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TITLE:

Surgical Techniques to Optimize Ovarian Reserve During Laparoscopic Cystectomy for Ovarian Endometrioma

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SUMMARY:

This protocol presents techniques to laparoscopically excise ovarian endometrioma, to perform adhesiolysis with sparing electrosurgical application, and to employ intraoperative chromopertubation to assess for genital tract patency. This systematic approach will facilitate optimal endometriosis management, guide concomitant adnexal surgeries, and enhance post-surgical fertility outcomes.

ABSTRACT:

Surgical management of ovarian endometrioma in patients desiring fertility is complicated by the need to balance maximal resection of disease with efforts to spare normal ovarian cortex. Optimization of tubal anatomy is another frequent consideration. Fertility-sparing laparoscopic techniques at the time of cystectomy for ovarian endometrioma seek to limit iatrogenic surgical damage to the ovarian cortex and strategically assess and respond to genital tract patency. Surgical candidates frequently desire relief from endometriosis-associated pain while also seeking to optimize spontaneous or assisted conception rates. Operative benefits include potential for surgical and histopathologic diagnosis of endometriosis, evaluation of genital tract patency, and treatment of visualized lesions. Resection of ovarian endometrioma nonetheless poses significant risks, including surgical injury, blood loss, post-surgical decline in ovarian reserve

and post-operative inflammation with adhesion formation, both of which may impair folliculogenesis.

We present the case of a 32-year-old woman with known endometriosis and continued pain refractory to medical management who opted for surgical management of her disease tailored toward optimizing her chances at future conception. Using this case as an example, we describe techniques and considerations for diagnostic laparoscopy, adhesiolysis, ovarian cystectomy, chromopertubation, and salpingectomy with a focus on maintaining a fertility-preserving approach.

INTRODUCTION:

Endometriosis is a chronic inflammatory condition defined by ectopic endometrial tissue[1]. Patients with endometriosis commonly present with pain-related complaints and organ dysfunction related to the site of ectopic implantation, which may be anywhere in the body though is typically within the pelvis[2,3]. Ovarian endometrioma, in which a cyst of endometriosis forms within the ovary, contributes to subfertility by multiple means, including depletion of the ovarian follicle pool, promoting an inflammatory environment, progesterone resistance, and impaired ovum release and capture[4]. Affected patients frequently have diminished ovarian reserve upon presentation, and the follicle pool is further depleted following surgery[5,6]. Cyclic bleeding in sites with ectopic endometrial tissue leads to inflammation and significant adhesions, which may impair ovum pick-up and transport, fertilization, and embryo passage[7–9]. The abnormal inflammatory environment may also impair folliculogenesis and early embryonic development[10,11].

At a practical surgical level, the resultant adhesions frequently obliterate normally avascular surgical planes, placing patients at elevated risk of prolonged operative times, blood loss, and surgical injury. Surgical management of patients desiring future fertility presents additional challenges, most notably risk of iatrogenic damage to the tubes and ovaries, compromising tubal patency or ovarian reserve[12–14]. However, surgical resection of endometriosis also presents a unique opportunity to potentially diagnose, evaluate, and treat identified lesions, including optimizing fertility[15].

We detail our approach to the treatment of ovarian endometriomas in patients desiring future fertility. We strongly favor a laparoscopic approach over laparotomy for enhanced post-operative results, including less pain, shorter hospital stay, and quicker recovery[16]. This protocol prioritizes excision of ovarian endometrioma over drainage and ablation as it provides a more favorable outcome with cyst recurrence, pain recurrence, and spontaneous pregnancies[17–20]. Additionally, it allows for the specimen retrieval for histology. We excise ovarian endometrioma *via* a stripping technique with limited electrosurgical energy application. Nonetheless, many specialized tools have been described for the management of ovarian endometrioma and multiple acceptable surgical approaches exist for patients desiring future fertility. Regardless of any specific technique employed, the considerations and surgical principles described in this protocol are applicable to all patients with endometriosis desiring fertility-optimizing surgery.

The protocol described below was employed for the care of a 32-year-old woman with chronic pelvic pain and histologically proven endometriosis identified during a prior laparoscopy, during which endometriosis was incompletely resected. She endorsed pain refractory to the first-line medical management and was interested in future fertility, although had not actively attempted spontaneous conception. She was deemed a candidate for minimally invasive surgical resection and underwent an exam under anesthesia, diagnostic laparoscopy, lysis of adhesions, ovarian cystectomy, chromopertubation, and salpingectomy. Her surgery and recovery were uncomplicated.

PROTOCOL:

The patient described provided written informed consent for the use and publication of medical data, operative video, and related images for educational and scientific purposes. The following protocol adheres to the human research ethics committee guidelines of Montefiore Medical Center and New York City Health and Hospitals Corporation.

Due to limitations of the available raw recording, not every step in the protocol could be fully documented in the video on this patient.

1. Preoperative evaluation

NOTE: Select patients who are candidates for a minimally invasive surgical resection. Preoperative evaluation is important to create a comprehensive surgical plan and facilitate a thorough informed consent discussion to delineate indications for, risks of, benefits and alternatives to surgical management.

1.1. Obtain a thorough history.

1.2. Perform an abdominal and pelvic exam.

1.3. Screen the patient for features of malignancy or deep-infiltrating endometriosis (DIE), which may require pre-surgical coordination with other specialists such as colorectal, urological surgeons, or gynecologic oncologists.

1.3.1. Obtain abdominal-pelvic imaging with transvaginal ultrasonography (TVUS). Transvaginal ultrasonography is a standard imaging modality as it usually provides adequate visualization and enhanced resolution of the uterus, posterior cul-de-sac, right adnexa, and left adnexa.

1.3.2. Consider obtaining magnetic resonance imaging (MRI) as shown in **Figure 1** to evaluate for the presence of adnexal pathology, adenomyosis, hydronephrosis, and evidence of deeply infiltrating endometriosis (DIE). These findings may be reliably assessed by ultrasound when the study is performed with bowel preparation by an experienced radiologist.

NOTE: Hysterosalpingogram (HSG) may be performed to assess for tubal patency.

1.4. Determine whether the patient is an appropriate surgical candidate. Indications for surgical cystectomy include size greater than 4 cm with pain or infertility, or size less than 4 cm with medically refractory pain or concern for follicle count or accessibility during assisted reproduction.

NOTE: Tailor the approach to the patient's goals and preferences. Determine whether the patient desires complete removal of endometriosis or prefers more limited surgery. Consider post-surgical fertility plans and whether bilateral or unilateral adnexal resection is indicated. Incomplete resection of disease increases the risk of recurrence but may allow for shorter surgery and reduced morbidity and complications.

1.5. Complete an informed consent discussion to discuss potential risks and benefits of the proposed surgery. Ensure that the patient has no other contraindications.

NOTE: A more complete resection of ovarian disease often risks decline in ovarian reserve. The patient should be informed of management options regarding abnormal salpinges. In cases of deep infiltrating endometriosis, significant surgical morbidity and need for bowel resection must be addressed. Surgeons must discuss probable events and possible procedure-related complications, including bowel injuries, bleeding, genital-tract injuries, urologic injuries, return of pelvic pain, and post-operative infection.

2. Exam under anesthesia and diagnostic laparoscopy

NOTE: The preoperative evaluation and exam under anesthesia are crucial to safely entering the peritoneum and guide the diagnostic laparoscopy.

2.1. Position the anesthetized patient in dorsal lithotomy position. The arms should be tucked in a neutral anatomical orientation and care should be taken to protect neurovascular areas.

2.2. Perform an exam under anesthesia. Evaluate for the presence of abdominal wall hernias and scars to guide trocar placement, the size and position of pelvic organs, and for the presence of nodularity in rectovaginal septum as well as other possible sites of endometriosis not appreciated during prior pelvic exam.

2.3. Prepare the surgical site.

2.3.1. Use appropriate agents (chlorhexidine gluconate in isopropyl alcohol for skin, povidone-iodine or chlorhexidine gluconate) and allow the skin to dry. Cover the patient with sterile drapes.

2.3.2. Place a urinary Foley catheter in the bladder for urine output monitoring and bladder decompression.

2.4. Create pneumoperitoneum using standard techniques with entry either peri-umbilically or at Palmer’s Point (**Figure 2**).

NOTE: Use the smallest required trocars and the lowest insufflation pressures to decrease postoperative pain.

2.5. Place at least two additional lower abdominal ports as shown in **Figure 2**.

2.6. Perform a diagnostic laparoscopy to exclude surgical injury during entry and to identify anatomy, adhesions and possible endometriotic implants in the peritoneal cavity (upper and lower abdomen). Evaluate for avascular sites free of adhesions for accessory port placement.

NOTE: Port placement should facilitate ergonomics and allow for full visualization and manipulation of pelvic tissue.

2.7. Complete diagnostic laparoscopy.

NOTE: A combined approach with adhesiolysis (see steps 3.1–3.4) may be required to completely evaluate the pelvis. The surgeon may choose to defer complete adhesiolysis when balancing its higher surgical risk with the benefits of comprehensive pelvic assessment.

2.7.1. Place a uterine manipulator (see **Table of Materials**) and utilize a steep Trendelenburg position to optimize visualization of pelvic structures.

2.7.2. Sweep mobile structures out of the pelvis with atraumatic graspers.

2.8. Systematically evaluate all pelvic structures and spaces. Biopsy any possible endometriotic lesions for diagnostic purposes.

NOTE: Endometriosis typically appears as red or white lesions; however, its appearance may be highly variable.

2.8.1. Use a 30° laparoscope to aid visualization around structures, as needed.

2.8.2. Obtain pelvic washings of free peritoneal fluid.

2.9. Score the extent of pelvic disease using a validated system.

NOTE: The revised American Society for Reproductive Medicine (rASRM) system[21] is most commonly used. However, the Endometriosis Fertility Index (EFI)[22] is most appropriate for predicting fertility outcomes.

3. Lysis of adhesions

NOTE: This phase is critical for the exposure, restoration of neutral anatomical position, and subsequent enhancement of genital tract function. Ovarian adhesions may prevent follicular

development and extrusion of a ruptured follicle with ovulation, while fimbrial adhesions may compromise sweeping of an ovum. Additionally, adequate adhesiolysis is crucial to assure tubal patency. Adhesions are created by inflammatory states, whether by prior surgeries, infection, or endometriosis. Adhesions interfere with adequate exposure, distort anatomy, and subsequently increase complication risk when handling tissue and attempting plane development. Due to distorted anatomical planes, major pelvic vessels and the ureter are frequently in close proximity to the sites of dissection. The surgeon must be prepared to perform retroperitoneal dissection and ureterolysis for safe identification of anatomy.

3.1. Consider placement of additional ports at this time, as it will allow for more instruments to work in tandem along with the laparoscope.

3.2. Once port placement is optimal, dissect adhesions to expose the adnexa. Divide “kissing” ovaries and lyse tubal adhesions to free the length of the entire salpinges, including fimbriae.

3.2.1. Start with the blunt dissection from the healthy tissue proximally, working towards dense adhesions and abnormal anatomy. Triangulate applied forces to allow for efficient dissection.

NOTE: Blunt dissection is not always possible with dense adhesions. It is best to start with filmy adhesions to mobilize pelvic and vascular structures to facilitate plane development between adherent structures which may require sharp dissection. The suction irrigator can bluntly dissect, push, sweep, hydrodissect, and aspirate from the surgical field without instrument exchanges. Use atraumatic graspers to apply traction to sensitive tissue and to push and spread.

3.2.2. Continue along a dissection plane until it can no longer be easily developed bluntly, with care to avoid excessive force. Use scissors or energy devices with minimal lateral thermal spread such as ultrasonic shears to dissect dense adhesions, as these instruments minimize potential for inadvertent injury.

3.2.3. Focused electrosurgery may be required to control bleeding.

3.3. Free the ovary from adjacent structures, such as the pelvic sidewall and cul-de-sac. Ensure full tubal length is freed from adhesions including fimbriae.

NOTE: The ovary is often encased in adhesions, which may prevent ovum capture by the salpinges following ovulation.

3.4. Perform retroperitoneal dissection and ureterolysis for safe identification of anatomy prior to dividing adherent structures.

NOTE: This step ensures that the ureter is not inadvertently damaged. The retroperitoneum is best opened starting at a site of normal anatomy adjacent to the endometriosis and is commonly entered at the level of the pelvic brim by the pelvic sidewall.

4. Chromopertubation

4.1. Inject dilute methylene blue (**Table of Materials**) through the uterine manipulator.

4.2. Evaluate laparoscopically for the distension of the fallopian tube and spillage of dye from the fimbriae (**Figure 4**). If tubal patency is not demonstrated and the fimbriated end appears irreparable, then perform salpingectomy.

4.3. If tubal patency is not demonstrated, perform the following steps.

4.3.1. Ensure adequate fimbriolysis.

4.3.2. Use atraumatic graspers to occlude the patent tube proximally.

NOTE: Dye will most readily pass through the side with lower occlusion pressure. Use graspers to transiently occlude a patient side and favor passage of dye through the other.

4.3.3. Replace the uterine manipulator with a dedicated catheter for HSG and re-attempt distension.

5. Address tubal pathology

NOTE: Features of abnormal salpinges include irregular contours from adhesions or contents of hydro-, hemato-, or pyosalpinx. Salpinges are also pathologic if chromopertubation fails to demonstrate patency following adequate adhesiolysis. Abnormal salpinges are associated with poor spontaneous pregnancy rates and risk for ectopic pregnancy. Additionally, retrograde flow of tubal contents may reduce implantation rates. Bilateral salpingectomy or occlusion will necessitate *in vitro* fertilization for future fertility and must be explicitly defined in the surgical plan. Consider salpingectomy if access to salpinges and mesosalpinx is permissible, otherwise consider proximal tubal ligation to occlude retrograde flow of dilated tubal contents into the endometrial cavity. Proximally occluded tubes may be left *in situ*.

5.1. Identify the fallopian tube and the infundibulopelvic ligament.

5.2. Expose and elevate the tube with graspers.

NOTE: The fimbriated ends should be maintained far from the ovary and the pelvic sidewall to avoid damage from inadvertent lateral thermal spread to either structure.

5.3. Start the dissection of the tubal lumen from the mesosalpinx at the fimbriated end. Avoid infundibulopelvic ligament ligation and limit the amount of mesosalpinx excised to avoid damage to the anastomotic vascular connections that support ovarian blood supply.

NOTE: Preserve ovarian blood supply. These vascular sites may be of potential importance for maintaining ovarian reserve.

5.4. Reaching the isthmus, transect across the full tubal lumen to complete the salpingectomy.

NOTE: The patient should be informed of her tubal status and the presence of any remaining tubal tissue after surgery as it may affect her risk of malignancy.

5.5. Ensure adequate hemostasis.

5.6. Perform on the contralateral side, if applicable.

5.7. Remove specimens through the trocar or in a containment device.

6. Ovarian endometrioma cystectomy

NOTE: Cystectomy offers the lowest rate of endometrioma recurrence and has been demonstrated to improve pain outcomes and spontaneous pregnancy outcomes; however, it also removes more normal ovarian tissue than ablation (e.g., with CO_2 laser). Endometrioma cyst walls are usually adherent from fibrosis and vascular at their base. The surgeon must balance removal of normal ovarian parenchyma and hemostasis with preservation of normal ovarian tissue. Cystectomy should only be attempted if the patient will be expected to have adequate ovarian reserve following the cystectomy. Removal of endometrioma in patients desiring fertility is generally restricted to lesions >3 cm and only if removal improves accessibility of follicles or endometriosis-associated pain.

6.1. Identify the ovary. Divide the remaining adhesions to allow to free the ovary. Elevate the structure with graspers to facilitate exposure of the cyst wall.

NOTE: Any disruption of the endometrioma cyst wall will yield chocolate-colored fluid.

6.2. Elevate the ovary with graspers to facilitate the exposure of the lesion. Incise the thinnest portion of ovarian cortex to expose the endometrioma cyst wall (**Figure 5**).

NOTE: This incision is ideally made over the thinnest area of the endometrioma surface or at the antimesenteric border of the ovary. Avoid multiple incisions in the ovarian cortex as this is the area where follicles are located. Alternative approaches to develop the cleavage include injection of dilute vasopressin or normal saline.

6.3. Utilize traction-counter traction to separate the cyst wall from normal ovarian parenchyma. Dissect efficiently using close placement of graspers with applied force perpendicular to the dissecting plane.

NOTE: As the surgical plane develops, regrasp both the endometrioma cyst wall and the healthy ovarian tissue to ensure traction forces continue to be applied close to the site of dissection (**Figure 6**).

6.4. After complete excision, assess the operative bed for hemostasis.

NOTE: As the dissection reaches the ovarian medulla near the end, it can be challenging to continue because of the presence of utero-ovarian vessels and potential for more brisk bleeding.

6.4.1. Use copious irrigation and aspiration to remove hemoperitoneum and evaluate for active bleeding.

NOTE: Consider dropping the insufflation pressure to ascertain hemostasis.

6.4.2. Observe the ovary for 1–3 min as the endogenous coagulation cascade is activated.

6.4.3. If bleeding continues, apply topical hemostatic agents. Such agents avoid the need for application of energy to ovarian tissue and the potential for damaging ovarian follicles. Consider laparoscopically suturing an actively bleeding vascular lesion.

6.4.4. If conservative or medical application fails, apply focused ultrasonic energy once assured of a safe margin from genitourinary and gastrointestinal structures.

NOTE: Select an energy source with the least potential to cause ovarian damage by lateral thermal spread. Lateral thermal spread is lowest with laser vaporization, which has a minimal depth of penetration, followed by ultrasonic energy, followed by bipolar electrosurgery, while monopolar electrosurgical application has the greatest potential for lateral thermal spread and inadvertent injury to adjacent structures. Electrosurgery should be avoided adjacent to the bowel or ureters and judiciously minimized on the ovary.

6.5. Gather all specimens for retrieval into a bag to reduce risk of port-site endometriosis. Specimen removal should be under direct visualization.

7. Address the remaining sites of endometriosis per surgical plan

NOTE: Endometriosis outside of the ovary or tubes may have limited impact on spontaneous conception rate, but excision may be particularly important for treating pain or dysfunctional symptoms. Resection of implants should be site-directed. Peritoneal sites of endometriosis as well as other deep infiltrative sites should be addressed at this point. Retroperitoneal dissection is often required. Consider the morbidity of such procedures and patient goals when determining the necessity of such steps.

7.1. Address peritoneal implants.

7.1.1. Select biopsy sites.

7.1.2. Strip or ablate all visible peritoneal implants.

7.1.2.1. Use ultrasonic energy to divide the peritoneum adjacent to the implant.

7.1.2.2. Mobilize tissue adjacent to implant. Remove implants en bloc.

7.1.2.3. Remove endometriosis from the pelvic sidewall. This may require retroperitoneal dissection of the relevant avascular planes and identification of the branches of the internal iliac artery and the course of the ureter.

NOTE: Ureterolysis should be performed with blunt dissection using the push and spread technique to create a safe margin and preserve vascular supply to the ureter.

7.2. Address deep infiltrating endometriosis (DIE) per the surgical plan.

NOTE: Common sites of endometrial implants include the posterior-cul-de-sac and uterosacral ligaments. Removal of disease that cannot be shaved or safely ablated may require coordination with specialists such as urologic or colorectal surgeons.

8. Closure

8.1. Confirm hemostasis at the operative bed.

8.2. Close any fascial defects larger than 1 cm.

8.3. Close the skin intracutaneously.

REPRESENTATIVE RESULTS:

Table 1 shows results of our patient example. Total operation time was 251 min from anesthetic induction to extubation, with an estimated blood loss of 200 mL. The recovery period was uncomplicated. As she desired future pregnancy remote from the time of surgery, she began oral contraceptives. Histopathological examination revealed a right hydrosalpinx with paratubal cyst, bilateral endometriomas (4.5 cm and 3.7 cm), and ovarian tissue.

The surgery utilized a combination of fertility-sparing and fertility-optimizing approaches to laparoscopic cystectomy for ovarian endometrioma. Endometriomas previously visualized on imaging such as ultrasound or MRI (**Figure 1**) were removed from the ovary. Abdominal trocar placement (**Figure 2**) enabled visualization of all key pelvic anatomical structures, with demonstrated independent mobility of the uterus, fallopian tubes and ovaries and separation of these structures from the bladder, rectum, and pelvic sidewalls at the conclusion of the surgery. Fallopian tubal patency was characterized (**Figure 3**). Tubal adhesions were lysed and damaged/irreparable tubes were removed once this was demonstrated.

Endometrioma excision was achieved with a minimum amount of additional healthy ovarian cortex excised (**Figure 4**) at the same time thanks to efficient use of the stripping technique (**Figure 5**). All structures were confirmed to be hemostatic at the end of the case. The ovary was comprehensively evaluated, and any bleeding was addressed using the least damaging intervention possible.

At the completion of the surgery, this patient with bilateral ovarian endometriomas and significant tubal disease was treated for her pain, optimized for spontaneous conception and positioned to pursue assisted reproduction with a minimal decline in ovarian reserve.

FIGURE AND TABLE LEGENDS:

Figure 1: Pre-operative MRI imaging.

Figure 2: Suggested abdominal port placement. Circles represent minimum three-port placement. Consider placing up to two additional ports as marked by the encircled x.

Figure 3: Chromopertubation.

Figure 4: Exposing the endometrioma. The endometrioma (pale, translucent object) is exposed after making an incision over the thinnest area of the endometrioma surface. Additional blunt dissection with a probe and suction irrigator free the adherent ovarian cortex from the endometrioma.

Figure 5: Efficient use of traction-counter traction forces. (**A**) Dissecting the endometrioma from the normal ovary. Two graspers are used to place downward traction on the endometrioma cyst wall. In parallel, graspers stabilize and elevate the ovary to facilitate dissection. (**B**) Placement of graspers in closer proximity to the dissection plane (arrowhead) would result in a more efficient dissection.

Table 1. Results of fertility-sparing surgical resection.

DISCUSSION:

Patients with diagnosed endometriosis commonly report pain or implant-related organ dysfunction, including infertility. Up to 50% of patients with endometriosis meet criteria for infertility[23]. Ovarian reserve, measured *via* AMH levels, FSH levels around menses or an antral follicle count, is used to predict patient response to gonadotropin stimulation. Surgical management of endometrioma is known to decrease ovarian reserve[23]. However, ovarian reserve continues to decline in patients with endometriomas even with conservative management[14]. Management of women with endometrioma remains debated and shared-decision making is crucial. Many patients opt for surgical resection of their disease for a variety of indications, including improvement of pain and to optimize post-surgical fertility outcomes.

In infertile women with mild/moderate endometriosis (rASRM stage I/II classification[21]), surgeons should excise or ablate endometriosis lesions and perform adhesiolysis to improve

pregnancy rates[17]. Although studies are limited, research suggests that removal of the endometrioma capsule can aid spontaneous and even facilitate assisted reproduction. Endometriomas have the potential to interfere with assisted reproduction as they may preclude development of an adequate cohort of antral follicles and may incur the risk of infection if the endometrioma were to rupture at the time of oocyte retrieval[1]. Professional societies and expert opinions support ovarian cystectomy for endometriomas above a certain size among symptomatic patients with significant pain symptoms (>4 cm), medically refractory pain (<4 cm), and those planning assisted reproductive conception (ART) with concern for poor antral follicle count or possible cyst rupture during oocyte retrieval (<4 cm)[1,24]. Additionally, resection of endometrioma is favored compared with drainage and ablation due to lower rates of recurrence of dysmenorrhea and dyspareunia post-operatively.

Nonetheless, in patients who only desire fertility and report no other symptoms, many can avoid surgery, as pregnancy is often possible through assisted reproduction. Conservative non-surgical management should particularly be considered for patients with diminished ovarian reserve who are planning assisted reproduction, as even a successful surgery may affect their potential to obtain adequate oocytes from ovarian stimulation. For patients with endometrioma desiring surgical management, gynecological surgeons are urged to create surgical plans to minimize iatrogenic damage to ovarian reserve and optimize post-surgical fertility outcomes.

One of the critical advantages of surgery is it provides the opportunity to evaluate and treat identified lesions which may hamper future fertility[2]. The amount of normal ovarian tissue removed together with the endometrioma is related to the experience of the operator and is decreased with experience[25]. Stripping technique is our preference for ovarian cystectomy as it limits the use of electrosurgery on healthy ovarian tissue and thereby reduces the potential for lateral thermal spread. Similarly, all efforts should be made to limit damage to the anastomotic ovarian blood supply. Intraoperative bleeding from the ovarian tissue following endometrioma excision is a common complication. This protocol outlines the use of sparing ultrasonic application and use of hemostatic agents. All ovarian and related vasculature tissue should be managed as conservatively as possible to preserve ovarian reserve. Although not detailed in this video, alternative hemostatic techniques, including use of plasma energy, laser vaporization, and suturing, should be considered over electrosurgery application whenever feasible.

Adhesions and inflammatory-related sequelae of endometriosis are particularly prone to damage the salpinges, but the decision to remove them is often individualized. If chromopertubation after maximum adhesiolysis demonstrates genital tract obstruction, spontaneous conception *via* the affected tube is unlikely and salpingectomy may reduce the risk of ectopic pregnancy. However, salpingectomy appears to have a small but detectable detrimental effect on ovarian response to controlled ovarian hyperstimulation[26]. The decision to remove affected salpinges is more clear-cut for treatment of hydrosalpinx or hematosalpinx, as reflux of this fluid into the endometrial cavity appears to directly compromise implantation and early pregnancy rates.

In conclusion, this protocol visually reviews techniques for ovarian cystectomy and highlights important surgical principles during dissection and excision of endometrioma to reduce loss of

ovarian reserve. A fertility-preserving resection of ovarian endometrioma also includes restoration of normal anatomy through adhesiolysis, evaluation of tubal patency and excision of irreparable tissue and removal of extraovarian endometriosis.

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All the authors report no disclosures or conflicts of interest.

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Figure 1

Click here to access/download;Figure;Figure 1-preop MRI.png

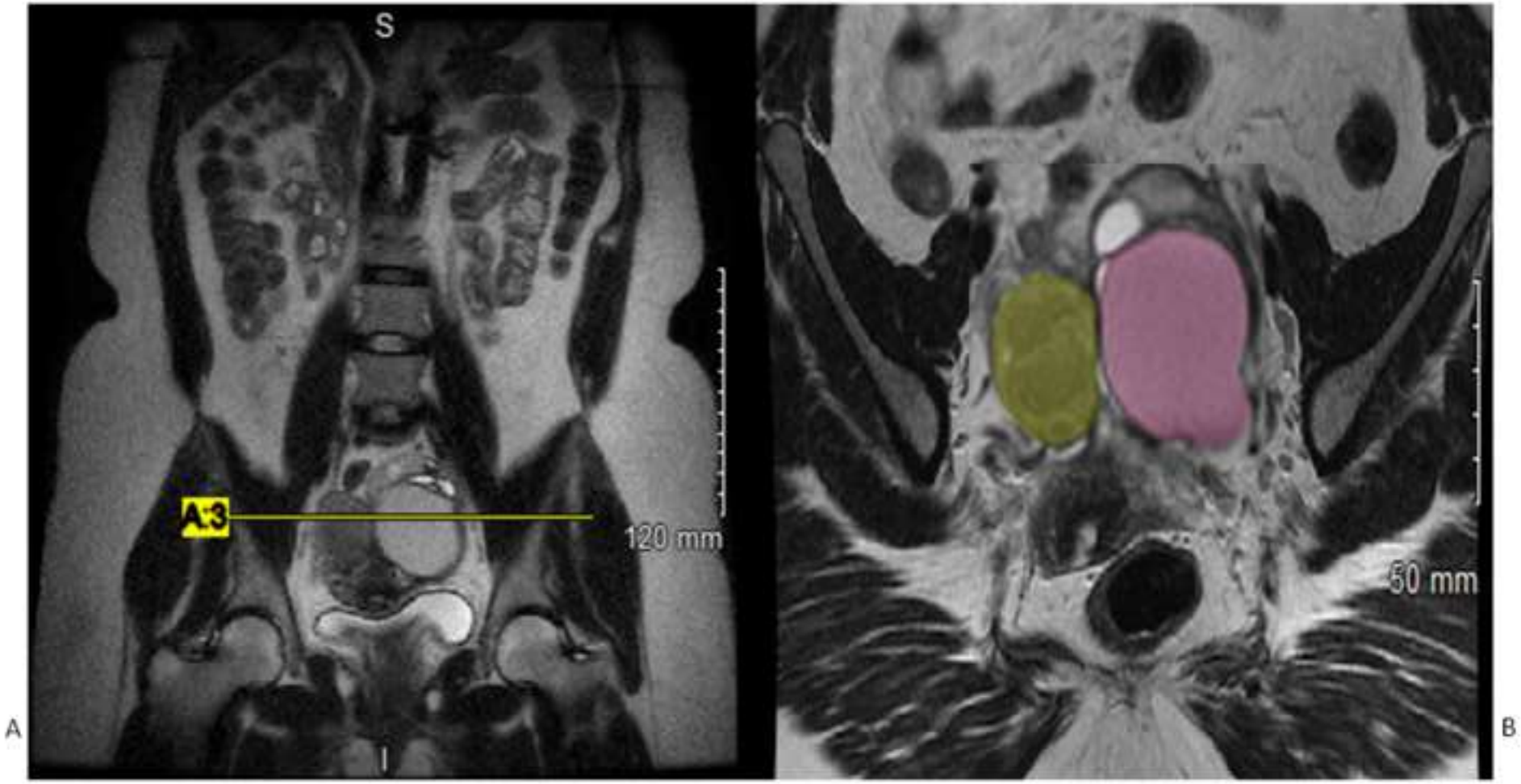


Figure 2

Click here to access/download;Figure;Figure 2-abd port placement.png

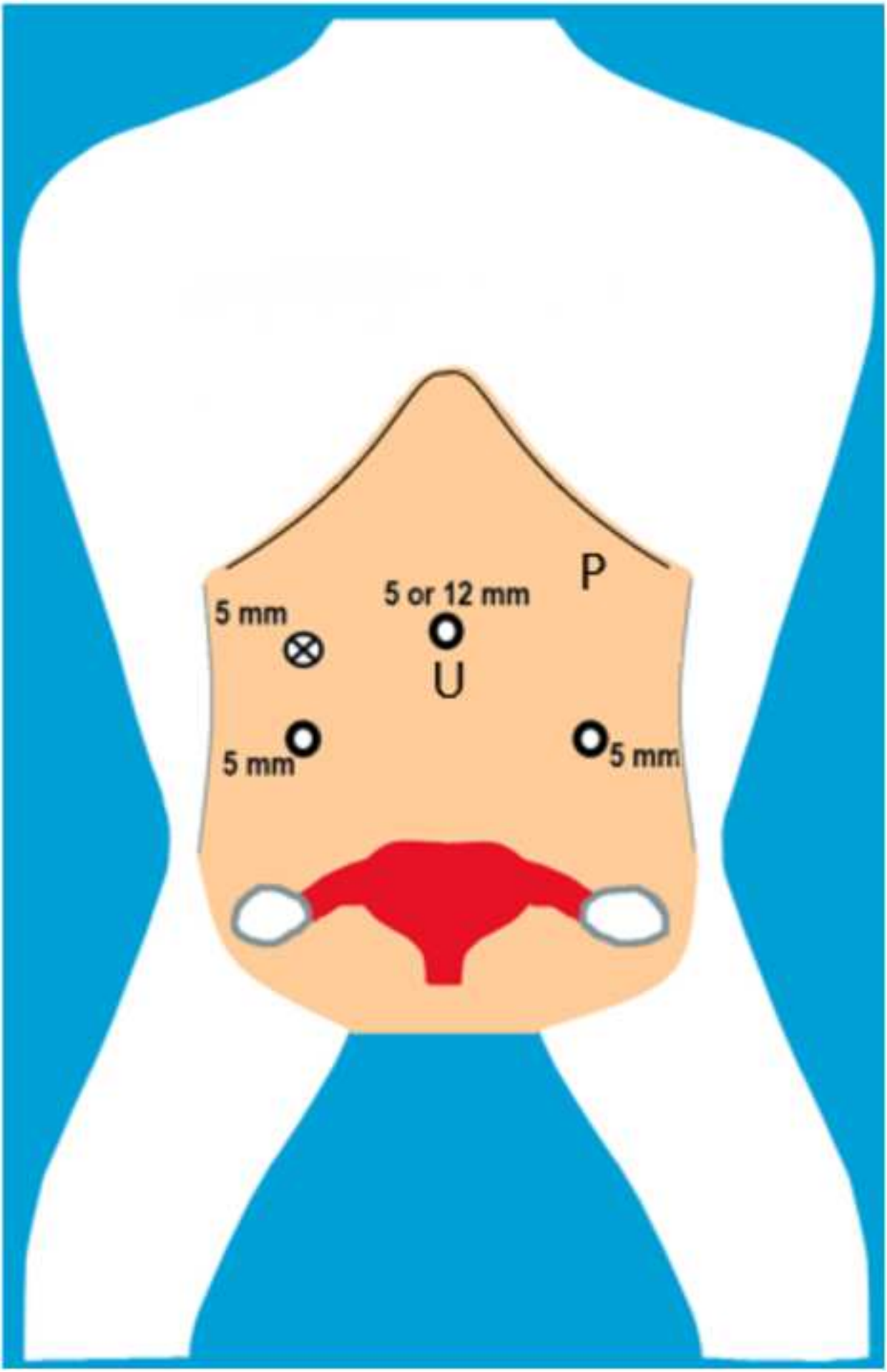


Figure 3

Click here to access/download;Figure;Figure 3-chromopertubation.png

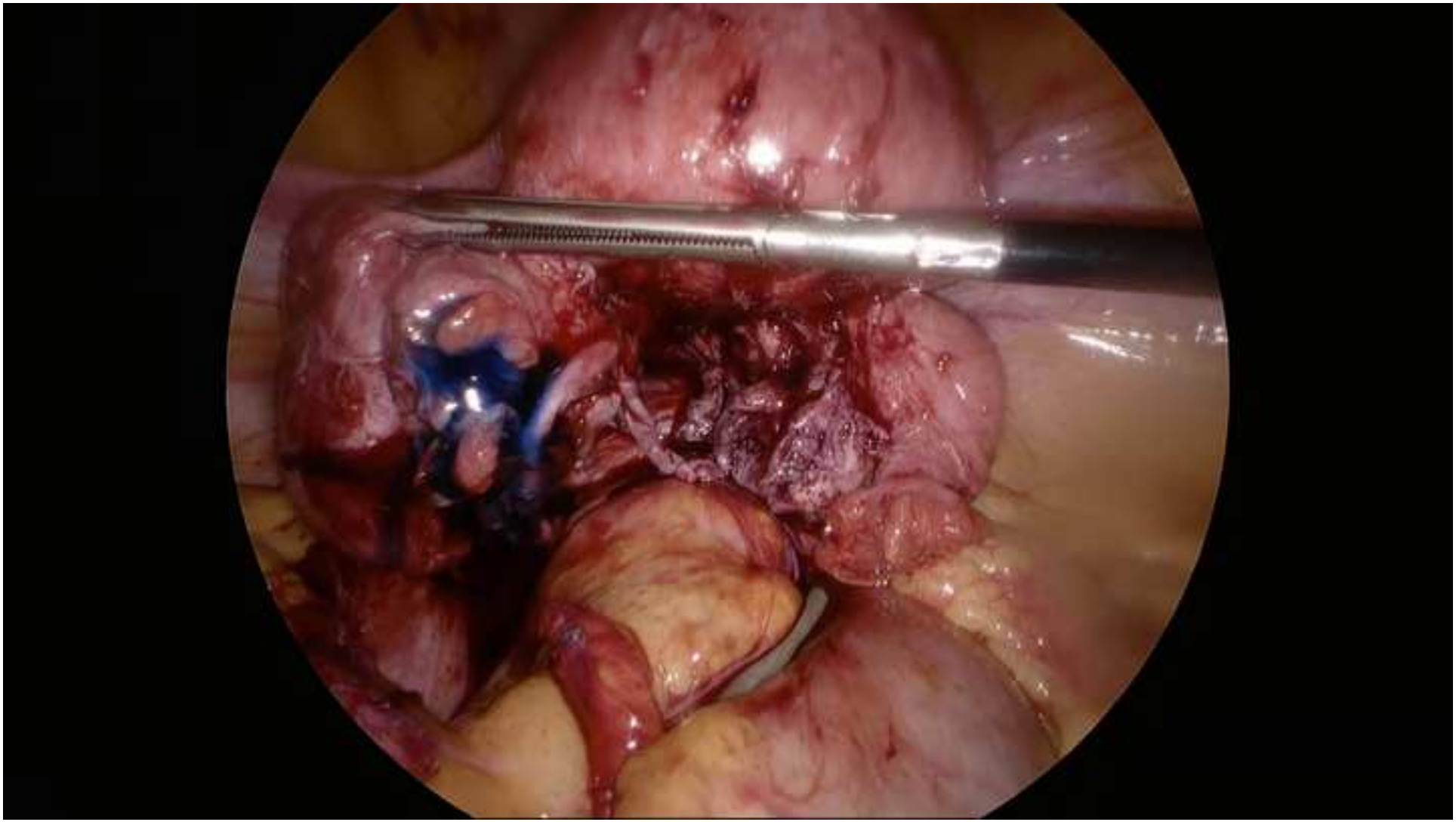


Figure 4

Click here to access/download;Figure;Figure 4-dissecting out endometrioma.png

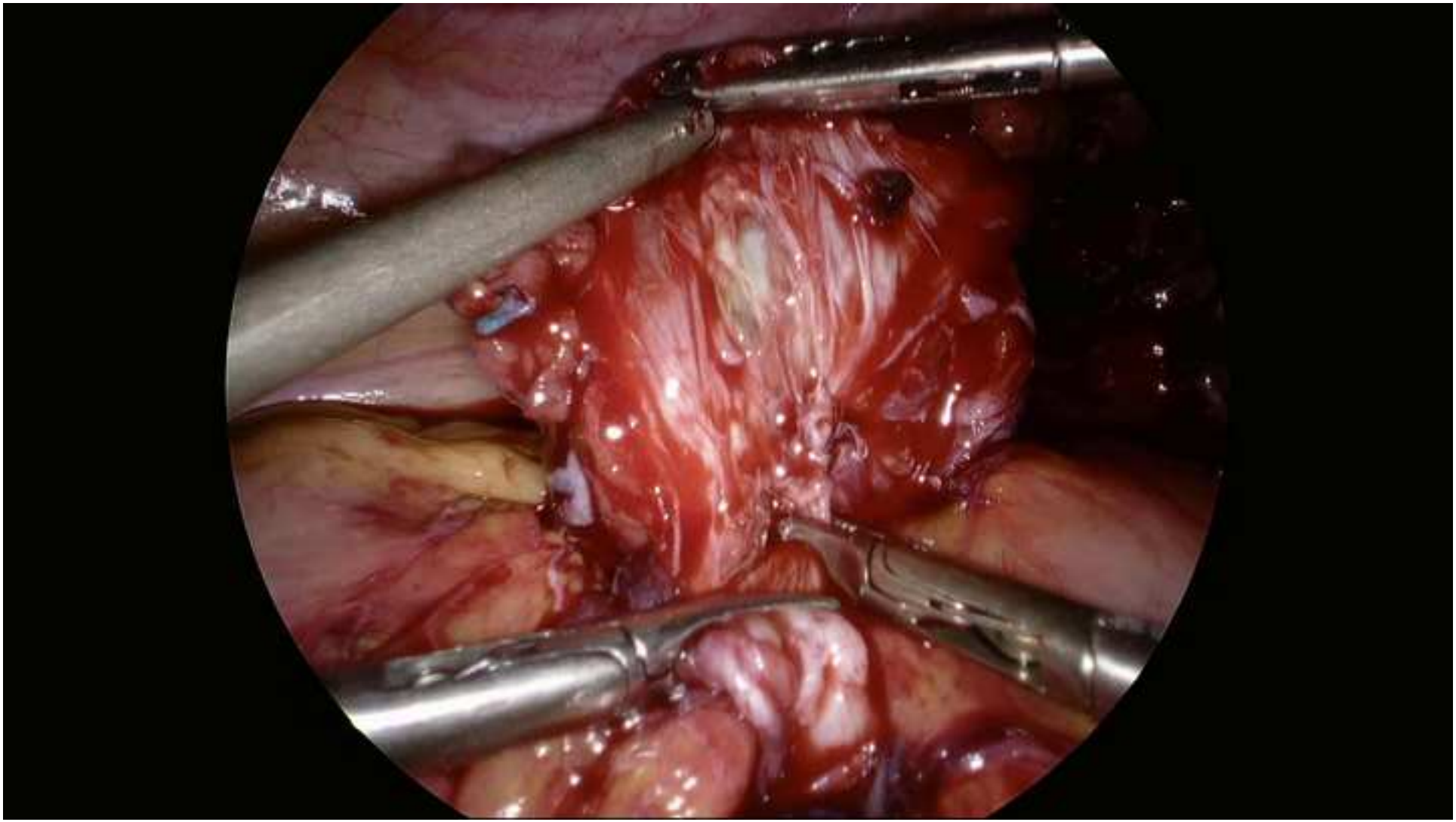
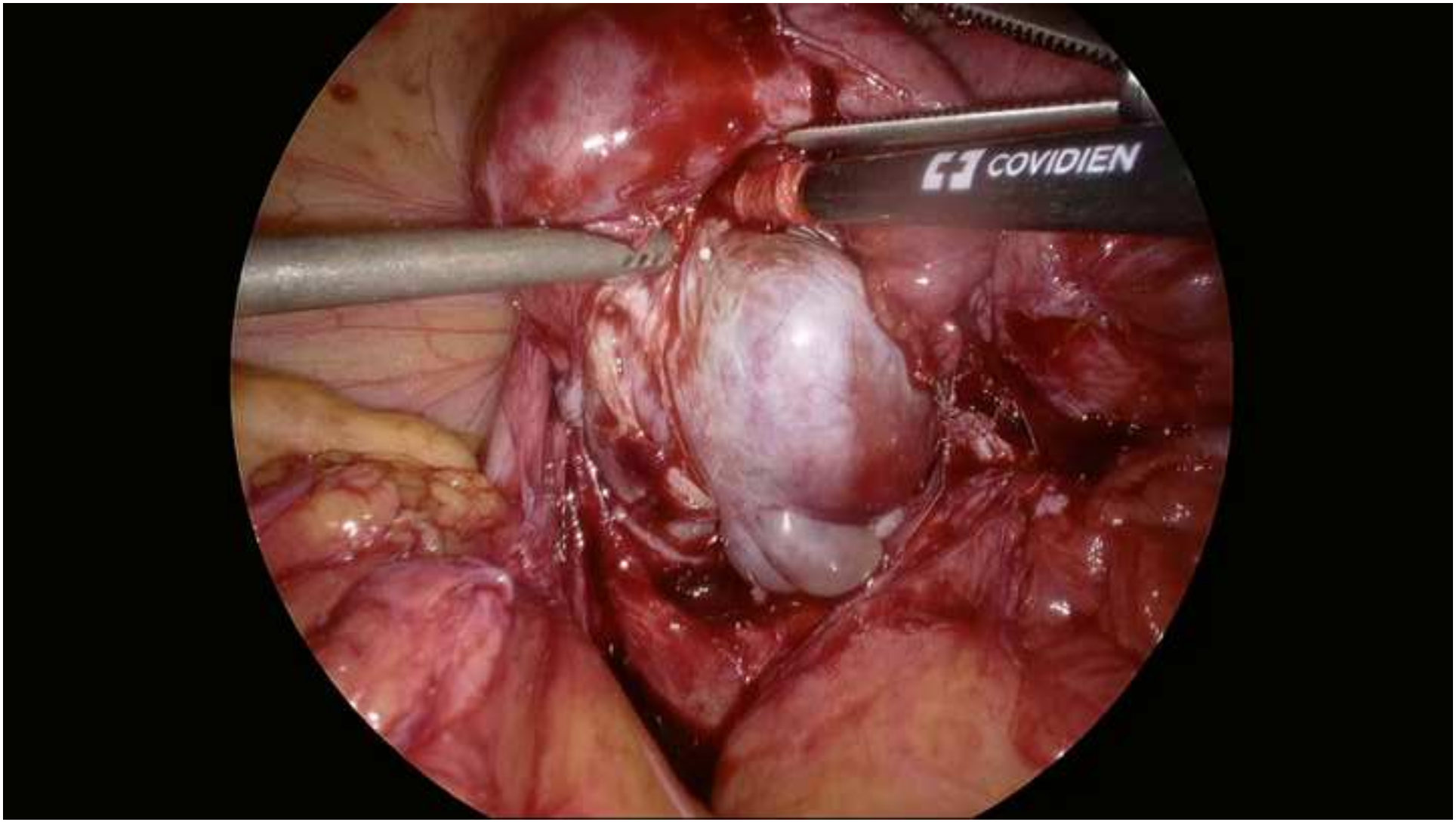


Figure 5



	Number
Operative time[a] (min)	251
Estimated blood loss (mL)	200
Length of stay (days)	0
Post-operative complications	0

[a] *Operative time is the number of minutes between intubation and extubation.*

Click here to access/download

Table of Materials

Material List.xlsx

JoVE Rebuttal Letter

10/10/2021

Dear Dr. Bajaj,

Thank you for your insights and continued invitation to submit a revised draft of “Surgical Techniques to Optimize Ovarian Research During Laparoscopic Cystectomy for Ovarian Endometrioma.” We appreciate the composite effort of the team at JoVE in giving us feedback and time to strengthen our submission. We have incorporated your suggestions.

To facilitate your review of our revisions, the following is a point-by-point response to the questions and comments delivered in your letter.

Editorial and production comments:

“Text:
1. The editor has formatted the manuscript to match the journal's style. Please retain and use the attached version for revision.
2. Please address all the specific comments marked in the manuscript.
3. Please ensure that the text protocol is homogenous to the narration in the video. Not all steps need to be shown in the video. There can be steps in the text which are not shown in the video, however. Please see examples and revise accordingly to make the text and the narration homogenous.”

RESPONSE: We have continued with the formatting provided to us in the latest copy to keep with the journal’s style. All comments were addressed in the manuscript with ‘tracked changes’ enabled so you can see the revision. Text protocol was revised to be homogenous to the narration in the video.

Video:
1 Title Cards:

• Please capitalize the first letter of every important word in your title. i.e "Surgical Techniques to Optimize Ovarian Reserve During Laparoscopic Cystectomy for Ovarian Endometrioma"

RESPONSE: We agree with that revision and have made that change.

• Please add standalone chapter title card for each section or Sub Section of the Video. Sections must be separated by chapter title cards and there should be one (or more) for the main Protocol, the Results, and the conclusion." For more information see Jove guideline for ASV.

RESPONSE: We agree with that revision and have made that change.

• Consider some Points for chapter title cards:
Remove the Brand Logo from the Bottom of the chapter title cards.
Align the title or text to the Center of the chapter title card.
Please Capitalize the first letter of every important word in your chapter title card

RESPONSE: We agree with those suggestions and have incorporated them into the video.

Here are the following timing for Standalone chapter title card Example which can be Followed:
01:05 Protocol
01:06 Informed Consent and Pre-Operative Evaluation
03:05 Exam Under Anesthesia and Diagnostic Laparoscopy
04:24 Lysis of Adhesions
05:35 Chromopertubation
06:37 Address Tubal Pathology
07:36 Ovarian Endometrioma Cystectomy
10:08 Address Remaining Sites of Endometriosis
10:28 Closure
10:39 Results
11:04 Conclusion

RESPONSE: We agree and have made those changes.

2. Video Editing Content:
• Please use Video or Images to explain the content rather than using text or title cards. it will look more attractive and understandable to the Audience.

RESPONSE: We agree with the comment however are limited in the quality of raw surgical footage and have done our best to balance between visual and audio explanations.

• 01:15 Please remove the glitch in the given timecode.

RESPONSE: We agree with that revision and have made that change.

3. Audio Editing and Pacing
• Audio Levels are low. Please increase the levels to +4dB or 30% and ensure audio level peaks average around -9 dB.

RESPONSE: We agree with that revision and have made that change.

• Please ensure that the Narration should start After the Main Title Card i.e 00.10

RESPONSE: We agree with that revision and have made that change with narration starting at 00.10.

We appreciate your time, efforts, and for giving us the opportunity to strengthen our manuscript with your valuable feedback. We look forward to your prompt review.

Sincerely,

Kathryn Saturnino