

Fertility Enhancing Surgeries that aid in natural Conception

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Abstract

Infertility is a rising problem worldwide, hampering the psychological and social wellbeing of thousands of couples. There is a huge financial involvement for its diagnosis and treatment as well. The main goal of reproductive pelvic surgery is to restore pelvic anatomy ensuring a patent and functional pathway for the sperm to reach the ovulated oocyte and a safe implantation into the endometrial cavity. The striking progress in assisted reproductive technology (ART) have upgraded the fertility outcome in despondent cases recently. This review article aims to highlight some surgical procedures commonly performed for better fertility outcome. It involves studying the available material in the textbooks, printed and online journals. The surgically treatable causes of infertility include Endometriosis, Polycystic Ovarian Syndrome, Tubo-peritoneal disease, Mullerian Anomalies and Uterine Myoma. In addition, Endometrial Polyps and Asherman's Syndrome may also be treated surgically. A thorough evaluation and work up is mandatory to individualize the treatment plan for each patient. A wide spectrum of promising surgeries is available for the treatment of infertility. The surgical approaches have to be individualized depending upon the disease aspect. This is the sound way to measure the effectiveness of reproductive surgeries to restore the natural conception.

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Introduction

Infertility is a rising scourge. Worldwide, it is a distressing reality for huge number of couples. It tremendously hampers their psychological and social wellbeing. In addition, there is a huge financial involvement for its investigation, diagnosis and treatment. Many causes of infertility can be treated surgically to increase the chances for conception. The main goal in performing reproductive pelvic surgery among infertile patients is to restore pelvic anatomy and have a patent and functional pathway for the sperm to reach the ovulated oocyte for fertilization and transport of the embryo back into the endometrial cavity for implantation. Fertility enhancing surgeries have very promising role in infertility treatment which aid in natural conception. Recently the striking progresses in assisted reproductive technology (ART) have upgraded the fertility outcome in despondent cases. This review article aims to highlight some surgical procedures commonly performed for better fertility outcome.

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Fertility enhancing surgeries

Causes of infertility potentially amenable to surgical treatment include tubo-peritoneal disease and abnormalities of the uterine cavity.¹ Surgery can help in achieving natural conception by correcting some uterine and tubal pathologies like myoma, tubal obstruction or adhesions. Over previous several decades, new techniques and instruments have been innovated that have reshaped the performance of reproductive pelvic surgery. First was the recognition of the role of “microsurgery” in the execution of these procedures. The advantages of microsurgery include achieving meticulous hemostasis, minimizing tissue handling, preventing desiccation of tissue, using fine suture material of low tissue reactivity, and precisely reapproximating tissue planes.^{2,3} The second was the implementation of endoscopic surgery as preferred approach in the surgical treatment of infertility. Third was the option for tissue incision or excision with the use of electro surgery, harmonics or lasers.

Following surgical approaches are cornerstones to help achieve natural conception:

- Uterine myomas: Laparoscopic or hysteroscopic myomectomy.
- Endometrial polyp: Hysteroscopic polypectomy.
- Proximal tubal occlusion: Tubal cannulation.
- Distal tubal obstruction: Tubal reconstruction and adhesiolysis
- Polycystic Ovaries: Laparoscopic ovarian drilling.
- Endometriosis: Adhesiolysis, laser ablation and fulguration of endometriotic deposits, endometrioma cystectomy.
- Congenital uterine septum and Tshaped uterus: Hysteroscopic septoplasty and Lateral metroplasty.
- Asherman’s syndrome: Adhesiolysis.

Female infertility conditions treated by surgery:

Endometriosis:

20 to 40% of women with endometriosis may experience subfertility. Endometriosis can contribute to infertility in several ways. It may be a direct cause through formation of adnexal adhesions (peritoneal or tubal adhesions) which form a mechanical barrier or otherwise impairs tubal ovum pickup and subsequently sperm–oocyte interaction. Endometriosis can also have effects on ovarian steroidogenesis, ovulation, tubal motility, tubal ciliary action, peritoneal macrophage activity and implantation. Endometriosis has several clinical presentations like superficial endometriosis, deep endometriosis and endometrioma. The severity of symptoms may not correlate with disease process.

Surgical approach to endometriosis:

In minimal to mild endometriosis: Adhesiolysis and ablation of endometriotic deposits are done to improve fertility. After laparoscopic adhesiolysis and ablation of superficial endometriosis there are two fold increase in conception rate.

In moderate to severe endometriosis: Laparoscopic surgery is effective. Adhesiolysis is done to restore normal pelvic anatomy. Two prospective cohort studies show that after laparoscopic surgery spontaneous pregnancy rate became 57-69% in moderate endometriosis and 52 to 68% in severe endometriosis, whereas another study reveals that there are lower spontaneous pregnancy rates following expectant management: 33% (moderate endometriosis) and 0 % (severe endometriosis).^{4,5}

In Endometrioma: When the endometrioma is less than 4 cm in diameter, it may be managed conservatively.⁶ But, when the endometrioma is greater than 4 cm in diameter, laparoscopic cystectomy improves fertility in comparison to drainage and ablation. It is considered that ovarian reserve tends to reduce following cystectomy in comparison to drainage and ablation, but cystectomy is still better option in context of improving the

chance of natural conception and reduction in recurrence rate of symptoms. There is a debate whether post-surgical long term use of medical therapy for suppression of endometriosis would be appropriate or not. In vitro fertilization may be needed in patient with tubal damage, associated male factor infertility or if there is failed previous fertility treatment. In case of moderate to severe endometriosis prior treatment with GnRH agonist for 2-3 months can improve conception rate.⁶

Polycystic ovarian syndrome:

Polycystic ovarian syndrome (PCOS) is the most common endocrine disorder affecting young women (over 5% women of childbearing age).⁷ It causes over 70% of cases of infertility due to anovulation.⁸ Laparoscopic ovarian drilling is the second line method of treatment for infertile polycystic ovarian disease patients who have shown resistant to clomiphene citrate, letrozole or other gonadotrophin therapy. Laparoscopic ovarian drilling can minimize the risk of multiple pregnancy and ovarian hyperstimulation syndrome following gonadotrophin therapy. It ensures mono ovulation and surpassing the side effect of ovarian hyper stimulation syndrome. During ovarian drilling 4 to 8 punctures are performed through electrosurgery in each ovary using 400-800J energy. More than 8 punctures may cause postoperative pelvic adhesions and decrease ovarian reserve. Following ovarian drilling 74% of cases have normal ovulation within 6 months.⁹ Following ovarian drilling there is spontaneous restoration of fertility in 20 to 64% cases of infertile women with PCOS who did not respond to clomiphene citrate treatment.¹⁰

Tubo-peritoneal disease:

Pelvic adhesions have been considered as significant contributing cause of infertility. In these patients aim of reconstructive pelvic surgery include adhesiolysis that interfere with physiologic processes of ovum release, pickup, and transport, and minimal

subsequent development of postoperative adhesions. After optimum adhesiolysis pregnancy is more likely to occur in the presence of low-grade compared with high grade adhesions. There is chance of improved pregnancy rate when more than 50% of the ovary can be visible and adhesions are filmy and avascular rather than dense and vascular. The postsurgical pregnancy rate was 32% with mild adhesions, 26.6% with moderate adhesions, and 5.5% with severe adhesions.¹¹

25 to 35% of infertility is caused by fallopian tubal blockage. Surgical approaches depend on the site and extent of tubal block.

Proximal tubal block:

The proximal tubal obstruction is more common and is caused by mucous plug, tubal spasm or due to fibrosis following infection or endometriosis. It is surgically treated with salpingography under fluoroscopy, tubal cannulation and tubo-cornual anastomosis. Mucous plug blockage can be easily removed by salpingography under fluoroscopy. Proximal tubal cannulation is performed by introducing hysteroscopically guided catheter with simultaneous visualization by laparoscopy. It reveals 95% successful result following unilateral tubal cannulation and 85% successful result following bilateral tubal cannulation. In proximal tubal occlusion tubo-cornual anastomosis is another surgical option.

Mid tubal block:

Tubal microsurgical procedures are better option in case of mid tubal block and distal tubal block. Microsurgical interventions minimize tissue damage and proper healing of tissue to prevent adhesions. In case of tubal sterilization reversal and salpingitis isthmica nodosa microsurgical interventions are better option. Among women desiring reversal of previous tubal ligations, the success rate depends on age, the method of sterilization, site of anastomosis, final length of the reconstructed tube. The method of tubal occlusion is a major prognostic factor in subsequent pregnancy outcome. The best results are observed with clips or fallope rings;

the worst outcome follows unipolar cautery. Intermediate pregnancy rates are achieved following segmental resection or bipolar cautery. These differences may be partially explained by the resultant length of tube after anastomosis, increasing tubal length correlates directly with improved pregnancy outcome. An additional factor may be the extent of damage to the tubal blood vessel arcade, some studies have suggested a possible role of this network in ovulation and pregnancy outcome. In tubocornual anastomosis, an additional advantageous prognostic factor is preservation of as much of the intramural segment of the fallopian tube as possible.¹² The length of time between tubal ligation and reversal has been shown to be another prognostic factor. Time inversely correlates with subsequent pregnancy outcome. Location of tubal occlusion is another major prognostic factor. Risk of ectopic pregnancy following tubal reanastomosis is 3 to 7%. It is better to do preoperative assessment by doing hysterosalpinography.

Distal tubal block:

Distal tubal obstruction is commonly caused by hydrosalpinx or fimbrial phimosis. It is claimed that the chance of pregnancy rates are halved and the occurrence of spontaneous abortion are almost doubled in case of hydrosalpinx. Hydrosalpinx can be treated by clipping, aspiration of hydrosalpinx fluid, neosalpingostomy and salpingectomy. For Fimbrial phimosis, fimbryolysis and fimbrioplasty can be done to release fimbrial adhesion. Salpingoscopy and fimbrial biopsy can help predict the likelihood of establishing a pregnancy after distal tubal obstruction treatment. It has long been observed that the pregnancy outcome after neosalpingostomy depends on the extent of tubal disease. The relatively poor pregnancy outcome after neosalpingostomy, compared with other types of reconstructive pelvic surgical procedures, and despite re-establishment of tubal patency in most patients, is thought to be caused by intraluminal tubal pathology. The presence of coexistent pelvic adhesions, which restrict

tubal motility and ovum capture has also been implicated in reduction of successful pregnancy outcome. Patients with severe forms of tubal disease have diminished pregnancy rates after neosalpingostomy and may benefit from ART rather than surgery.

Uterine pathology:

A variety of congenital and acquired abnormalities of the uterus have been suggested as contributing factors for infertility.

Mullerian anomalies:

Mullerian anomalies are congenital anatomical defects that occur due to fusion defects of the mullerian ducts. These account for 5 to 12% of infertility.

Uterine septum:

Septate uterus is the most commonly encountered congenital malformation that may result in repeated pregnancy loss and infertility. According to the European Society of Human Reproduction and Embryology (ESHRE) classification septate uterus (class U2) is defined as the one with an internal indentation > 50% of uterine wall thickness with an external contour that is straight or has indentation of <50%. They are further subclassified into partial and complete septum.¹³ Most of these patients are asymptomatic and identified during infertility work up. Although there is no conclusive evidence suggesting septal resection in every case of infertility, multiple studies have claimed that septal resection improves chances of pregnancy in case of patients with repeated pregnancy loss. Hysteroscopic transcervical septal resection using cold scissors, needle electrodes forms the mainstay of treatment of partial septum resection. It is better using Collins knife resectoscope in case of broad, thick and complete septal resection. A study showed complete healing of uterine cavity occurs within 8 weeks.¹⁴

Dysmorphic T-shaped uterus:

Dysmorphic T-shaped uterus is now considered in class U1 of the ESHRE classification.⁹ It is associated with infertility or adverse pregnancy outcome. Although the actual mechanism of contributing to infertility is not known, it is claimed that altered volume and shape of uterine cavity may interfere with endometrial receptivity.

For treating this type of anomaly hysteroscopic lateral metroplasty proves to be a fertility improving surgery. Hysteroscopic lateral metroplasty is usually done using scissors or resectoscope with monopolar hook or bipolar electrode. The goal of surgery is to restore a triangular shape to the uterine cavity.

Uterine myoma:

Fibroids or uterine leiomyoma are frequently found among reproductive age group women and are considered as cause of infertility. It is estimated that 5 to 10% of infertile women have fibroids and that fibroids are present in 1 to 2.4% of infertile women with no other obvious cause of infertility.¹⁵ The international Federation of Gynecology and Obstetrics (FIGO) classify fibroids/ leiomyoma into eight sub group.¹⁶ Among them Intramural and submucosal fibroids are implicated for infertility and pregnancy loss. The routine approaches of myomectomy for infertility patients having fibroid are controversial. Decision in favor of myomectomy usually depends on number, site and size of fibroids. Any symptomatic submucosal or intramural fibroids distort the uterine cavity, presence of multiple fibroids or single intramural fibroid bigger than 5 cm or history of recurrent implantation failure in fibroid patient need to be operated. Laparoscopic myomectomy is the preferred route for surgery for large intramural fibroid or multiple fibroids. A thorough proper preoperative evaluation and correction of anemia is crucial. In cases with large fibroid, preoperative gonadotrophic releasing hormones (GnRH) agonist administration for 6-12 weeks may reduce the size and

vascularity of fibroids. During surgery per operative use of injection vasopressin and tranexamic acid help to decrease blood loss during myomectomy. Smooth myoma enucleation followed by appropriate suturing of myoma bed are the most crucial steps of surgery. Excessive use of electrocautery should be avoided and delayed absorbable sutures are usually preferred during myomectomy. Small submucous myoma are better to be removed by hysteroscopic myomectomy. Resectoscope is the standard instrument for resecting submucous myoma. Bipolar electrode is preferred considering greater safety margin. Now a days hysteroscopic morcellator is a recent advancement for fibroid resection, which can avoid complications of fluid overload and electrosurgical complications. Chance of pregnancy increases following myomectomy. Multiple studies demonstrated better pregnancy outcome following laparoscopic and hysteroscopic myomectomy.¹⁷⁻²⁰

Endometrial polyp:

Endometrial polyps are benign local overgrowths of the endometrial mucosa. Although most polyps are asymptomatic, some may present with abnormal uterine bleeding. The association between polyps and infertility is still ill-defined. The polyps may mechanically interfere with sperm transport or alter expression of molecular markers, HOXA11 and HOXA11 gene that affect endometrial receptivity and embryo implantation.²¹⁻²² Polyps can be diagnosed by transvaginal ultrasound, hysterosalpingography or more sensitively by saline infusion sonohysterography (SIS). Hysteroscopy is the gold standard method for the diagnosis of endometrial polyps. All symptomatic polyps need to be removed. Hysteroscopic polypectomy is usually performed by using cold scissors, graspers. In case of larger polyps resectoscope and morcellator are used for polypectomy. Some observational studies reported 50 to 78% post-polypectomy spontaneous pregnancy rate in infertile women with endometrial polyps.²³⁻²⁶

Asherman's syndrome:

Asherman's syndrome is the presence of adhesions within the uterine cavity. It occurs due to damage to the basal layer of endometrium. The adhesions partially or completely obliterate the uterine cavity. Obliteration of the uterine cavity by adhesions causes hypomenorrhoea, amenorrhoea and infertility. The most common cause of intrauterine adhesions is sharp curettage of gravid uterus for the treatment of spontaneous abortion. Uterine infection is another common cause of intrauterine adhesion formation. When it occurs following corporeal tuberculosis the treatment outcome is poor.²⁷ Asherman's syndrome can be diagnosed by saline infusion sonogram (SIS), hysterosalpingography (HSG) and hysteroscopy. The American Fertility Society classified intrauterine adhesions into three different stages- mild, moderate and severe, depending on the extent of cavity involved (<1/3, 1/3–2/3, >2/3), type of adhesions (filmy or dense), and menstrual pattern (normal, hypomenorrhoea or amenorrhoea). It is better to perform adhesiolysis before initiating infertility treatment. In mild or moderate group adhesiolysis is usually done using cold scissors. In patients having severe degree of adhesions use of electro-surgery may be needed. The post adhesiolysis pregnancy rate decreases with the severity of adhesions.²⁸ Most patients require IVF as there is very negligible chance of natural conception. The chance of re adhesion formation is very high ranging between 3.1% and 23.5%.²⁹

Conclusion:

The infertility related problems are alarmingly increasing these days. A thorough evaluation and work up is mandatory to address the possible detrimental effects on female fertility and to individualize the treatment plan for each patient. There are wide spectrums of promising surgery for the treatment of infertility. No standard protocol is universal for all patients. The surgical approaches

have to be individualized depending upon the disease aspect. This is the sound way to measure the effectiveness of reproductive surgeries to restore the natural conception.

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