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The Role of Endoscopy in Management of Infertility

Jozsef Daru and Attila Kereszturi

Additional information is available at the end of the chapter

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1. Introduction

1.1. Laparoscopy

1.1.1. Methods, techniques and equipment

Laparoscopy is used world-wide to investigate infertility. It is a minimally invasive surgical technique used in infertility diagnosis and treatment and generally accepted that diagnostic laparoscopy is the gold standard in diagnosing tubal pathology and other intra - abdominal causes of infertility. Laparoscopic surgery has revolutionized gynecological surgery. In a female, the uterus, fallopian tubes and ovaries are located in the pelvis which is at the very bottom of the abdomen. Laparoscopy allows seeing abnormalities that might interfere with a woman's ability to conceive a pregnancy. Infertility diagnostic and operative laparoscopy help evaluate gynecological problems such as uterine fibroids, structural abnormalities of the uterus, endometriosis, ovarian cysts and adhesions. A large number of procedures can be performed laparoscopically. Most commonly it is used to inspect the pelvic organs (diagnostic laparoscopy), and often to perform surgical procedures (operative laparoscopy) at the same time. Complicated endometriosis, pelvic adhesions, removal of large ovarian cysts and fibroids should only be performed by highly skilled laparoscopic surgeons. The fiber-optic camera on the laparoscope is very small. It is inserted into the body, through an incision made in the navel, another incision may be made near the upper pubic region.

1.2. Laparoscopy is often used for

- evaluating infertility
- treating the fallopian tubes
- removing scar tissue or adhesions
- treating endometriosis

2 Enhancing Success of Assisted Reproduction

- removing ovarian cysts
- unexplained infertility
- abnormal vaginal bleeding
- abdominal pain
- frequent miscarriage
- Ovarian drilling

Laparoscopy is performed using general anesthesia. This means that the patient is completely asleep during the entire procedure.

2. Basic equipment for laparoscopy

- Laparoscopic Trolley
- Light Source – Halogen
- High flow CO₂ insufflator
- Television monitor
- Video camera
- Videocassette recorder
- Suction/irrigation system
- Primary trocar, 10–12 mm
- Laparoscope, 10–12 mm
- 1 to 3 secondary trocars, 5 mm
- Biopsy forceps
- Blunt manipulating probe
- Bipolar coagulator
- Monopolar coagulator
- Grasping instruments
- Lasers, CO₂, KTP, Nd:YAG or argon
- Laparoscopic Morcellator
- Laparoscope needle holder
- Clip applicator
- Uterine manipulator
- Myoma Screw
- PCOD Needle
- Port Closures
- Ring Applicator
- Aspiration Needle
- L-Hook
- Cables, such as Cable-Martin, Cable-2 pin and Cables-L&T
- LigaSure

2.1. Laparoscopic microsurgery

In many situations, laparoscopy provides important and essential information in the management of infertility. It is a minimally invasive surgical procedure that uses a small

camera that allows direct visual examination of the pelvic reproductive anatomy. Laparoscopy detects endometriosis, scarring, fallopian tube damage, adhesions, ovarian cysts, fibroids, congenital abnormalities and polycystic ovaries. Laparoscopy allows to see abnormalities that might interfere with a woman's ability to conceive a pregnancy. The most common problems are endometriosis, pelvic adhesions, ovarian cysts and uterine fibroids. Laparoscopy less invasive surgery than traditional surgery; offers a closed internal environment, minimal tissue handling, less tissue trauma and is less adhesiogenic. It gives the desired magnification for microsurgery. Traditional surgery requires making an incision in the abdomen which is several centimeters long. This in turn means that the patient has to spend two to three nights in the hospital. After laparoscopy the patient has one to three smaller incisions. Laparoscopy allows seeing the abdominal organs and sometimes making repairs, without making a larger incision that can require a longer recovery time and hospital stay. Each incision may be one half a centimeter to a full centimeter in length. Most often, patients who have had a laparoscopy will be able to go home the same day as the surgery.

2.2. The benefits of laparoscopy

- More accurate diagnosis.
- No stitches.
- Therapeutic benefit
- Shorter recovery time
- Fewer post-op complications Less scarring.

2.3. Indications for laparoscopic microsurgery

- Tubal anastomosis
- Bowel repair
- Bladder repair
- Ureteric repair
- Microsurgical repair of *myoma*
- Neosalpingostomy
- Tubal anastomosis
- Tubocornual implantation

2.4. Environmental effects of fertility

Environment represents the totality of physical, chemical, biological and socioeconomic factors or conditions that constitute the external milieu surrounding the human organism. Up to 10% of infertility cannot be explained medically. Female factors in infertility stem from ovulation problems, thyroid irregularities, polycystic ovarian syndrome, and fallopian tube obstruction. Geographic differences may suggest environmental exposures that need investigation. Some toxins, gases can also have an impact on a person's fertility. The basic idea was to go to places in the world where we know that people have high level of exposures to substances that are suspected to cause these effects in fertility. Exploring multi-compound exposures is yet another challenge in environmental epidemiology.

2.5. Stress-related female infertility:

- Psychogenic amenorrhea
- Pseudocyesis
- Chronic anovulation
- anorexia nervosa
- Bulimia
- Menstrual dysfunction
- Early pregnancy loss
- Hyperprolactinemia and amenorrhea

The following factors increase a woman's risk of infertility:

- age
- stress
- overweight or underweight
- tobacco
- alcohol
- sexually transmitted diseases (STDs)
- health problems that cause hormonal changes
- athletic training
- poor diet

2.6. Toxic effect

- Heavy metals
- Centrally acting drugs
- Environmental pesticides
- Hormones

2.7. HSG versus Chromopertubation

The diagnosis of uterine and/or tubal pathology as causes of female infertility represents a fundamental step in the evaluation of the infertile couple. As a tubal factor is a common cause of infertility, evaluation of the infertile couple should include assessment of the fallopian tubes for patency. Several other diagnostic techniques useful to the clinical evaluation of the uterine cavity and tubal anatomy are: transvaginal sonography (TVS), hysterosalpingography (HSG), hysteroscopy and hydrosalpingography (HDS) and laparoscopy. In the evaluation of uterine and tubo-peritoneal factors causing infertility, almost all the protocols retain hysterosalpingography (HSG), hysteroscopy and laparoscopy, first choice diagnostic tools. HSG was widespread as a test method before the development of the Echovist®, which made it possible to visualize the fallopian tubes with ultrasound. Laparoscopy provides the most comprehensive information on the status of the internal genitalia. It permits the use of a contrast medium or dye to examine the fallopian tubes (chromopertubation). Secondly, the procedure provides important information regarding the presence of adhesions, inflammatory changes and endometriosis.

2.8. Endometriosis and infertility

Endometriosis is a condition in which endometrium tissue, normally found lining the uterus, spreads to other areas within a woman's pelvic cavity and abdomen, usually the fallopian tubes, ovaries and intestines. It is a leading cause of disability among reproductive age women secondary to infertility and pelvic pain. The epidemiology of endometriosis is poorly defined. The most widely accepted hypothesis is that endometrial cells are transported from the uterine cavity and subsequently become implanted at ectopic sites. Retrograde flow of menstrual tissue through the fallopian tubes could transport endometrial cells intra-abdominally; the lymphatic or circulatory system could transport endometrial cells to distant sites (eg, the pleural cavity). Another hypothesis is coelomic metaplasia: Coelomic epithelium is transformed into endometrium-like glands. According to medical statistics the infertility can affect around 40% of women with Endometriosis. Pelvic examination may be normal, or findings may include a retroverted and fixed uterus, enlarged ovaries, fixed ovarian masses, thickened rectovaginal septum, indurations of the cul-de-sac, and nodules on the uterosacral ligament. Rarely, lesions can be seen on the vulva or cervix or in the vagina, umbilicus, or surgical scars. Association between endometriosis and autoimmune diseases such as rheumatoid arthritis, systemic lupus erythematosus, hypothyroidism, hyperthyroidism, and multiple sclerosis have recently been described. In order to properly diagnose endometriosis, it is necessary to have a laparoscopy performed. During a Laparoscopic procedure, endometrial implants can be easily seen once these implants have reached a reasonable size. Endometriosis may be found in up to 50% of infertile women, according to the American Society for Reproductive Medicine.

The signs of endometriosis

- General Pelvic Pain
- Painful Sexual Intercourse
- Heavy Menstrual Periods
- Infertility
- Bladder Problems
- Constipation and/or Diarrhea
- Family History of Endometriosis

Pathophysiology of infertility in endometriotic patients:

- Increased prostaglandin level
- Sperm motility and binding
- Vascular Endothelial Growth Factor (VEGF)
- Tumor Necrosis Factor alpha(TNF- α)
- Immunological abnormalities
- Abnormal follicular development
- Reduced embryo implantation

Some patients with minimal endometriosis and normal pelvic anatomy are also infertile; reasons for impaired fertility include the following:

- Increased incidence of luteinized unruptured ovarian follicle syndrome (trapped oocyte)
- Increased peritoneal prostaglandin production or peritoneal macrophage activity (resulting in oocyte phagocytosis)
- Nonreceptive endometrium (because of luteal phase dysfunction or other abnormalities)

2.9. Endoscopic techniques in endometriosis

Infertility and pelvic pain in its various forms are the main expressions of endometriosis. The fallopian tubes and ovaries may adhere to the lining of the pelvis or to each other, restricting their movement. Another factor which cause infertility with Endometriosis, may be the over-production of prostaglandins. No laboratory findings are particularly helpful in making or confirming a diagnosis of endometriosis. Treatment of endometriosis, medical or surgical, is directed at ameliorating the symptoms and severity of the pelvic pain and infertility. Some of the options for treatment to conceive include:

- Medical therapy(GnRH, danazol,Ru486(Mifepristone),selective estrogen receptor modulators, TNF- α inhibitors,
- Ultrasound-guided aspiration
- Laparoscopic surgery
- IVF treatment
- IUI
- acupuncture
- NSAIDs for discomfort
- Drugs to suppress ovarian function

Surgery may include lysis of adhesions, restoration of normal anatomy and ablation of all endometriotic implants, cystectomy or resection of endometriomas and in extreme cases even the removal of the ovaries and the uterus. During laparoscopy can remove endometrial growths, scar tissue, and adhesions caused by the endometriosis. This is not a really cure, and endometriosis may return later. However, some women will have increased fertility for up to 6- 9 months after surgery.

2.10. Management of endometrioma

Endometriomas usually present as a pelvic mass arising from growth of ectopic endometrial tissue within the ovary. They typically contain thick brown tar-like fluid (hence the name "chocolate cyst"). Ultrasound is useful for supporting the clinical diagnosis of endometrioma. In case of infertility, the management of endometriomas is controversial. Many women with endometriosis can conceive naturally. For those who have difficulty, surgery often provides a "window of opportunity" during which the chances of conception increase the medical treatment alone usually is inadequate. The ultrasound-guided aspiration of the chocolate-colored fluid aspiration sometimes have serious consequences including post aspiration infection, pelvic adhesions, and ovarian abscess. Laparoscopic cystectomy is the gold standard, and preferred approach for the treatment of endometriosis and endometrioma.

Surgical treatment is associated with a high recurrence rate and its employment for women undergoing assisted conception.. Excision of the entire cyst by laparoscopy or laparotomy appears to be the optimum treatment approach. Fenestration and ablation of the lining of an endometrioma is a less preferred option. Aspiration alone is ineffective. Laparoscopic drainage of endometriomas has the same disadvantages as ultrasound-guided aspiration. The recurrence rate is very high (80-90%). Fenestration and ablation is also less effective than excision, both in terms of improving fertility and for reducing pain. Laparoscopic cystectomy remains a first-line choice for the treatment of endometrioma. This consists of: opening the cyst, identifying the cyst wall and removing it from the ovarian cortex by traction and with grasping forceps. Surgery is not only the elimination of the endometrioma effectively but also to reconstruct the pelvic anatomy. The advantage of medical treatment has not been shown to be effective in controlling symptoms or improving fertility potential. After surgical treatment GnRH for a period of 12 weeks or dienogest (Visanne®, 2 mg) should be useful. Birth control pills have been shown to be ineffective in postoperative treatment of endometriomas. Recurrent ovarian surgery is not recommended.

It is generally accepted, that patients with endometriosis have lower success rates with IVF than patients without endometriosis. Several investigations have been occurring to improve the pregnancy rates following treatment with IVF in patients with endometrioma.

2.11. Adhesions - laparoscopic adhesiolysis

Adhesions are bands of scar tissue that connect normally separated pelvic structures. Postoperative adhesions occur in 60% to 90% of patients undergoing major gynecologic surgery. Pelvic adhesions (scars) develop as a normal tissue response to inflammation, which occurs whenever the tissue is damaged. Adhesions are a frequent cause of infertility and pelvic pain in women. Pelvic adhesions impair fertility by disrupting normal tubal-ovarian relationships. Postoperative adhesions are sequel of impaired fibrinolysis of the fibrin and cellular exudates after peritoneal injury. Both microsurgical and laparoscopic techniques are used to treat pelvic adhesions. Additional studies also indicate the benefit of adhesiolysis in treating infertility. The most important factors which suppress fibrinolytic activity and promote adhesion formation are:

- Port wound just above the target of dissection
- Tissue Ischemia
- Prolonged operation
- Visceral injury
- Drying of serosal surfaces
- Blood clots
- Traction of peritoneum
- History of infection in the abdominal cavity
- Endometriosis
- Previous intra-abdominal trauma or bleeding (ectopic pregnancy, motor vehicle accidents, appendicitis)

- Surgical glove powder
- Delayed postoperative mobilization of patient

Causes of pelvic adhesions

- Previous pelvic or abdominal surgery (most common reason)
- History of cancer or radiation therapy

The incidence and severity of adhesions

- no adhesion
- filmy avascular adhesions
- vascular adhesions
- cordlike fibrous adhesions
- plain fibrous adhesions

Prevention of adhesions in surgery

With an optimal surgical technique intending to minimize mesothelial injury, peritoneal trauma is inevitable. laparoscopy leads to less adhesion formation compared to open surgery.

The most commonly used agents for preventing postoperative adhesions:

2.12. Adhesion Prevention Techniques

- Gentle Tissue Handling
- Use of Barrier Agents
- Precise Treatment of the Surgical Area
- Minimal Blood Loss
- Copious Pelvic Irrigation
- No Glove Powder Exposure
- Antibiotics
- Barriers (solid membranes, liquids)
- Antihistamines
- Hormones
- Nonsteroids

2.13. Laparoscopic adhesiolysis

Adhesiolysis is essential to restore normal tubo-ovarian anatomical relationships. The basic principles for carrying out adhesiolysis are followed: If the adhesion is thin and avascular, it is easily lysed and the chances of recurrence are not much. If adhesion is thick and highly vascular it is difficult to separate. Theses adhesion requires use of energy (Unipolar or Bipolar, Ultrasonic dissector). After achieving haemostasis sharp dissection with scissors are necessary. After adhesiolysis some fluid can be left inside to prevent recurrence or high molecular weight dextran tried to prevent re-adhesion. The fertility results after adhesiolysis are correlated with the state of the adhesions.

2.14. Complications

The most common intraoperative complication is injury to the bowel. With dense adhesions, this risk increases. Other intraoperative complications may include bleeding and injury to adjacent organs such as the gallbladder, spleen, ovaries, especially when working next to these organs-

3. Myomectomy

Uterine fibroids are the most common pelvic tumor, occurring in about 70% of women by age 45. However, many fibroids are small and asymptomatic. About 25% of white and 50% of black women have symptomatic fibroids. Fibroids are benign tumors of the muscle of the uterus most myomas do not cause clinical symptoms and do not require intervention. Based on location the various types of myoma are subserous, intramural and submucous fibroid. Most frequently, they develop in the myometrial wall and can lead to uterine distortion. Common problems associated with myomas are pelvic, abdominal, or back discomfort; urinary bladder irritability; abnormal uterine bleeding; bowel dysfunction; infertility; and pregnancy loss and/or complications. Myomas can cause infertility are mechanical interference with implantation, sperm and embryo transport, focal endometrial vascular and endocrine disturbances, endometrial inflammation, and abnormal uterine contractility. During the past few years, there have been a number of studies advancing the knowledge about the efficacy and safety of treatments of myomas, including medical and minimally invasive therapies. Laparoscopic myomectomy was first described by Semm and Metler in 1980 for subserosal fibroid there is an increasing trend for minimal access surgery for treatment of uterine myomas. Laparoscopic myomectomy is a very recent advance in the field of gynaecological surgery. Laparoscopic myomectomy has provided minimal invasive alternative to laparotomy with advantage of faster recovery and less postoperative adhesions. Laparoscopic myomectomy (LM) is an effective technique that is associated with the development of operative laparoscopic equipment and surgical techniques. The size does not matter for performance of a myomectomy laparoscopically. Laparoscopic myomectomy has evolved into a safe, efficient, and cost effective approach for the treatment of intramural, subserosal, and pedunculated fibroids. Criteria for myomectomy for surgical intervention, supported by the American College of Obstetricians and Gynecologists (ACOG) and American society for reproductive medicine (ASRM) are:

- Clinically apparent myomas that are a significant concern to the patient even if otherwise asymptomatic;
- Myomas causing excessive bleeding and/or anemia;
- Myomas causing acute or chronic pain; and
- Myomas causing significant urinary problems not due to other abnormalities;
- Infertility with distortion of the endometrial cavity or tubal occlusion.

Before myomectomy, Hysteroscopy is performed in most patients at the outset of the procedure, than all pelvic structures and the abdominal cavity are inspected

Steps of operation: subserosal myomas

- Injection with vasopressin.
- Positioning of Roeder loop around the base of the myoma.
- Coagulation of the capsule.
- Incision of the capsule.
- Myoma enucleation.
- Tension on the Roeder loop.
- Dissection of myoma.
- Closure of the capsule with Roeder loop or linear stapler.
- Myoma extraction with Morcellator.

Steps of operation: intramural and deep subserosal myomas

- Injection with vasopressin.
- Regulation of entry point for incision.
- Incision of uterus and capsule.
- Enucleation of myoma.
- Dislocation of myoma
- Coagulation of uterine bed.
- Closure of wound with deep muscular and superficial serosal closure.
- Morcellator and extraction of myoma.

3.1. Complications

- Secondary hemorrhage may occur
- Gastrointestinal injuries
- Adhesions
- Inflammations

3.2. Modalities of laparoscopic myomectomy

- Laparoscopic assisted myomectomy (LAM)
- Laparoscopic assisted Trans vaginal myomectomy
- Robotic laparoscopic myomectomy
- Laparoscopic myolysis and cryosurgery

Laparoscopic myomectomy generally is associated with shorter hospitalization; laparoscopic myomectomy is a benefit when traditional surgical management and future fertility are declined. After myomectomy the conception rate is approximately 53-70%. Laparoscopic uterine surgery predisposes an increased risk of uterine rupture during pregnancy, and delivery.

3.3. Infertility and Polycystic Ovary Syndrome

Polycystic ovarian syndrome (PCOS) is a fairly common condition. The incidence of Polycystic ovarian syndrome (PCOS) varies between 3% and 15% of women of reproductive

age, depending on the population studied and the diagnostic criteria applied. The cause of PCOS is unknown. However, PCOS is thought to be a genetic disorder (autosomal dominant) meaning that each child has a 50% chance of inheriting the disorder from a parent who carries the gene. The gene can be inherited from either mother or father. The exact gene causing PCOS has not yet been identified. The condition was first described in 1935 by American gynecologists Irving F. Stein, Sr. and Michael L. Leventhal, from whom its original name of *Stein-Leventhal syndrome* is taken.

In 1990 a consensus workshop sponsored by the NIH/NICHD suggested that a patient has PCOS if she has all of the following:

1. oligoovulation
2. signs of androgen excess (clinical or biochemical)
3. other entities are excluded that would cause polycystic ovaries

In 2003 a consensus workshop sponsored by ESHRE/ASRM in Rotterdam indicated PCOS to be present if any 2 out of 3 criteria are met

1. oligoovulation and/or anovulation
2. excess androgen activity
3. polycystic ovaries (by gynecologic ultrasound)

The insulin resistance with compensatory hyperinsulinemia is a prominent feature of the syndrome and seems to have a pathophysiologic role in the hyperandrogenism. It is a common hormonal disorder that is poorly understood and clinically characterized by lack of regular ovulation, irregular menstrual cycles, infertility, abnormal facial hair growth, obesity and polycystic ovaries. Polycystic ovarian syndrome can be difficult to diagnose because not all patients with PCOS display the same symptoms. Polycystic ovarian syndrome is a disorder characterized by insulin resistance and a compensatory elevated insulin level, which are found in both the overweight and non-overweight woman with the syndrome. In addition the patients has a risk for possible long-term metabolic hazards such as Type 2 diabetes mellitus, dyslipidemia, and cardiovascular disease. The symptoms of PCOS and their severity can vary from patient to patient;

- Irregular, absent, or few menstrual cycles
- Infertility
- Elevated levels of insulin, resistance to insulin, or diabetes
- Multiple cysts on ovaries
- Enlarged ovaries
- Obesity concentrated in the midsection
- Acne or oily skin
- High blood pressure
- Excess facial or body hair
- Thinning hair on the scalp

3.4. Standard diagnostic assessments

- History-taking, specifically for menstrual pattern, obesity, hirsutism, and the absence of breast development.
- Gynecologic ultrasonography, specifically looking for small ovarian follicles
- Serum (blood) levels of androgens, sex hormone-binding globulin (SHBG), LH (Luteinizing hormone), FSH (Follicle stimulating hormone), estrogen, and progesterone
- Fasting biochemical screen and lipid profile
- 2-hour oral glucose tolerance test (GTT)
- Laparoscopic examination

3.5. Differential diagnosis

Other causes of irregular or absent menstruation and hirsutism, such as:

- Hypothyroidism,
- Congenital adrenal hyperplasia (21-hydroxylase deficiency),
- Cushing's syndrome,
- Hyperprolactinemia,
- Androgen secreting neoplasms, and
- Other pituitary or adrenal disorders

PCOS has been reported in other insulin-resistant situations such as acromegaly

3.6. Therapy

Diet: Where PCOS is associated with overweight or obesity, successful weight loss is the most effective method of restoring normal ovulation/menstruation

Exercise

3.7. Symptomatic treatments

Anti-Androgens: Spironolactone (Aldactone), Cyproterone acetate, Flutamide (Eulexin), Finasteride (Propecia, Proscar)

Anti-Obesity Drugs: Orlistat (Xenical), Sibutramine (Meridia)

Metformin: National Institute for Health and Clinical Excellence recommended in 2004 that women with PCOS and a body mass index above 25 be given metformin when other therapy has failed to produce results. Metformin treatment reduces hyperinsulinemia, LH levels, free testosterone concentrations, in overweight women with PCOs. Metformin improves menstrual cyclicity and increases the frequency of ovulation.

Clomiphene citrate (Clomid, Serophene) alone or in combination with weight loss can be used to induce ovulation or with other, more aggressive, treatments for infertility. Including injection of gonadotropin hormones and assisted reproductive technologies may also be

required in women who desire pregnancy and do not become pregnant on Clomid therapy (Gonadotropin injections, hCG, human chorionic gonadotropin, GnRH Lutrepulse). The primary indications for the use of CC is normogonadotropic normoprolactinemic anovulatory infertility i.e. PCOS. Approximately 70-80% of the women will ovulate half of which will conceive.

IVF (in-vitro fertilization)

Steroid hormones: Oral contraceptives (birth control pills), Progesterone (bioidentical), Estrogens, and Corticosteroids

Bilateral wedge resection of ovaries were abandoned due to peri - ovarian adhesion formation.

Ovarian drilling: Surgical procedure which can help induce ovulation in some women who have not responded to other treatments for PCOS. In this procedure a small portion of ovarian tissue is destroyed by an electric current delivered through a needle inserted into the ovary. This is less invasive technique and less chances of multiple Pregnancy and ovarian hyperstimulation. Laparoscopic Ovarian Drilling is a safe and cost effective procedure and increases the sensitivity to gonadotrophins.

Tubal factor

Physiology of the fallopian tube

The fallopian tube has complex task:

- Pick up the released ovum
 - Transport the spermatozoa towards the ampulla
 - Sperm activation
 - Fertilization support
 - Embryo cleavage
 - Zygote transport

Tubal infertility includes the changes due to inflammation which affect the fallopian tube and its relation towards the ovary in a way that will affect ovulation, the transport of the egg, sperm, or embryo, or alter the function of the tube as the site of fertilization. Injury the distal oviduct resulting in a complete or partial occlusion is the most common tubal lesion. Microsurgical or laparoscopic repair is the primary method of treatment with pregnancy rates. Hydrosalpinges produces an adverse impact on results of *in vitro* fertilization. Removal of Hydrosalpinges will improve IVF success rates. The surgeon has to distinguish between the pathological findings according to the site which is affected.

This are:

1. Distal tubal obstruction (complete or incomplete)
2. Hydrosalpinx.
3. Isthmo-cornual block (complete or incomplete).
4. Any combination of the previous three categories.
5. Peritubal or periovarian adhesions.

3.8. Reversal of sterilization

Laparoscopic surgery offers greater comfort to the patients and is more economical, with shorter operative and postoperative hospitalization than laparotomy. Laparoscopic procedures limit the risk of postoperative adhesions to. Operative laparoscopy may be an alternative to microsurgery by laparotomy for management of tubal lesions. Many people, including doctors, mistakenly believe that tubal sterilization is permanent and irreversible. Tubal reversal surgery can also be performed laparoscopically. The laparoscopic technique uses magnification and allows much less pain, discomfort, disfigurement and adhesion formation than the traditional open method. Because the laparoscopic approach to tubal ligation reversal surgery is relatively new technique there is a limited amount of experience worldwide. Tubal ligation is performed for birth control. Tubal ligation blocks the fallopian tubes preventing the egg and sperm from passing through the fallopian tubes. Procedures are performed in several different ways including: burning, removal of a piece, placement of a tight surgical band or clip on the fallopian tube. People sometimes change their minds. The removal of this blockage is the tubal reversal. Tubal reanastomosis surgically opens the fallopian tubes to allow the sperm to reach the egg. When the tubes are severely damaged IVF is the first choice. A laparoscopic approach may be recommended especially in overweight patients where the abdominal wall is too thick to do the procedure the more common way by minilaparotomy. Laparoscopy allows the surgeon to inspect the tubes first to see if the reanastomosis can be done. The success of reversal is dependent on the amount of fallopian tube that has been damaged. Some tubes do not work well because of the surgery to block them followed by surgery to reopen them. In other circumstances a woman's age or her husband's sperm count are preventing success following tubal reversal surgery. Tubal reversal has a higher risk of ectopic pregnancy. Tubal reversal surgery is same-day surgery and takes between two and four weeks to recover. The success rate is greater than 75% for pregnancy.

3.9. Tubal reversal surgeries:

- Tubo - tubal anastomosis
- Tubo - uterine implantation
- Ampullary salpingostomy
- Mini-laparotomy tubal reversal
- Laparoscopic tubal reversal
- Robotic assisted tubal reversal
- Essure sterilization reversal
- Adiana sterilization reversal

Tubal reversal success rates vary widely depending upon many factors. These include the women's ages, methods of tubal ligation that they had performed experience of the surgeon and techniques for repairing the tubes, length of follow-up after reversal surgery among other factors.

4. Salpingitis Isthmica Nodosa

The etiology of salpingitis isthmica nodosa is unknown; however it may be a post infectious reaction. Patients have histological evidence of previous salpingitis and may have high serum Chlamydia antibody titers. The radiological prevalence of SIN is 3.9-7.5%. The disease is usually bilateral (over 50% of cases). In severe cases, it leads to complete obliteration of the tubal lumen. SIN is associated with infertility and ectopic pregnancy. Salpingitis isthmica nodosa is also referred to as tubal diverticulosis. HSG demonstrates multiple small diverticular collections of contrast protruding from the lumen into the wall of the isthmic portion of the fallopian tubes. Histologically, the up to 2 mm sized diverticula represent hypertrophied tubal mucosa that penetrates the myosalpinx. There is secondary hyperplasia and hypertrophy of the surrounding myosalpinx, and hence at laparoscopy, localized nodular thickening or swelling of the isthmus is identified.

Laparoscopic finding: enlargement of the tubocornual or isthmic portion of the fallopian tube. The condition is associated with infertility and the occurrence of ectopic pregnancy. The appropriate management of the patients with SIN segmental resection with microtubal reanastomosis.

4.1. Salpingectomy in IVF patients with tubal infertility and hydrosalpinges

Hydrosalpinges are dilated and occluded fallopian tubes generally the result of a prior pelvic infection. These are a cause of female infertility in a number of patients IVF the only option for having a child. The accepted theory today is that the hydrosalpinx fluid plays a causative role in the reduced pregnancy rate with ART. Hydrosalpinx fluid may reduce the receptive ability of the endometrium. It is well known that the success of ART for patients with tubal disease with hydrosalpinx is reduced by half compared with patients without hydrosalpinx. A number of studies were published examining the effect of salpingectomy on IVF pregnancy rates. Removing a hydrosalpinx by laparoscopic salpingectomy may to improve pregnancy rates. Surgical treatment should be considered for all women with hydrosalpinges prior to IVF treatment. In cases of sonographically apparent hydrosalpinges, a salpingectomy, rather than a salpingostomy, is the preferred route of treatment. Some couples, however, may prefer a salpingostomy, which offers some potential of a spontaneous pregnancy, but laparoscopic salpingectomy of hydrosalpinges prior to IVF treatment increases the odds of pregnancy and live birth compared to no treatment.

4.2. Management of ectopic pregnancy

Ectopic pregnancy is a high-risk condition that occurs in 1.9 percent of reported pregnancies. The etiology of ectopic pregnancy remains uncertain although a number of risk factors have been identified. Risk factors most strongly associated with ectopic pregnancy include previous ectopic pregnancy, tubal surgery, assisted reproductive technology, genital infection and pelvic inflammatory disease intrauterine contraceptive device. A history of genital infections or infertility and current smoking increase risk.

4.3. Diagnosis

- Diagnostic tests for ectopic pregnancy include a urine pregnancy test
- Ultrasonography
- beta-hCG measurement
- Occasionally, diagnostic curettage.
- some physicians have used serum progesterone levels
- no combination of physical examination findings can reliably exclude ectopic pregnancy
- 40 percent in a patient with abdominal pain and vaginal bleeding but no other risk factors
- 30 percent of patients with ectopic pregnancies have no vaginal bleeding
- 10 percent have a palpable adnexal mass
- 10 percent have negative pelvic examinations
- In cases where an ectopic pregnancy is suspected and ultrasound is inconclusive, a diagnostic laparoscopy may be required.

4.4. Differential diagnosis of ectopic pregnancy

- Acute appendicitis
- Ovarian torsion
- Pelvic inflammatory disease
- Miscarriage
- Ruptured corpus luteum cyst or follicle
- Tubo-ovarian abscess
- Urinary calculi

4.5. Treatment

Expectant management

Is between 47 and 82 percent effective in managing ectopic pregnancy

Medical treatment

Methotrexate, a folic acid antagonist, is a well-studied medical therapy. Side effects of methotrexate include bone marrow suppression, elevated liver enzymes, rash, alopecia, stomatitis, nausea, and diarrhea. The time to resolution of the ectopic pregnancy is three to seven weeks after methotrexate therapy.

Surgical treatment

A laparoscopic approach is preferable to an open approach in a patient who is haemodynamically stable. If the contra lateral tube is healthy, the preferred option is salpingectomy, where the entire Fallopian tube, or the affected segment containing the ectopic gestation, is removed. In the past few years laparoscopy with salpingostomy, without

fallopian tube removal, has become the preferred method of surgical treatment. Laparoscopy has similar tubal patency and future fertility rates as medical treatment.

Follow-up and prognosis

During treatment, physicians should examine patients at least weekly and sometimes daily. Serial beta-hCG measurements should be taken after treatment until the level is undetectable.

Adnexal mass in infertility

There are a number of possible disorders that can cause a pelvic mass. Some are common, while others are quite unusual or even rare. The physical exam should include visualization and palpation of the abdomen. The next step is usually an imaging study, such as ultrasound, CAT scan, or MRI

Differential diagnoses

- Uterine fibroids
- Uterine cancer
- Benign ovarian cyst
- Ectopic pregnancy
- Fallopian tube cyst
- Hydrosalpinx
- Ovarian cancer

Follicular cysts

There are several different types of ovarian cysts, the most common being functional cysts. Often, ovarian cysts do not cause symptoms. Women in the age group of thirty to sixty are more prone to having ovarian cysts. The follicular cysts are easily identified on vaginal sonography, usually measure a few millimeters to a few centimeters in size, and rarely become symptomatic. If they enlarge in size they may rupture, producing transient abdominal pain. Ovarian cysts can cause several other problems if they twist, bleed, or rupture

Dermoid cyst

Ovarian dermoid cyst, also known as mature teratoma, is a non cancerous ovarian tumor, which is more commonly found in young women. Although dermoids are non cancerous, in some rare cases, they might develop into cancerous growth. Dermoid cysts may contain substances such as nails and dental, cartilage like, and bonelike structures. These growths can develop in a woman during her reproductive years. Dermoids can range in size anywhere between two to ten centimeters. It is very difficult to identify the presence of these cysts inside the ovaries as they do not produce any symptoms. They can cause torsion, infection, rupture, and cancer. These dermoid cysts can be removed with either conventional surgery or laparoscopy. Ovarian dermoid cysts do not affect the fertility of the woman.

Tubo ovarian abscess

Tubo-ovarian abscess is an advanced form of pelvic inflammatory disease most often caused by spread of bacteria from the lower genital tract. It is one of the most severe complications of PID and can lead to significant morbidity and occasional mortality. The microbial etiology of TOAs typically is polymicrobial with a mixture of anaerobic, aerobic, and facultative organisms being isolated. The most common bacterial pathogens are anaerobic. Sexually transmitted disease, early age of first sexual encounter, multiple sexual partners, douching, IUDs are at increased risk for pelvic inflammatory disease and tubo-ovarian abscess. Diverticulitis and appendicitis are also potential causes.

5. Differential diagnosis

- Hemorrhagic cyst
- Endometrioma
- Ectopic pregnancy - if pregnancy test positive
- Cystadenoma
- Cystadenocarcinoma
- Dermoid cyst
- Acute appendicitis
- Diverticulitis

5.1. Complications:

Infertility due to tubal occlusion, increased risk of ectopic pregnancy, and chronic pelvic pain as the result of adhesions.

5.2. Therapy

Treatment of TOA historically was surgical with most women having a total abdominal hysterectomy and bilateral salpingo-oophorectomy. Management of TOAs has changed drastically in the past decades with the advent of broad-spectrum antibiotics (ampicillin, clindamycin, and flagyl) and continues to evolve with improved imaging and drainage techniques. Recently antibiotics, surgical intervention, with either conventional surgery or laparoscopy to be in use.

Adnexal torsion

Adnexal torsion is an uncommon gynecologic emergency that is caused by the twisting of the ovary, fallopian tube, or both along the vascular pedicle. It is a rare gynecologic emergency of women at reproductive ages. Usually adnexal torsion is a process of benign tumors. The clinical presentation is often nonspecific with few distinctive physical findings, commonly resulting in delay in diagnosis and surgical management. The causes of adnexal torsion include functional and pathologic ovarian cysts, paraovarian cysts, ovarian hyper stimulation, adhesions, ectopic pregnancy, and congenital malformations. Classically,

patients present with sudden onset, severe, unilateral lower abdominal pain that worsens intermittently over many hours. Nausea and vomiting occur in approximately 70% of patients, mimicking a gastrointestinal source of pain and further obscuring the diagnosis. Colored Doppler sonography with its non-invasive modality detects blood flow patterns within the ovarian vascular networks and gives important information about the diagnosis of torsion. Laparoscopy surgery must be the choice for less post operative morbidity, and a better cosmetic appearance. Detorsion must be performed even in necrotic appearing adnexa because of a high rate of survival of ovaries even looking necrotic. Salpingo-oophorectomy may be indicated if severe vascular compromise, peritonitis, or tissue necrosis is clearly evident.

6. Endoscopy complications

Diagnostic laparoscopy is normally the standard procedure performed as the final test in the infertility work up before progressing to infertility treatment. For the most part, the risks associated with laparoscopy are of the same type that occurs with traditional surgery. Problems from anesthesia, bleeding and infections can occur with either type of surgery. The risk of damage to internal organs is also possible with either type of surgery. The risks of laparoscopy are minimal. Complications among young, healthy women undergoing laparoscopy are rare and occur only in about three out of 1000 cases. These complications can include injuries to structures in the abdomen such as: injury to the bowel, stomach, urinary bladder, ureters, abdominal and pelvic blood vessels, ovaries and uterus. For such injuries, a laparotomy might be necessary to stop bleeding or make repairs. Most often, these injuries occur when the laparoscope is placed through the navel. The risk of a serious complication is less than 1%. Any surgery can have an anesthesia-related complication or be associated with post-operative infection. Fortunately, all of these complications are very unusual. According to the American Society of Reproductive Medicine, one or two women out of every 100 may develop a complication, usually a minor one. Some common complications include:

- damage to the bladder, bowel, and kidneys
- damage to the blood vessels
- internal bleeding
- infection
- reaction to anesthesia
- bladder infection after surgery
- skin irritation around the areas of incision
- formation of adhesions
- hematomas of the abdominal wall
- infection
- allergic reaction
- nerve damage
- urinary retention
- Weeping Peritoneum

- Gas Embolism
- Blood clots
- Hernia
- Thermal Injury
- Port site metastasis
- Other general anesthesia complications
- Death (around 3 in every 100,000)

Certain conditions make laparoscopic surgery a bad choice. Some of these conditions include:

- Severe congestive heart failure
- Respiratory insufficiency
- Presence of a distended bowel
- Previous laparotomy incisions
- Patients with cardiac disease or COPD
- Patients with numerous previous abdominal surgery
- Old age
- Obesity

As in all aspects of medicine, laparoscopic surgery requires experience on the part of the surgeon in order to afford patients the best possible outcome. Accurate diagnosis and appropriate management of complications are requisite of all surgeons.

7. Hysteroscopy

Hysteroscopy is the visual examination of the canal of the cervix and interior of the uterus.. The device is inserted through the vagina.Using fiber optic technology, the hysteroscope transmits an image of the uterine canal and cavity to a monitor, allowing to properly guide the instrument into the endometrial cavity. Hysteroscopy may be performed in women who have an abnormal uterine bleeding, abnormal Pap test, or postmenopausal bleeding. It may be used to help diagnose causes of infertility or repeated miscarriages. Hysteroscopy may also be used to evaluate polyps, uterine adhesions (Asherman's syndrome), and fibroids, and to locate and remove displaced intrauterine devices (IUDs). There are two types of hysteroscopy. Diagnostic hysteroscopy is performed to examine the uterus for signs of normalcy or abnormality, while operative hysteroscopy is performed to treat a disorder after it has been diagnosed. The procedure is very similar to diagnostic hysteroscopy except that operating instruments such as scissors, biopsy forceps, electocautery instruments, and graspers can be placed into the uterine cavity through a channel in the operative hysteroscope. Hysteroscopy can take from two to five minutes to more than one hour. During hysteroscopy either fluids or CO₂ gas is introduced to expand the cavity.

7.1. Indications

- Asherman's syndrome
- Endometrial polyp
- Gynecologic bleeding

- Endometrial ablation
- Myomectomy for uterine fibroids
- Congenital Uterine malformations
- Evacuation of retained products of conception
- Removal of embedded IUDs
- Infertility:
- sterilization
- Absent/ scanty menses.
- Cornual block.

7.2. The advantages of hysteroscopy

- No incisions
- Shortened hospital stay
- Reduced post-operative pain
- Shortened Convalescence
- Reduced risk of infection
- High patient satisfaction

7.3. Resection of polyps/fibroid

In the past, the treatment of benign uterine lesions metrorrhagia; Hysteroscopic surgery is effective to treat menorrhagia and leiomyomas, and other lesions, such as septate uterus and synechiae. In the last 20 years there has been an increased acceptance of hysteroscopic surgery into the gynecological surgery. Diagnostic hysteroscopy is a highly sensitive and specific technique for the management of uterine bleeding problems. It may distinguish between myomas or polyps and provides additional information about surrounding endometrium. Endometrial polyp is the commonest pathology among the structural uterine abnormalities. A polyp is attached to the intestinal wall either by a stalk, peduncles, or by a broad base. The sizes of uterine polyps range from a few millimeters — no larger than a sesame seed — to several centimeters — golf ball sized or larger. Many women with myomata, polyps, uterine septae, and synechiae may now benefit from the convenience of hysteroscopic therapy compared to more aggressive surgical techniques. Hysteroscopy is the first choice in the resection for the treatment of endometrial polyps in women with abnormal uterine bleeding and postmenopausal metrorrhagia. The greatest advantage of hysteroscopic myomectomy is the quick recovery time. The prevalence of malignancy or atypical hyperplasia is 3.2% in women with symptoms and 3.9% in those without symptoms. Transcervical resection is the gold standard for treatment of endometrial polyps. Uterine polyps most commonly occur in women in their 40s and 50s.

7.4. Intrauterine adhesions- adhesiolysis

Intrauterine adhesions develop as a result of intrauterine trauma. Intrauterine adhesions can be asymptomatic and of no clinical significance. Symptoms associated with clinically significant intrauterine adhesions include:

- Infertility
- Menstrual irregularities (hypomenorrhea, amenorrhea)
- Cyclic pelvic pain
- Recurrent pregnancy loss.

The diagnosis is based upon visualization of intrauterine adhesions either directly by hysteroscopy, or indirectly by imaging. The standard treatment of intrauterine adhesions is surgery with lysis under direct visualization. Intrauterine adhesions are cut hysteroscopically using current so that the uterine cavity appears normal. This is usually performed as an ambulatory procedure using operative hysteroscopy. Postoperative management is focused upon reducing the risk of reformation of adhesions.

7.5. Septum resection

Complete septum extending from fundus of uterus till cervix. Hysteroscopic resection uses hysteroscopy to operate within the uterine cavity. An intrauterine septum is cut using current, so that the uterine cavity becomes normal. Polyps, fibroids and uterine septums may be treated with this technique.

7.6. Hysteroscopic resection of fibroid

A local or general anesthetic may be used. The uterus is filled with fluid and the hysteroscope is inserted through the cervix into the uterus. This device guides the physician to the fibroid, which is then removed in pieces with a wire loop. Sometimes a second procedure is needed to remove the entire fibroid. Pregnancy rates have been high among women who had this procedure to remove a fibroid that was causing fertility problems.

7.7. Hysteroscopic metroplasty

Congenital uterine malformations are a group of miscellaneous anomalies in the uterine cavity that may alter the reproductive outcome of the patient. Each type of uterine anomaly has a different impact on pregnancy outcome. These are usually asymptomatic, but are sometimes associated with recurrent pregnancy loss or infertility. A uterine septum is a fibrous band that divides an otherwise normal womb into two halves. It is a much commoner condition than bicornuate uterus and can be associated with subfertility or recurrent miscarriage. Obstetrical prognosis of patients presenting repeated pregnancy loss and septate uterus is statistically improved by hysteroscopic metroplasty. Hysteroscopic metroplasty is a day-case procedure and pregnancy can be attempted soon afterwards.

7.8. Office hysteroscopy

There have been a number of studies published that indicates office-based hysteroscopy identifies uterine defects in a large number of infertility patients. Office hysteroscopy is a very simple procedure that requires minimal instrumentation. Office hysteroscopy is

advantageous both to the patient and the physician. Office-based hysteroscopy has many benefits to diagnose and treat uterine defects which should improve embryo implantation and pregnancy rates. Hysteroscopy can be performed in a routine office exam room. Office hysteroscopy has been performed using carbon dioxide. Diagnostic office hysteroscopy is a safe procedure, with few significant complications, and the patient can resume normal activities immediately.

7.9. Complications

Complications occur rarely during hysteroscopy. A possible problem is uterine perforation when either the hysteroscope itself or one of its operative instruments breaches the wall of the uterus. Injury of the bowel during a perforation, the resulting peritonitis can be fatal. Cervical laceration, intrauterine infection, electrical and laser injuries, and complications caused by the distention media can be frequently encountered. The use of insufflations media can lead to serious and even fatal complications due to embolism or fluid overload with electrolyte imbalances. Other possible complications include allergic reactions and bleeding. The overall complication rate for diagnostic and operative hysteroscopy is 2% with serious complications occurring in less than 1% of cases. The complications of hysteroscopy:

- Bleeding
- Infection
- Perforation of the uterus (rare)/damage to cervix
- Pelvic inflammatory disease
- Complications from fluid or gas used to expand the uterus

Author details

Jozsef Daru and Attila Kereszturi

Department of Obstetrics and Gynecology, University of Szeged, Hungary

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