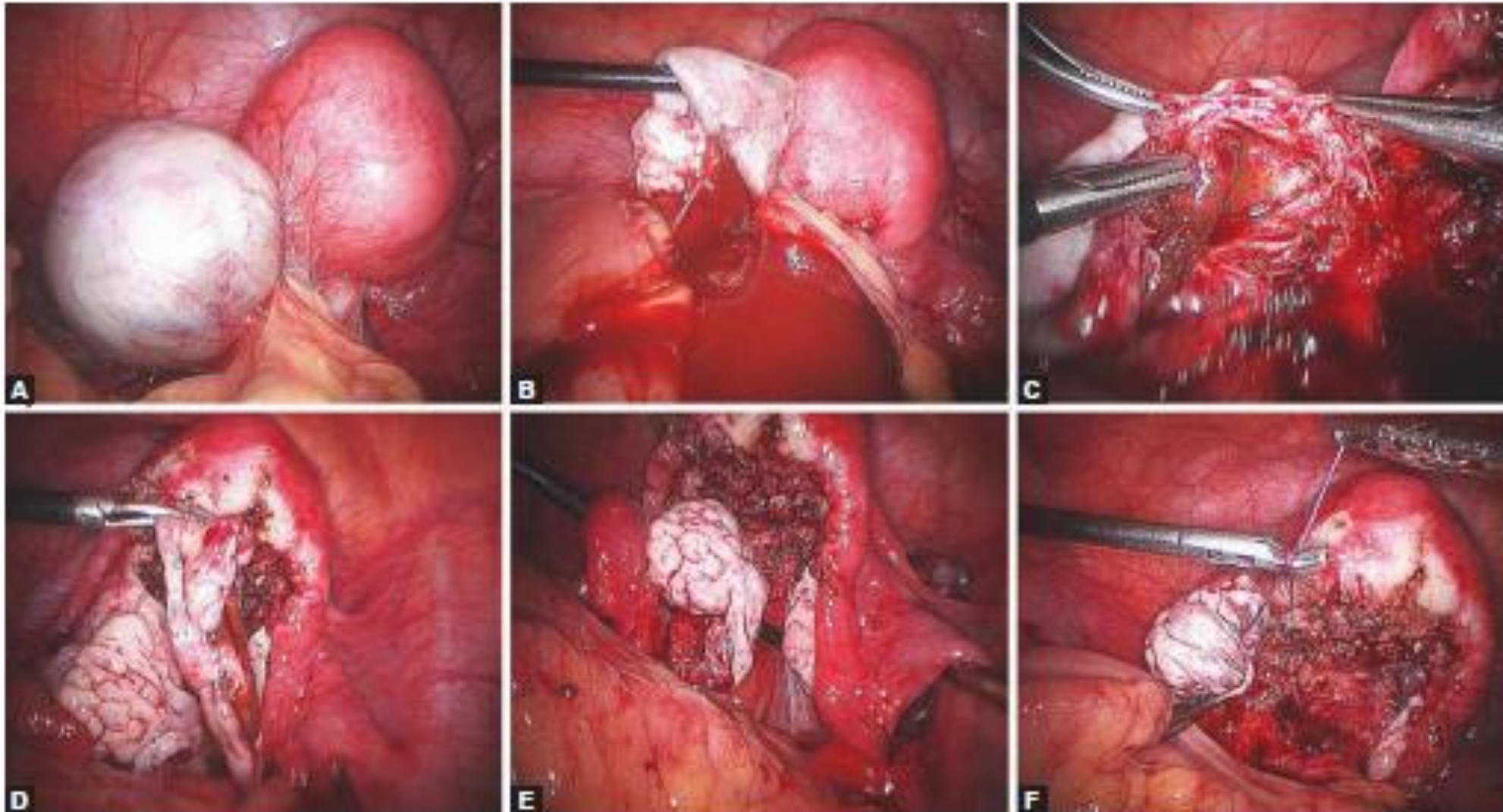
Three different types of endometriosis:

1. Peritoneal (mainly implants)
2. Ovarian (cysts)
3. Rectovaginal (most severe form of the disease, characterized by complete or partial obliteration of cul-de-sac).

Endometriotic Implants

The destruction of implants can be achieved using numerous techniques:

- precise excision,
- bipolar coagulation,
- mono polar coagulation,
- CO2 laser vaporization or excision



Figs 6A to F (A) Appearance of large endometrioma densely adherent to the back surface of uterus, obliterated pouch of Douglas; (B) Drainage of thick chocolate material during adhesiolysis from the endometrioma; (C) Ovarian cortex held by atraumatic grasper and cyst lining held by tooth grasper; (D) Cyst lining enucleated; (E) Left ovary and Fallopian tube after enucleation; (F) Normal looking ovary after ovarian reconstruction

LAPAROSCOPIC OVARIAN SURGERY

Ovarian Drilling

Polycystic ovary syndrome (PCOS) is a heterogenous endocrine condition that affects approximately 5 to 10 percent of women in reproductive age group. PCOS is the most common endocrine disorder in women.

Polycystic ovary syndrome is changing woman's health paradigm. The magnitude of the problem ranges from early age reproductive disorders (menstrual disorders, hirsutism, contraception, sexual health and above all infertility) to long-term metabolic and cardiovascular health (pregnancy complications, quality of life, type 2 diabetes, obstructive sleep apnea, cardiovascular disease and lastly risk of cancer).

Problems in inducing ovulation and anovulation are well recognized in these women.

Surgical ovarian wedge resection was the first established treatment for women with anovulatory PCOS but was abandoned because of the risk of post-surgical adhesion formation, which converted endocrinological subfertility to mechanical subfertility as a result of scarring.

Medical ovulation induction with clomiphene citrate and gonadotrophins was the next in line.

Ovulation induction with **clomiphene** is not always successful, with approximately 20 percent of women described as “clomiphene-resistant.”

Clomiphene resistant women can be treated with **gonadotrophins** which often lead to overproduction of follicles, thereby exposing these women to the risks of **ovarian hyperstimulation** syndrome and **multiple pregnancy**.

Also gonadotrophins are **expensive**, inconvenient and time consuming form of treatment that requires **intensive monitoring**.

Laparoscopic ovarian **drilling** can be considered in **clomiphene resistant** polycystic ovary patients.

Ovarian Surgery and Ovulation?

Proposal of Various Theories

- Originally, removal of a mechanical barrier, reducing the size of the ovary was thought to allow gonadotrophins to act more effectively after ovarian surgery.
- Others have suggested that surgery may cause increased blood flow to the ovaries, resulting in increased delivery of gonadotrophins.
- LOD destroys the ovarian androgen producing tissue and causes lower peripheral aromatization of androgens to estrogens, thereby restoring feedback to hypothalamus and pituitary.

Laparoscopic Ovarian Drilling

It was first described by Gjonnaess in 1984.

Both laparoscopic ovarian cautery and laser vaporization using carbon dioxide, argon or neodymium-doped yttrium aluminum garnet crystal lasers have been used to create multiple perforations (approximately 10 holes per ovary) in the ovarian surface and stroma.

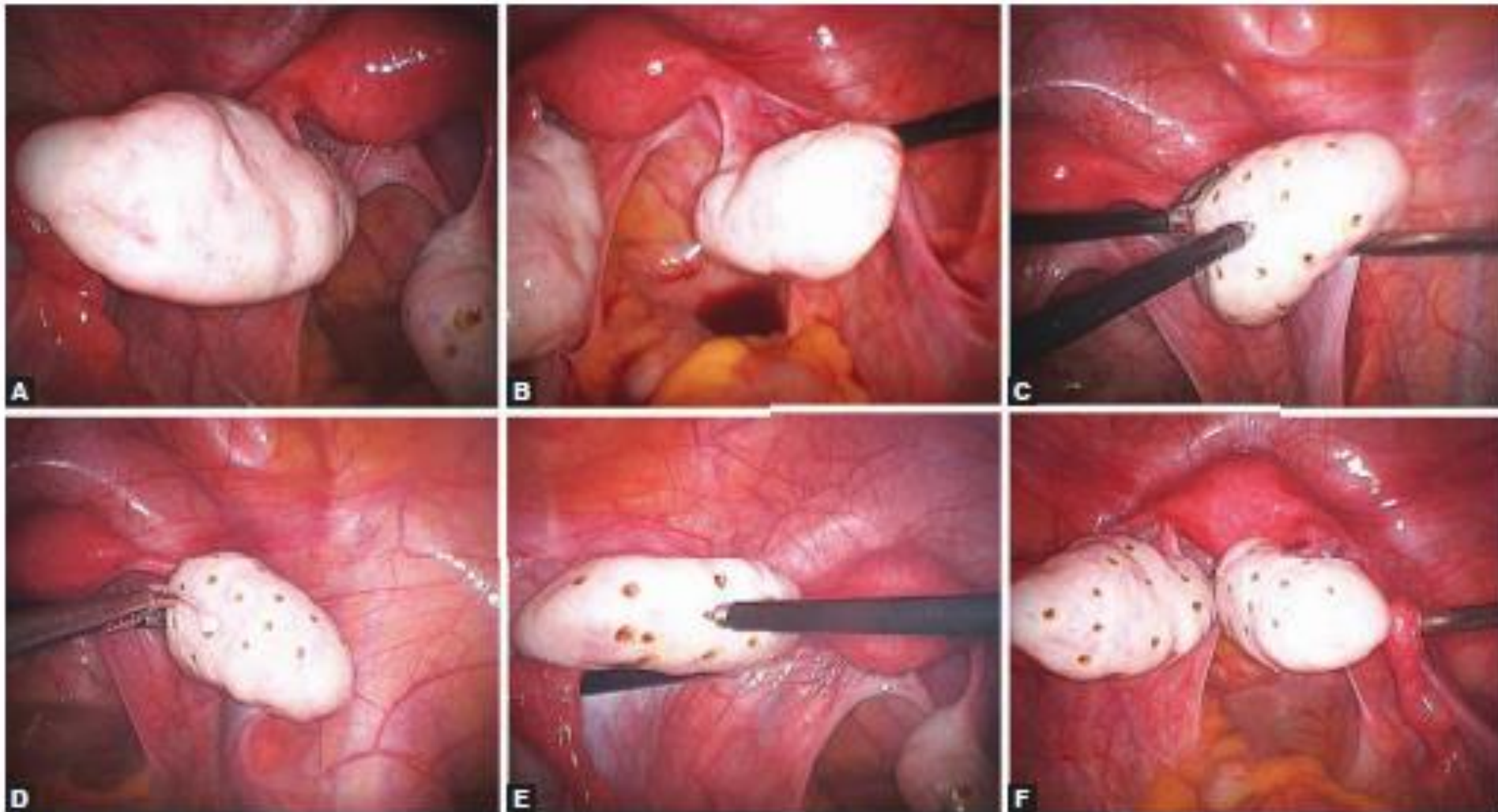
-

This provides a firm platform to the ovary while drilling is done. Ovaries must **be kept static** and should not keep falling down during the procedure. **Monopolar needle** is inserted from contralateral lower port and approaches the ovary at right angles. All visible bluish subcapsular follicles are cauterized.

Thorough irrigation of the ovaries is then carried out in order to cool them.

Depth of insertion of the monopolar cautery is **2 to 3** mm for just **2 to 3** seconds.

An underwater examination is done to look for any bleeding points



Figs 7A to F (A) Bilateral polycystic ovaries; (B) Lifting ovary from ovarian fossa with a blunt forceps; (C) Holding the ovarian ligament with atraumatic grasping forceps and approaching the ovary with monopolar cautery needle at right angle to the ovarian surface and drilling done; (D) Cooling the ovary after ovarian drilling with Ringers Lactate solution by suction irrigation cannula; (E) Treating (drilling) the left polycystic ovary by inserting the monopolar needle from the contra lateral port; (F) Bilateral polycystic ovaries after ovarian drilling

The following points are to be kept in mind while performing laparoscopic ovarian drilling:

- It is very important to **stabilize** the ovary while drilling otherwise if ovary falls, the **charged monopolar needle** can hit any vital structure and cause unintended damage.

Worst would be if it touches the **external or internal iliac vessels** at pelvic brim or ovarian fossa. This can cause sudden hematoma formation. Even a laparotomy may be needed if it grows big.

Future Fertility

Patients are allowed to conceive immediately after the surgery.

Couple should be put on minimal required stimulation.

There is no risk of hyperstimulation after drilling, till ovulation induction drugs are used in moderation, with very good pregnancy rates.

CONCLUSION

Advances in endoscopic surgery have revolutionized in the past few decades. Endoscopic surgery for infertility, when performed by an experienced endoscopist, is a boon to the suffering patient and can produce much better results than traditional procedures. Hysteroscopy should remain the primary diagnostic endoscopic procedure in the routine surgical assessment and management of infertile women.