procedures. HALS allows the surgeon to insert his or her hand into the abdominal cavity through a relatively small incision while preserving the ability to work under pneumoperitoneum. This new technique of hand assistance during laparoscopic provides tactile sensation of the lesion that is not possible with simple laparoscopy. HALS has been used in the treatment of early-stage colorectal, renal, and ovarian cancers and for various other benign surgical and gynecological indications.

Robotic Surgery

Robotic technology represents significant progress along the continuum of minimally invasive operative techniques, accounting for shorter performance times, improved accuracy, greater dexterity, and quicker suturing when matched against conventional laparoscopy.

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Principles of Different Laparoscopic Technics for treating Pelvic Organ Prolapse

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Advantages of Laparoscopy for repair of pelvic organ prolapse are due to its superior visualization and magnification. With laparoscope a realistic view of the pelvic floor can be obtained and the pelvic supporting defects can be clearly identified.

Moreover, unlike the traditional vaginal or abdominal surgical approach, the laparoscopic approach permits the surgeon to not only see the supporting defects clearly, but to also feel the defects by performing a vaginal examination under direct laparoscopic view during the procedure.

With laparoscopic route suturing is precise and effective. Furthermore, the minimal invasive nature of laparoscopic surgery results in greatly reduced the postoperative pain and discomfort and shortened hospitalization and recovery period.

In this write up basic principles and technique of four procedures including Laparoscopic Sacrocolpopexy/ Sacrocervicopexy (Laparoscopic Promonto Fixation), Laparoscopic Pectopexy (Laparoscopic Pectineal Ligament Suspension), Laparoscopic Lateral and Paravaginal (Cooper's ligament) suspension are discussed.

Port placement

The entire procedure is performed laparoscopically under general anesthesia. The patients are placed in the steep semi lithotomy position. A 4-puncture transperitoneal video laparoscopic approach is used for surgical access. Two 12-mm trocars are inserted centrally (intraumbilical and 5 cm above the symphysis), and two 5-mm trocars are inserted bilaterally at the level of the umbilicus (Figure 1).

Figure 1.
Port placement and OR arrangements

Laparoscopic Sacrocolpopexy and Sacrocervicopexy

The technique of laparoscopic sacrocolpopexy and sacrocervicopexy involves placement of a Y-shaped polypropylene mesh and attaching it to the vaginal apex and the anterior sacral ligament. Peritoneum is incised over the promontory (Figure 2a), along the right pelvic side wall and pararectal space to the vaginal apex. Vaginal apex or cervix is dissected free from the bladder and rectum for manipulation (Figure 3a & 3b). The arms of the Y-shaped graft are then secured to the fibromuscular pubocervical fascia anteriorly (Figure 4) and the rectovaginal septum posteriorly with a series of 4 – 6 permanent 2-O breaded sutures thereby spreading out the tension on the graft over the entire vaginal apex. Additional dissection till levetor plate and fixing stems of mesh to levetor plate is advocated in large defect. Sutures are placed with almost a full-thickness pass, but care is taken to avoid any suture material from passing through the vaginal mucosa.

The depth of dissection, especially posteriorly, varies depending on the extent of the prolapse. The Y arm is then secured to the anterior sacral ligament with 2 permanent synthetic stitches without any tension on the graft (Figure 2b). Ideally, the graft lays along the right pelvic sidewall and is completely reperitonealized at the end [1-3].

If a concomitant hysterectomy is performed first, it is a supracervical hysterectomy, and the mesh is attached to the cervix in a similar fashion

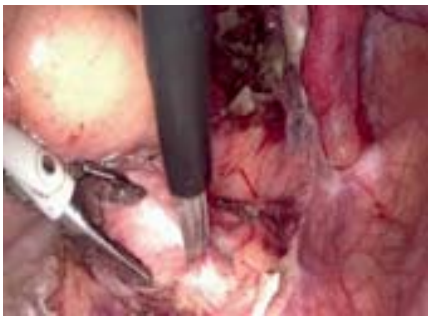


Figure 2a.
Dissection over Sacral Promontory

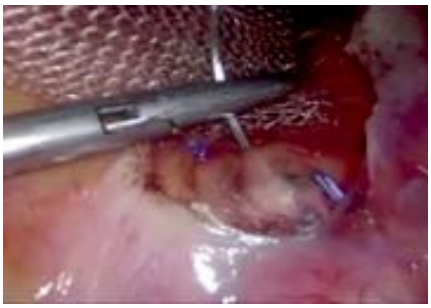


Figure 2b.
Mesh Fixation over Sacral Promontory

Urethral support with a tension-free sling is offered in the standard fashion in patients with urethral hypermobility, occult stress incontinence, and genuine stress incontinence on urodynamic studies.

Figure 3a.
Dissection in Rectovaginal space and on Levetor Ani

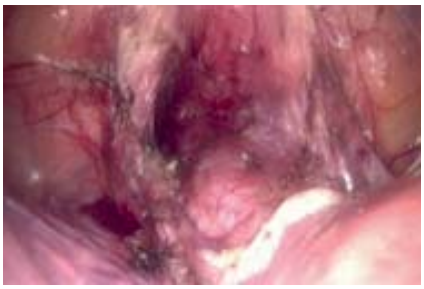


Figure 3b.
Vesico Vaginal Space Dissection

A posterior colpoperineorrhaphy is advised vaginally to complete the Level III repair by plicating the endopelvic fascia and perineal body. Urinary catheter is kept at least one day.

Figure 4.
Anterior Mesh Fixation

The Y arm of the graft is individually adjusted so that adequate vaginal length is attained without tension on the graft. The tension-free sling adequately provides the paravaginal support as well, because no large anterior prolapses are noted despite global detachments before surgery

Laparoscopic Paravaginal Repair

The bladder is reflected traversing peritoneum, loose areolar tissue, and the thin membrane overlying the arcus-tendineus-fascia-pelvis (ATFP). An arched peritoneal incision is made with electrosurgical scissors centrally between the two lateral umbilical ligaments and above the bladder dome. The bladder is then reflected away from the pubic symphysis by blunt dissection of loose areolar tissue (Figure 5a). The bladder is bluntly dissected medially to reveal the paravaginal space, remaining anterior to the ischial spines and obturator bundles and clear of aberrant obturator vessels.

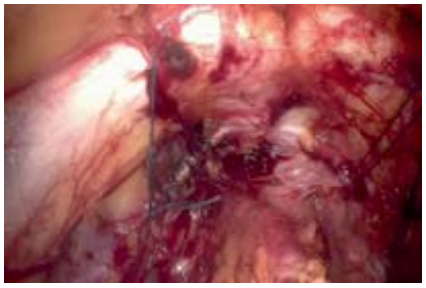
With a finger in the vagina recognition of actual defect is achieved. Paravaginal defects are closed with 4 to 6 sutures of synthetic permanent 2-0 material starting from the distal point and alternating right and left sides to maintain vaginal symmetry (Figure 5b). One bite is taken in the lateral pubocervical fascia and subepithelial vagina and one in the ATFP and obturator internus muscle, tying 3 to 4 knots [4].

The commonest configuration is four sutures on each side, with the distal third as triple-bite sutures and the proximal one taking one bite in the vagina and one in the iliopectineal ligament. Omitting the obturator internus bite is vital to avoid neurovascular injury.

The sutures are tied without tension merely to close the defect, but tied more tightly if correction of urethral hypermobility is needed.

Concomitant hysteropexy or colpopexy and a laparoscopic supralevator repair can be offered depending on the defects. Screening cystoscopy is recommended to exclude intravesical sutures and to ascertain an intact bladder and normal ureteric function.

Figure 5a.
Space of Ritzius dissection,



5b.
Paravaginal Repair

Laparoscopic Lateral Suspension

Endopelvic fascia is dissected first. The anterior vaginal wall and pubocervical fascia are freed from the bladder and the dissection continues below the cystocele.

The posterior vaginal wall and rectovaginal septum are then dissected away from the rectum. The upper part of the levator ani muscles is dissected bilaterally. If indicated, subtotal hysterectomy is preferred to total hysterectomy, as reports suggest more infections and postoperative vaginal erosions when using mesh with Total Laparoscopic Hysterectomy.

Then reinforcement of the rectovaginal septum is carried out, using a rectangular Synthetic mesh. The size is modified according to the size of the defect (6- to 8-cm long and 4- to 6-cm wide). After preparation, the mesh is introduced into the peritoneal cavity through the midline suprapubic trocar and placed over the dissected rectovaginal septum. The patch is then fixed inferiorly to the levator ani muscles and superiorly to the isthmus or to the anterior part of the uterosacral ligaments, using separate interrupted permanent sutures.

This is followed by reapproximation of the uterosacral ligaments to the posterior isthmus or the vaginal vault using permanent sutures followed by pouch of Douglas obliteration. The vaginal vault / uterus is suspended using mesh, placed as a transversal hammock.

Another strip of approximately 30 cm is prepared from the mesh. Then bilateral retroperitoneal tunnels, is performed under vision. Small cutaneous incisions (3 mm) are made 2-cm above and 4-cm lateral to the anterior superior iliac

spines. Through these incisions, a laparoscopic atraumatic forceps (4-mm) is introduced, perforating only the aponeurosis of the external oblique muscle. The introduction of the forceps is done in an avascular area outlined by transillumination. The forceps advance caudally and retroperitoneal, passing under the ipsilateral round ligament and exiting through the peritoneal incision. On each side, the distal end of the mesh is grasped by the laparoscopic atraumatic forceps, and pulled out of the cutaneous incision above the iliac crests. The hammock is then suspended up to the desired level of the vaginal vault by pulling away, symmetrically, on both ends [5].

As with the tension free vaginal tape (TVT) procedure, the protruding ends of the mesh are retained, unsutured, at the desired level until the end of procedure. Then the mesh ends are cut 2-mm below the cutaneous incision. Running absorbable suture is used for reperitonealization of the vesicouterine fold and cul-de-sac. In the presence of genuine stress incontinence (GSI), a laparoscopic Burch procedure is usually carried out after the second step of the same operation.

Laparoscopic Pectopexy

The peritoneal layer is opened along the left round ligament toward the pelvic wall. The dissection starts at the left external iliac vein and is carried out in the medial and caudal direction with intermittent bipolar coagulation. Approximately 3-cm segment of the left iliopectineal ligament (Cooper ligament) adjacent to ileopsoas muscle insertion is exposed (Figure 6a). This portion of the ligament is at the level of S2. Special care is taken to avoid any contact with the obturator nerve, situated caudal to it [6].

The same dissection is repeated on the right side. The incisions on both sides are connected by opening the peritoneal layer toward the cervical stump/ vaginal apex.

In patients who have undergone a complete hysterectomy, the peritoneum is dissected, and the anterior and posterior parts of the vaginal apex are prepared for the mesh fixation. The next step starts with the insertion polypropylene mesh into the abdominal cavity. The mesh ends are attached to both iliopectineal ligaments using nonabsorbable suture material. The cervical stump or vaginal apex, respectively, is elevated to the intended tension-free position; the fixation is performed using either non-absorbable suture material (for cervical stump) or polydioxanone suture (PDS) (for vaginal apex) (Figure 6b). A hammock-like fixation of the cervix/vaginal apex resulted (Figure 6c). Finally, the mesh is covered with peritoneum using absorbable suture material in a continuous endoscopic suturing technique [7].

Figure 6a.
Left Pectineal Ligament Dissection and mesh fixation

Figure 6b.
Mesh fixation with vault

Figure 6c.
Laparoscopic Pectopexy

Pectopexy, compared with sacropexy, offers clear practical advantages to the surgeon because of a less hazardous preparation. Pectopexy is equivalent to the sacral colpopexy in respect to the relapse rate of apical descensus and better long-term outcome because of the lower probability of disorders caused by narrowing of the pelvis like defecation disorders and stress urinary incontinence (SUI).

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Safety Guidelines in The Fluid Management of Operative Hysteroscopy

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INTRODUCTION

The endometrial lining is a fragile entity and has a tendency to bleed on contact , therefore a media is used to distend the cavity and view the endometrium in a panoramic mode. There are different media used such as gaseous (CO2) and liquid (Hyskon , glycine, sorbitol, normal saline).

The liquid distension media which are commonly used are :

1. Glycine 1.5% (for monopolar use)
2. Normal saline (for bipolar use)

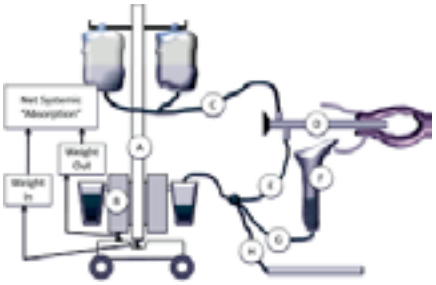
The Body Mass Index(BMI) of each patient is an important factor to be kept in mind because lower the BMI higher are the chances of the patient going in for volume overload.

WARNING SIGNS OF DISTENSION MEDIUM OVERLOAD:

1) Acute hyponatremia – serum sodium levels <130 meq/L ,have to be managed by giving 3% normal saline upto 1.5 to 2 meq/ hr and furosemide 40mg .
2) ECG changes – QRS Complex broadening, ST segment elevation.
3) Bradycardia
4) Hypotension
5) Restlessness (during SA)
6) Prolongation of bleeding time and clotting time (seen with dextran)
7) decreased glomerular filtration rate /anuria
8) increased pulmonary wedge pressure
9) pulmonary edema.

SAFETY METHODS OF FLUID INFUSION:

1. AUTOMATED FLUID MANAGEMENT SYSTEM



A – pole
B – canister for collecting fluid
C – towards resectoscope
D – towards endometrial cavity
F – leaks around the resectoscope

2. COMPRESSION CUFF WITH PRESSURE GUAGE

AAGL PRACTICE GUIDELINES 2013 RECOMMENDS THE FOLLOWING :

1. Preoperative recording of baseline levels of sodium, potassium and chloride in women on diuretics or with predisposing conditions to electrolyte disturbances.
2. The risks associated with volume overload can be reduced by reducing preoperative oral or intravenous fluid intake.
3. The uterine cavity distension pressure should be maintained below the mean arterial pressure.
4. The surgical team should be trained to monitor distending fluid medium input-output including all 3 potential sources: return from the hysteroscope, spill from the vagina and loss to the floor.
5. The use of an automated fluid management system is recommended.
6. Maximum fluid deficit when using hypotonic solutions in elderly patients should not exceed 750ml and in younger individuals upto 1000ml is permitted.

SAFETY CHECK POINTS

1) The Anaesthesiologist and the nursing staff in the operating room should be well trained to make note of the fluid deficit , warning signs of volume overload and necessary emergency measures in case of intraoperative or postoperative complications.
2) Both general and spinal anaesthesia are used but quick intubation facility should be available whenever situation warrants. Advantage of spinal anaesthesia is the level of consciousness of the patient and breathing pattern of the patient can be monitored.
3) ICU back up should be available.
4) Monitoring of the blood pressure , pulse rate, oxygen saturation,respiratory rate and urine output in the post operative period.
5) Good optics - camera clarity and telescope
6) Preferably bipolar cautery should be used.
7) Surgeon skill & expertise.

8) Proper selection of patient.

9) Complete evaluation of the patient with proper pre-anaesthetic check up.

10) Fluid input-output should be checked/monitored/calculated at an interval of every 10 mins by using fluid collecting bag below the patient(leak/spillage around the resectoscope)

11) Deficit is the difference between input and output of distension medium. If deficit is 1 litre procedure should be completed in 5 minutes and if deficit is more than 1.5 litres procedure should be abandoned when using 1.5% Glycine as the distension media.

CAUTION : INFUSION PUMPS WITH THE SPHYGMOMANOMETER CUFF SHOULD NEVER BE USED.

CONCLUSION

Although operative hysteroscopy is a minimally invasive scarless surgery there is a multi organ involvement due to the use of distension media and a lot of hemodynamic changes occur during the procedure. Proper evaluation of the patient & precautionary measures are necessary for a successful hysteroscopic surgery.

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Vasopressin use in Gynecologic Laparoscopy

Dr. Mahendra Borse

Dr. Tejas Gundewar

Vasopressin is a naturally occurring hormone produced by magnocellular neurons of hypothalamus & secreted by posterior lobe of pituitary gland (1, 2). Vasopressin has multitude of effects on various organ systems but its effect of vasoconstriction has attracted gynecologic surgeons.

Vasopressin was one of the first hormones known to mankind. It was discovered by Oliver & Shafer in 1895 (3). But it took almost 60 years before it was used in gynecologic surgery. Reports of its use in gynecologic surgery date back to 1959 when Dillon (4) published a report describing use of vasopressin as a hemostatic agent in gynecologic surgery. Most of the reports that followed, focused on prophylactic use of vasopressin at the start of procedure to decrease blood loss during surgery.

However in 1990, Ornipressin a commercial formulation of vasopressin was banned in France owing to several deaths associated with its use (5). Similar reports came from England which led to banning of vasopressin use in gynecologic surgeries in several European countries.

Till date we have been unable to find any review regarding the use of vasopressin in general and laparoscopic gynecological surgeries. Herein, we review the available literature on physiology, pharmacology, potential benefits, safety profile and contraindications of vasopressin.

Physiology, Pharmacology & Clinical application

Vasopressin also known as antidiuretic hormone (ADH), is a neurophysial hormone found in most mammals. In most species, it contains arginine & is thus also called as arginine vasopressin (AVP) or argipressin. Vasopressin a nonapeptide hormone, is produced by magnocellular neurosecretory neurons in Paraventricular & Supraoptic nucleus of hypothalamus. It then travels down the axons to the posterior pituitary where it is stored, until released into blood. Gene encoding it, is present on chromosome number 20 (2).

Vasopressin has a dual role in normal homeostasis. Its principal role lies in regulating extracellular fluid osmolality. Through a completely different mechanism it participates in volume & pressure regulation. Basal vasopressin levels range between 0.5 – 2 pg/Ql. Given its short half life of 24 minutes, body is able to maintain this narrow range (2).

Vasopressin mediates its action through three receptors. V1 receptors are present on vascular tree & smooth muscles throughout the body especially gastrointestinal tract. These receptors are of special interest in gynecologic surgery since uterus primarily contains this form (6, 7). Activation of these receptors results in vasoconstriction of vessels and smooth muscle contraction (8). Via this mechanism it regulates volume & pressure. So, the vasoconstrictive effect & increased myometrial contractility (9) contribute to the effectiveness of vasopressin as a hemostatic agent in gynecologic surgery.

V2 receptors are present in the collecting ducts of kidney. Activation of these receptors increases water permeability of distal convoluted tubule & collecting duct cells, thus increasing water reabsorption and secretion of concentrated urine (i.e anti diuresis).

V3 receptors stimulate adrenocorticotropic hormone release from anterior lobe of the pituitary gland. Several special circumstances are worth mentioning in regard to physiological release of vasopressin. One such circumstance is a group of patients undergoing laparoscopic surgery. CO2 pneumoperitoneum results in an increase in mean arterial pressure (MAP), systemic vascular resistance (SVR), peripheral vascular resistance (PVR) and a decrease in cardiac output without a significant change in heart rate. The increase in SVR is associated with a marked release of vasopressin and catecholamines notably norepinephrine (10, 11). This pressor response is secondary to hypercarbia induced release of vasopressin & catecholamines (10, 12, 13).

Vasopressin products in India

Vasopressin is commercially manufactured by different pharmaceutical companies in two forms.

- Pre-filled Syringes / Injections
- Vials

It is available in different concentrations. 10 pressor units/ml, 20 pressor units/ml & 40 pressor units/ml.

Dosing & Administration

Vasopressin is typically packaged in vials of 20 U/mL, with 1 mL in the vial. It is almost universally accepted that, dilution be performed because the vasopressin molecule is extremely potent, and diffusion of the drug into the tissues creates hemostasis over a large area. However, there is a paucity of data about appropriate dosing and dilution of vasopressin in gynecologic procedures because no dosage trials have been performed in this arena. What we

have are reports that describe maximal dosages that may result in complications. The lowest concentrations in trials that demonstrated effectiveness in reducing blood loss were as low as 0.05 U/mL (14, 15). Although, most trials typically used concentrations of 0.2 U/mL, which is easily prepared by combining the contents of 1 vial with 100 mL normal saline. There are multiple advantages of using larger dilutions. First, if there is inadvertent intravascular injection, there will be less chance of a single large bolus of the medication. Secondly, it is possible to re administer vasopressin if required. Because the half life is less than 30 minutes, it is conceivable that multiple dosing's may be necessary. This is possible only if solution is very dilute; else, levels for cardiac toxicity may be reached. Thirdly, large dilutions can help for creation of surgical planes and enable diffusion of the medication to larger areas of tissue and thus causing widespread tissue blanching (16). Vasopressin administration in gynecologic laparoscopic procedures is done with the help of laparoscopic needle. In cases of myomectomy, interstitial ectopic, cesarean scar ectopic it is administered intramyometrially. In cases of tubal recanalization & linear salpingotomy it is administered in the mesosalpinx and below the ovarian surface before stripping of ovarian endometriomas.

Table 1: Showing dilutions used for preparing vasopressin injections.

Sr. No	Vial Concentration	Dilution Volume	Concentration of Solution Prepared
1.	20U/ml	400ml	0.05 U/ml
2.	20U/ml	300ml	0.066 U/ml
3.	20U/ml	200ml	0.1 U/ml
4.	20U/ml	100ml	0.2 U/ml
5.	20U/ml	40ml	0.5 U/ml
6.	40U/ml	40ml	1 U/ml

Indications for use in Gynecologic Endoscopy

Hemorrhage is one of the most common complications in gynecologic surgery. Because of the vasoconstrictive effects, vasopressin reduces the blood loss during surgical procedures. This effect is strongest in the immediate area of administration, but is also systemic. It also causes increased myometrial contractility which contributes to decreased blood loss. This is important in circumstances in which the feeding vessels to the structures being operated on are unable to be interrupted before incision (i.e., myomectomy, tubal procedures). In such cases, the ability to operate without having substantial bleeding can reduce operative time and improve surgical visualization & efficacy.

Following are the indications for its use in gynecologic procedures.

1. Myomectomy (Laproscopic or Hysteroscopic)
2. Cystectomy for Ovarian Endometrioma
3. Ectopic Pregnancy Management
4. Tubal Recanalization & Tubal Microsurgery

Here we describe these various procedures individually along with the literature supporting or contraindicating its use.

Laparoscopic Myomectomy

The largest body of published literature on use of vasopressin during gynecologic procedures involves myomectomy. Multiple authors have proposed use of vasopressin, but in very few published reports controlled trials have been performed.

Sizzi *et al.* (17) conducted an Italian multicenter study of complications in 2050 laparoscopic myomectomies, which had the use of vasoconstrictive agent in 37% cases to reduce the operative time. It concluded that the operating time for fibroid enucleation was reduced with the use of vasoconstrictive agent.

Frederick *et al.* (18) conducted a randomised placebo –controlled trial as early as in 1994 to assess the efficacy of intramyometrial vasopressin for minimizing bleeding and its sequelae at myomectomy. Either 20 units vasopressin diluted to 20 ml in normal saline or placebo (20 ml NS) were injected intramyometrialy. Median blood loss of 225 ml in vasopressin group was significantly lower as compared to 675 ml in the placebo group.

Cohen *et al* (19) conducted a randomized controlled trial including 152 women undergoing laparoscopic myomectomy. Participants were randomized to high (200mL) or low

(30mL) volume vasopressin solution. Twenty units were diluted in saline and half of the resulting solution was injected (total of 10 units of vasopressin). They concluded that there was lower calculated estimated blood loss in the higher volume group, but it was not associated with differences in perioperative outcome.

T. Kimura *et al* (20) conducted a non-randomized study including 84 patients who were given intramyometrial vasopressin injection during myomectomy. It significantly reduced the intraoperative blood loss and postoperative hemoglobin fall in patients with or without GnRH agonist pretreatment. No serious complications occurred on account of the vasopressin injection. He concluded that intraoperative vasopressin injection is effective even in GnRH agonist-pretreated patients.

Rakesh Modi (21) reported a total of 157 patients who received intramyometrial vasopressin before Laparoscopic myomectomy. 10 units vasopressin was added to 100ml normal saline. For fibroids of 8cm size, 40 units were added to 400 ml of normal saline and

complete solution was injected. The mean blood loss was 20-250 ml & operative time ranged between 50-100 minutes. There were no complications & no need of blood transfusion.

According to E.J. Kongnyuy (22), who made a systematic review of 12 randomised controlled trials with 674 participants on different methods of reducing hemorrhage during myomectomy, significant reduction of intraoperative blood loss (298.72 ml) was noted when vasopressin is injected into the uterine muscles overlying the myoma. He concluded that blood loss was significantly lower with vasopressin vs placebo.

The department of Chinese University of Honk Kong (CUHK) conducted a randomized trial including 39 premenopausal women with symptomatic submucous fibroid. They were randomized to two groups – one group received direct injection of vasopressin to fibroid during hysteroscopy and the other received saline injection. The result proved that direct vasopressin injection to submucous fibroids significantly reduced fluid intravasation and blood loss during operation. It also provided a better surgical visualization and efficiency.

A recent Cochrane review concluded that there was a statistically significant decrease in blood loss when vasopressin was used without an associated risk of complications; the evidence is still limited, and further studies are needed on this topic.

Laparoscopic management of Endometrioma

Laparoscopic surgery has become a standard in the conservative treatment of ovarian endometriomas. In a Cochrane review, the authors concluded that excisional surgery for endometriomas provides a more favorable outcome than drainage and ablation with regards to fertility prognosis and recurrence of endometrioma (23). Few studies have indicated that cystectomy & cauterization with bipolar was associated with decreased postoperative ovarian reserve & high percentage of premature ovarian failure particularly in women with bilateral endometriomas (24-27). It has been reported that removal of healthy ovarian tissues and thermal destruction of ovarian follicles due to excessive use of bipolar coagulation may be the primary causes of damage to ovarian function (28, 29). So, to minimize recurrence and protect the ovarian reserve during laparoscopic cystectomy of endometriomas, vasopressin injection technique has been used.

Ai Saeki, MD et al (30) conducted a prospective study on 15 women with unilateral endometriomas. The women were divided into three groups. Group I – ordinary laparoscopic cystectomy performed, Group II – laparoscopic cystectomy after saline injection Group III – Laparoscopic cystectomy after vasopressin injection technique. Diluted vasopressin (0.1 U/mL

ie, 20 units diluted to 200 mL) was injected from inside of the cyst wall into the space between the cyst wall and the normal ovarian cortex. 2- to 3-mL diluted vasopressin injection was followed by a large amount of saline solution (50 to

70 mL) to achieve hydrodissection. 0.3-1.2 U of vasopressin was used in total. Pinpoint coagulation events were significantly lower in vasopressin group as compared to other two groups.

Ren Qiong-zhen, MD et al (31) conducted a prospective study on 86 women with bilateral endometriomas. Different techniques were used including cystectomy by stripping without injection (control group), cystectomy by stripping with injection of saline solution (saline group) & cystectomy by stripping with vasopressin injection technique (VIT group). In the vasopressin group 20-30 ml of diluted vasopressin (concentration 0.06 U/ml) was injected between cyst wall & ovarian cortex. Medially, 2.4 to 3.6 U of vasopressin was injected in every cyst. Fewer coagulation events were required in vasopressin group. There was no significant difference in thickness of ovarian tissue removed. Postoperative basal FSH levels were significantly lower in saline & vasopressin group as compared to control group but no statistical difference was observed between saline & vasopressin group.

Vasopressin injection technique can prevent ovarian damage during laparoscopic cystectomy of endometrioma by reducing the use of coagulation. Albeit, further studies in a larger number of patients or long-term analyses are required to determine the most appropriate technique for the laparoscopic excision of endometrioma.

Ectopic Pregnancy

Ugur, M et al (32) conducted a prospective study on 40 women with tubal ectopic. Prophylactic diluted vasopressin was injected in mesosalpinx prior to linear salpingotomy. It was observed that operating time was significantly shorter and the need for electrocoagulation was significantly less in the study group as compared to control. Postoperative hysterosalpingogram revealed patency of the affected tube in 76.5% of women in the study group compared with 57.1% of controls (p >0.05).

Hwa Sook Moon et al (33) conducted a retrospective analysis of 20 patients with interstitial ectopic pregnancy treated laparoscopically with 150-250 ml of highly diluted vasopressin (20U in 1000ml i.e 0.02 U/ml) injected in the uterus below interstitial pregnancy. Observed mean blood loss in these cases was 24ml. In few earlier studies there was suboptimal bleeding control when high concentration but low volume vasopressin was infused. They concluded that large amount of highly diluted vasopressin infiltration is an effective way that minimizes blood loss and operation time as well as desirable outcome for subsequent pregnancies. This study also provides a new insight on the concentration and volume of vasopressin used for hemostasis in laparoscopic treatment.

Tubal Microsurgery

During tubal microsurgery diluted vasopressin is injected into the proximal & distal segment of tubes. Vasopressin administration avoids

use of any energy source thus contributing to desired outcome of the surgery being performed.

Complications

Concerns about vasopressin use stem from the potential complications, reported to occur with its use. It is critical whenever evaluating an intervention to be cognizant of the potential risks, to prevent them or at least recognize them early so that treatment can be instituted when necessary. Complications in gynecological laparoscopic surgery occur due to inadvertent intravenous administration of vasopressin.

Cardiovascular Complications

The biggest concern about use of vasopressin is the potential effects on the cardiac system. These effects have prompted a ban on its use in several European countries.

Corliss et al (34) conducted a study to examine coronary effects of vasopressin in dogs. They found an 18% decrease in coronary blood flow ($p < 0.01$) and a 55% decrease in coronary sinus blood oxygen content ($p < 0.001$). There was also an increase in systemic vascular resistance. These results represent the vasoconstrictive effects of vasopressin. Other reported effects are decreased cardiac rate, cardiac output oxygen consumption, venous content of oxygen and occasionally arrhythmias. Femoral artery pressure decreased with increased pulmonary artery pressure, wedge pressure & left atrial pressure.

Nezhat et al (35) reported a 36-year-old patient who, developed severe hypotension and pulmonary edema after administration of vasopressin at laparoscopic myomectomy. 3 doses of 3 to 5 mL diluted to 0.6 U/mL vasopressin were administered, and the event occurred during the third dosing which was suspected to be injected intravascularly. An echocardiogram showed

significant hypokinesis of the left ventricular wall, resulting

in diminished ejection fraction. Cardiac enzymes were not elevated. The effect was explained by likely coronary artery spasm

subsequent to vasopressin use, with the pulmonary edema

secondary to cardiac failure.

Mills et al (36)analysed ECG changes in 100 patients.

ECG was performed 1 minute before and 10 minutes after vasopressin administration (10 units). There were no significant ECG changes in any of the patients, leading the authors to believe that either no cardiac compromise is associated with this dosage or adverse effects occur only in patients with significant preexisting cardiac disease or hypersensitivity to the medication. Since, this study was not powered; it would be difficult to extrapolate the data to the general population. In the most recent report in the gynecologic literature, by Hobo et al (37), a patient experienced cardiac arrest during laparoscopic myomectomy after administration of 11 U vasopressin diluted to 0.2 U/ml. Advincula et al (38) reported cardiogenic shock during vasopressin administration, 20 U per 40 mL (0.5U/ml) dilution at robotic-assisted laparoscopic myomectomy. The total amount administered was not mentioned.

Martin and Shenk (39) reported a patient who experienced

an intraoperative myocardial infarction after receiving

5ml vasopressin, diluted to 4.29U/mL, paracervically at cervical

Conization.

Tulandi et al (40) described pulmonary edema after use of vasopressin during laparoscopic myomectomy. A cardiac event occurred approximately 2 minutes after injection of 5 pressor unit's vasopressin, which resulted in bradycardia & hypotension.

Arrhythmias are another potential complication associated with the use of vasopressin. Kelly et al (41) described ventricular dysrhythmia after administration of vasopressin in a woman with hemorrhage secondary to a gastroesophageal tear.

As seen in all these reports there is paucity of data regarding minimum effective & maximal allowable vasopressin dose that's required; since no dosage trials have been performed in this arena. However, as demonstrated in the article by Hobo et al (37), the concentration was not at fault, but the total dose delivered was (11 U vasopressin was given).

Other Effects

The only absolute contraindication to its use is anaphylaxis or hypersensitivity to vasopressin. Other potential minor complications that have been noted with vasopressin use are tremors, sweating, vertigo, pounding in the head, abdominal cramps, passage of gas, nausea, and vomiting.

Conclusion

The uses of vasopressin in gynecological laparoscopic surgery are wide and varied. Use of vasopressin as a hemostatic agent in surgeries is very well supported by the available literature.

As with any medication, vasopressin also has its share of potential adverse effects hence caution must be exercised, to prevent these complications by strict judicious use of cardiac monitoring(ECG, Pulse and B.P) during initial injection given slowly. One should wait for 1-2 minutes before proceeding for surgery so as to achieve optimum effect. Vasopressin serves as an aid during surgery, ensuring hemostasis and decreasing operative time. But, it is no way a replacement for good surgical skills and strict attention to hemostasis. As more studies are produced in this arena there will be more clarity regarding the dosing, dilutions & concentrations that can be used. Until then, it seems wise to use vasopressin in appropriate cases to aid with hemostasis, with caution for the potential pitfalls and with use of the lowest dosages possible to achieve the desired effect.

Safe Entry in Laparoscopy

Dr. Meenu Agarwal

The relevance of entry in laparoscopy is of prime importance as 50% of the major complications of laparoscopic surgery occur at the time of entry into the peritoneal cavity. The primary objective of safe entry is to avoid injury to bowels and vessels and secondary objective is to recognize the injury and treat it in time.

Location of entry

1. Umbilical

a. Infra-umbilical
b. Intra-umbilical

At the level of umbilicus ,the skin, fascia and the peritoneum are fused together hence making it the thinnest area so the veress/trocar has to traverse least distance at this level. It also gives a cosmetically good scar.

2. Palmer's point

3 cms below the mid-clavicular line on the left side. Make sure there is no splenic enlargement. It's a good

practice to put in a nasogastric tube before the veress insertion at this point.

Entry through palmer's point is recommended in cases of anticipated adhesions at the level of umbilicus (previous abdominal surgeries with vertical scars)or also when there is a failure to enter from the conventional umbilical site.

3. Le-Huang's Point

It is the mid point between the xiphisternum and the supra-umbilical border. Can be used in cases of anticipated adhesions at the level of umbilicus and also when we are dealing with large uteri for TLH or big fibroids for myomectomy or large Ovarian masses to get more space and better length of instruments to operate.

Same as while using palmer's point ask the anaesthetist to put a nasogastric tube before the veress insertion.

4. Others

Supra-pubic , Trans-uterine , Pouch of Douglas etc. are the alternative sites less used.

Method of entry

1. Closed entry
   a. Veress Needle
   b. Direct
2. Open Method (Hasson's)
3. Others
   a. Endotip
   b. Visual trocars
   c. Single port laparoscopy etc

Closed Entry

Veress Needle

This method of closed entry is most commonly performed by gynecologists.

Important points

1. Veress needle should be held like a pen
2. The valve of the needle should be open
3. After lifting the abdominal wall , the veress needle is pushed with a steady continuous push till the sound of two clicks and sudden give away of resistance
4. A syringe filled with normal saline is attached to the veress needle. First aspirate (No blood/Fecal matter) Then push some fluid to break the vacuum and place a few drops of normal saline which will be sucked in
5. Do not move the needle left and right.
6. Attach the insufflator tube to the veress needle and start the flow.

THE INTRA ABDOMINAL PRESSURE READING LESS THAN 8 mms AND CO2 FLOWING AT A STEADY RATE IS THE MOST RELIABLE AND EVIDENCE BASED TEST FOR THE CORRECT PLACEMENT OF THE VERESS NEEDLE.

Direct Entry

The entry is achieved in only one step after making an intra/infra umbilical incision with a sharp primary trocar. No pre insufflation with veress is performed. It is used mostly in low risk cases with no previous scar and surprisingly one study has shown that it is used more commonly by male surgeons as compared to lady surgeons. It is a rapid entry but is least practiced . Statistically the incidence of major injury is not higher in direct entry but slightly higher incidence of minor omental injuries has been shown.

The present literature says " There is no clear evidence as to the optimal form of laparoscopic entry in low risk patients. However direct entry may be an underutilized and safe alternative to the veress needle and open entry technique".

Open (Hasson's Technique)

This technique is more commonly used by general surgeons. This is essentially a mini-laparotomy with 2 cms incision. The cannula and the trocar are then inserted into the peritoneal cavity without pre-insufflation.

The open method does prevent the injury to the large vessels but it does not reduce the risk of bowel injury. But an important point to keep in mind is that in open surgery if there is a bowel injury it is recognized faster as compared to closed method of entry.

EndoTip

Is a visual entry where a threaded cannula without the trocar is pushed gently through the intra/ infra umbilical incision simultaneously rotating in a clockwise direction. The telescope is placed inside the trocar which actually guides the entry. The tip of the cannula stretches the fascia radially and lifts the successive tissue layers exposing the pre-peritoneal space and then the peritoneum.

The entry and exit both are under vision.

There is no sharp cannula.

The surgeon should be well versed with this technique and care should be taken to minimize application of perpendicular force to prevent bowel injury.

Key Points

1. Use the technique you are most familiar with.
2. Ensure that the bladder is empty
3. Patient should be horizontal
4. OT table should be at a lower height than the surgeon's waist.
5. Sharp veress needle with good spring action
6. Do not swing the needle once inside
7. The veress needle or the primary trocar should hit the fascia at right angles
8. The most important test for correct placement is Intra-abdominal pressure <5mm and a steady and continuous increase in pressure
9. Always remove the primary trocar under vision. Most important is to look for and diagnose entry related bowel injury intra-operatively.
10. A 360 degree view of the entire abdominal cavity just after entry and before removal should be a dictum.

FAQs

1. What is safe entry and which technique is 100% safe?

   The literature review shows that there is no technique which is absolutely safe. All methods of entry have similar complication rates. So you must use the technique most comfortable and familiar for you to use.

2. Which is the best place for entry and why ?

   The best place for entry is the umbilicus as all the layers of the abdomen are fused at this point and the distance traversed by the trocar /veress is minimal. However it lies just above the bifurcation of the aorta so the abdominal wall below the umbilicus should be lifted and we go at right angles to the fascia but at 45 degree angle towards the pelvis as the fascia ia lifted up . In very obese patients as we can not lift the fascia we may have to vertically go down till we pierce the fascia and then change the direction to 45degree angle towards the pelvis.

3. How much should be the volume of the gas sufficient to for the primary port insertion?

   The volume of the gas is not important .You should have an intra abdominal pressure of 14-15 mm or more as the volume of gas may vary depending on the built of the patient.

4. High pressure entry >20mm . Is it better ?

   Yes

   Bigger CO_2 intra abdominal bubble

   Reduces the risk of major bowel and vessel injury in patients with no h/o adhesions

   Transient high pressure causes minor haemodynamic changes of no clinical significance in healthy women.

5. What to do if there's extra-peritoneal insufflation ?

   This can be a very annoying complication of entry. Keep the cannula in place to release the extra-peritoneal CO_2. Then place the telescope and reinsert the veress needle in the extra peritoneal space in front of the telescope and visually guide it inside. The other option is to change the site of entry after 2-3 failed attempts.