

# Difficulties on laparoscopic hysterectomy – revision of surgical strategies

## Dificuldades na histerectomia laparoscópica – revisão de estratégias cirúrgicas

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### Abstract

**Importance:** Hysterectomy is the most common non-pregnancy surgical procedure performed on women. Laparoscopic hysterectomy is a preferable alternative to open abdominal hysterectomy for those patients in whom a vaginal hysterectomy is not feasible. Complex situations that distort the pelvic anatomy make surgery more difficult. There is a need to determine how to do this approach in complex situation.

**Objectives:** The aims of this summary are to review the surgical technique for complex situations in laparoscopic hysterectomy such as fibroids, endometriosis, adhesions and obesity, possible complications, advantages and disadvantages with other approaches in these situations for best clinical practice.

**Evidence Acquisition:** We performed a thorough search of PubMed for current literature, including original research articles, review articles, and guidelines on laparoscopic hysterectomy and management in complex situations (large uterus, endometriosis, adhesions and obesity).

**Conclusions:** We concluded that laparoscopic hysterectomy is effective and efficient in difficult situations. These should not be considered contraindications to this technique. With good training and an understanding of laparoscopy, it is possible to have a low complications rate and a short-term recovery.

**Relevance:** This review is beneficial for all providers caring for women needing laparoscopic hysterectomy with complex situations.

**Target Audience:** Obstetricians and gynecologists.

**Learning Objectives:** After completing this CME activity, physicians should be able to (1) identify the complex situations for hysterectomy; (2) describe advantages and disadvantages for laparoscopic hysterectomy in these cases; and (3) discuss the possible changes in surgical technique that allow to perform this approach.

**Keywords:** Laparoscopic; Hysterectomy; Fibroids; Endometriosis; Adhesions.

### INTRODUCTION

Hysterectomy is the most common non-pregnancy related surgical procedure performed on women<sup>1</sup>. If the patient fulfills the criteria and warrants a hys-

terectomy, the three choices available to the surgeon are the abdominal, the vaginal or laparoscopic route<sup>1</sup>.

Minimally invasive surgery (MIS) to hysterectomy should be performed, whenever feasible, based on their well-documented advantages over abdominal hysterectomy (AH)<sup>2-3</sup>. The vaginal approach is preferred among MIS for benign indications<sup>2-3</sup>. Laparoscopic hysterectomy (LT) is a preferable alternative to open AH for those patients in whom a vaginal hysterectomy (VH) is not indicated or feasible<sup>2-5</sup>. In addition, surgical outcomes and approaches are known to be influenced by the surgeon's experience<sup>2-3</sup>. The MIS, when compared with laparotomy, results in shorter length of stay, few-

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er minor and major complications, and a quicker return to normal activity<sup>2-5</sup>. Sometimes, however, hysterectomy can be a very difficult and challenging surgery and even more so if performed laparoscopically<sup>6</sup>. Situations that distort the pelvic anatomy such as large fibroids, severe endometriosis, adhesions and obesity make surgery much more difficult<sup>6</sup>. Training, experience, and technical difficulty have been proposed as potential barriers to performing a LT<sup>2</sup>. However, none of these factors is an absolute contraindication to a MIS<sup>2</sup>.

While much has been published on outcomes of hysterectomy performed using an MIS technique, there is a need to determine how the approach in complex situation is affected by the severity of pathology and by patient factors such as High Body Mass Index (BMI)<sup>4</sup>.

## FIBROIDS

Fibromatosis is the most frequent benign uterine pathology affecting fertile women, representing the most frequent indication for hysterectomy<sup>7</sup>. Treatment of fibroids is usually conservative with a MIS through laparoscopy<sup>8</sup>. However, AH is usually preferred in the case of very large uteri. Nowadays, improvements in MIS have increased the number of these patients who undergo LH and is currently accepted as feasible and safe way for the treatment of benign uterine pathology as an alternative to standard AH<sup>8</sup>. Wattiez *et al*<sup>9</sup>, affirm that the rationale for LH is to convert AH into a laparoscopic procedure and thereby reduce trauma and morbidity. Well-known advantages to the patient provide substantial financial benefits to society<sup>9</sup>.

However, most studies set arbitrarily as a limit of uterine size the equivalent of 15–16 weeks of gestation to make a uterus suitable for laparoscopic surgery<sup>8</sup>. This seems to exclude very enlarged uteri from laparoscopic surgery, thus suggesting a laparotomic approach<sup>8</sup>. The reasons for this is the technical difficulties to perform the LH (as the uterine volume increases, the access to uterine vascular pedicles worsens and increases the risk of complications such as haemorrhage)<sup>9</sup>. Other concerns are linked to the risk of accidental bowel and urinary damage due to poor exposure, difficulty in extraction of the uterus, and duration of the procedure<sup>9</sup>.

A good surgical result is always based on a correct indication<sup>10</sup>. In case of very large fibroid uteri the evaluation of the possibility of a MIS has to consider the

uterine size, uterine mobility, the patients clinical history (prior surgeries and adhesion), and general physical conditions<sup>10</sup>. The success of the total minimal-access hysterectomy in uteri of more than 1000 grams also depends on the following factors: surgical experience of the team, instrumental equipment, positioning of the patient, uterine mobilization by a manipulator, the exibility of the anterior abdominal wall, the intraabdominal residual volume and ventilation pressure respectively<sup>10</sup>. The duration of the surgery also depends on these factors and not only on the uterine weight<sup>10</sup>. As curiosity the largest uterus removed laparoscopically was registered in the Guinness World Records as a uterus weighting 4.1 kg and reported by Dr Rakesh Sinha and it tooked 4hours and 15 minutes<sup>8</sup>.

## Surgical Techniques

Poor access and exposure are the main concerns. Several different methods have been suggested for do successful and safe LH in large uterus. Wattiez *et al*<sup>9</sup> introduced several modifications to the current technique for LH for large uteri. The key modifications consisted in higher insertion of the optic cannula with consideration of open abdominal entry to minimize the risk of lacerating the uterus. The optic cannula should be placed 10 cm above the umbilicus and the 30-degree optic can ensure better visualization of uterine pedicles<sup>9</sup>. The middle cannula should be placed through the umbilicus or even higher, while the other two lateral ones should be placed according to uterine size and location of fibroids<sup>9</sup>. The role of the uterine manipulator is especially important in case of very large uteri to optimize the exposure of structures (vessels and ligaments) and can significantly reduce the operating time. Not all uterine manipulators are suitable in these patients<sup>9</sup>. However, it was suggested that in some cases adding another port and using an additional instrument for manipulation may be helpful<sup>9</sup>. Another concern is the risk of hemorrhage, which in cases of very enlarged uteri can be increased due to difficult exposure<sup>9</sup>. This can be overcome through polar instruments as described by Wattiez *et al*<sup>9</sup> and Fiaccavento *et al*<sup>11</sup>. Since the uterine pedicle is enlarged as well, the surgeon should be experienced in performing ligation and suturing the uterine artery near its origin from the internal iliac artery. In selected cases, ligation or suturing may be of help in reducing the blood supply before applying bipolar coagulation, thereby lowering the risk of hemorrhage and ureteral injury<sup>9</sup>. Transec-

tion of the vaginal cuff can be performed vaginally or laparoscopically; however, better visualization of pelvic anatomic structures is obtained by laparoscopy, resulting in a safer procedure<sup>9</sup>. Enlarged uteri required significantly more morcellation than smaller uteri. This can be performed either vaginally or with a laparoscopic knife, which facilitated uterine extraction<sup>9</sup>. The laparoscopic knife has potential advantages, as it may reduce operating time and may be associated with few vaginal and rectal injuries<sup>9</sup>.

Tchartchian *et al*<sup>13</sup> described the combined LH in a case of a uterus with a weight of 2480 grams using the switch-over technique, which means a number of six trocars in the anterior abdominal wall. The necessity of the switch-over technique does depend not only on the uterine weight but also on the mobility of the uterus, the uterine shape and the exibility of the abdominal wall, and thus the residual intraabdominal volume<sup>13</sup>. As such, it is inserted 6 trocars including 3 on the left: one trocar in the lower, one in the middle, and one in the upper abdomen, allowing access to the left narrow space<sup>13</sup>. The 3 trocars on the right side are placed in a mirror-like position. The upper lateral trocar is to introduce the camera and the other two located trocars to introduce forceps and coagulator or scissors<sup>13</sup>. The patient is slightly tilted to the opposite side to facilitate visualization and preparation of structures<sup>13</sup>. Next, the surgeon and his team switched sides positioning to the other side of the patient, thus accessing the narrow space between the uterine wall and abdominal wall. Again, the patient is slightly tilted to the opposite side, enabling better exposure and preparation of organ structures<sup>13</sup>. Tchartchian *et al*<sup>13</sup> affirmed that this technique enables to complete hysterectomies of uteri of nearly all sizes and the use of the changeover technique is useful and advisable when a high uterine weight of more than 2.000-2.500g is expected.

Shahid *et al*<sup>14</sup>, performed a five port modified technique for a laparoscopic subtotal hysterectomy (LSH). The first trocar with 5mm was inserted in Palmer's point. A second 5 mm port was placed on the contralateral side, in the right hypochondrium and two other ancillary (5 mm) ports were inserted laterally at the level of the umbilicus depending upon the size of the uterus, above the level of the ovarian ligaments lateral to the epigastric vessels and a 10 mm suprapubic port 4 cm above the pubic symphysis in the midline<sup>14</sup>. The right side of the procedure was carried out with the laparoscope in the right subcostal port and likewise the left side was carried out with the laparoscope in the left

subcostal port. The advantages of this technique is that exposes the both pelvic side despite the size of the uterus as the camera can be placed on the left side for left sided pedicles and likewise on the right side for the right sided pedicles, avoiding the umbilical or supraumbilical port which minimize the laceration of the uterus<sup>14</sup>. This technique has added cosmetic benefits as all the ports above the bikini line are small (5 mm) and symmetrical with shorter operation time<sup>14</sup>. However, LSH brings the risk of developing cervical cancer in the future.

Yavuzcan *et al*<sup>15</sup>, described a four port technique for LT: a 10mm trocar inserted in the Palmer Point, another 10mm port below the umbilicus inserted under direct vision, two 5mm ancillary ports in both hypocondrium lateral to the rectus abdominis muscle, inferior epigastric vessels and 1/3 outer portion of the distance between spina iliaca anterior superior and umbilicus, and the laparoscope was inserted through intraumbilical trocar. This approach has better cosmetic results and does a total LH. However this study had a small number of patients and it's difficult to extrapolate information about complication rates and operation outcomes.

Uccella *et al*<sup>16</sup>, hypothesize that the reduction in the caliber of the trocars can be associated not only with better cosmetic results, but also with reduced operative trauma and a lower rate of wound complications. In particular, it should not be neglected that, up to now, no incisional hernias have been described through 3mm incisions among adults, whereas several reports have shown that 5mm trocars are at risk of this threatening complication and that its likelihood is related to the size of the accesses<sup>16</sup>. Under direct visualization, three 5mm or 3mm ancillary trocars were inserted, one suprapubically and two laterally to the epigastric arteries, in the left and right lower abdominal quadrants, respectively<sup>16</sup>. In fact, Uccella *et al*<sup>16</sup>, concluded that with high-level proficiency in the field of MIS, large uteri with a size between 16 and 20 weeks of gestation can be safely and effectively managed using 3mm instruments with no shortcomings compared with conventional laparoscopy and with better cosmetic outcomes.

Recent concerns about the risk of iatrogenic tumors in the abdominal cavity after morcellation by implants of lost morcellated tissue fragments have been discussed in the last years. Because of potential tissue dissemination within the abdominal cavity, the Food and Drug Administration recently warned against the use of

electromechanical power morcellation in hysterectomy and myomectomy.<sup>17</sup> The steering committee on fibroid morcellation of the European Society of Gynecological Endoscopy concluded that the prevalence of uterine sarcoma in presumed fibroids is 0.14% with a range from 0.49% to 0.014%<sup>18</sup>. The meticulous removal of all tissue particles after morcellation and a sufficient wash of the complete intrabdominal space are very important<sup>10</sup>. Uterine size, ultrasound examination, and radiologic methods cannot safely predict uterine malignancy<sup>10</sup>. Presurgical uterine biopsies have a very low sensitivity and therefore cannot help to avoid the morcellation of malignant or premalignant tissues<sup>10</sup>. In response, accessories have been innovated to minimize this risk. One example is specialized bag protection around the surgical instrument to prevent fragment dissemination into the peritoneal cavity. However the use of bags is limited to a certain uterine size<sup>10</sup>. The alternative laparoscopic-assisted vaginal hysterectomy (LAVH) with extraperitoneal vaginal morcellation or the vaginal removal of the uterine corpus was not feasible in the described cases<sup>10</sup>. A condition for the vaginal approach is the mobilization of the uterine tissue into the pelvis<sup>10</sup>. Due to their size, in the presented cases the uterine bodies were cranial of the pelvis, which made the vaginal mobilization of the cervix impossible<sup>10</sup>. However, in the case of suspicious myomas growing after menopause, growing on GnRH agonists, rapidly growing over a short time frame in premenopause, exceeding 10 cm in diameter, caution should be used, maybe evaluating the option of a laparotomic approach to avoid morcellation of the uterus or myomas<sup>8</sup>.

## Complications

Many improvements have been made in the number and location of laparoscope and trocars in an attempt to gather better results for both the patient and surgeon<sup>15</sup>. Powerful morcellators have been put in practice for morcellating large uteruses and fibroids that cannot be removed by vaginal route. In contrast to the routine practice in the last years, the idea of safely performing LH in large uteruses has been raised even in those uterus with >1000g<sup>8-10,13,16</sup>.

Some surgical strategies can be use to avoid complications. The identification of the ureteral trajectory is imperative before applying an energy source to seal the uterine vessels<sup>18</sup>. The uterine vessels are pushed laterally by the expanding lower uterine segment and are in closer proximity than usual to the ureters<sup>18</sup>. In addition,

the anatomy can be significantly distorted and the ureter(s) pushed cephalad by the uterus as it grows out of the pelvis<sup>18</sup>. Sometimes it is easier to seal the uterine vessels at their origin from the anterior division of the hypogastric artery<sup>18</sup>. Some authors have advocated the practice of universal cystoscopy during major gynecologic cases to improve injury detection<sup>18</sup>. It has also been suggested that intraoperative markers such as peristalsis and visualization of ureteral caliber may be unreliable to detect injury.<sup>18</sup> The prophylactic placement of ureteral stents is used in select cases to facilitate intraoperative ureter identification. Lighted ureteral stents have also been used, especially in laparoscopy, in which the haptic feedback is lacking<sup>18</sup>.

The uterine artery ligation can be done by four ways: conventional, anterior, posterior and lateral approach<sup>6</sup>. The anterior approach consists in the ligation of the ascending branch of the uterine artery without opening the posterior broad ligament<sup>6</sup>. This is useful for the uterus with large fibroids with poor access to the cul sac and posterior broad ligament or when they are not maneuverable by the manipulator<sup>6</sup>. This way isn't so useful for patients with fibrosis in the parametrium from endometriosis or dense bladder adhesions from caesarean<sup>6</sup>. The posterior approach resides in ligation of ascending branch of uterine artery without developing bladder flap<sup>6</sup>. This method is excellent in patients with extensive and dense uterine adhesions to the bladder and anterior abdominal wall<sup>6</sup>. The lateral approach is commonly done in radical hysterectomy for cervical cancer<sup>6</sup>. It's helpful for retroperitoneal fibrosis in the parametrium seen in severe endometriosis and large fibroids which can be difficult to visualize without angled scope in broad fibroid uterus<sup>6</sup>.

Wattiez *et al*<sup>9</sup>, concluded that if given adequate training in laparoscopic surgery and with the proper technique, LH can be performed successfully in most women with very enlarged uteri, with no increase in complication rates and short-term recovery comparable with women that have moderately enlarged uteri. They analysed a series of LH performed in women with enlarged uteri (>500g Vs ≤300g). No difference was seen in complication rates, day 1 haemoglobin level drop and hospital stay between groups. Operative time was significantly longer ( $p<0,001$ ) in the group with greater uteri. No was conversion to laparotomy required in either group.

Fiaccavento *et al.*<sup>11</sup>, compared 149 patients with a uterus weighting less than 350 g with 100 patients with a uterus weighting more than 500 g. There was a statistically significant increase in terms of operative time

and post-operative hospital stay length in the second group without differences in time to recovery between groups. There were no differences in terms of major complications.

The duration of the surgical procedure shouldn't be underestimated. In turn, this increases the risk for thrombosis and neurological complaints<sup>13</sup>. Prophylactic measures to avoid should be done, such as, mobilization of patient legs and occasional change of the position after 2 hours to avoid nerve lesion and other complications like compartment syndrome<sup>10</sup>.

Uccella *et al*<sup>16</sup> reported that LH enables a marked reduction in the need for AH and it's safe perform mini-laparoscopic approach in patients with enlarged uterus. Hospital stay and rate of intraoperative and postoperative complications are independent of uterine weight<sup>15</sup>. Bonilla *et al*.<sup>19</sup> investigated if an enlarged uterus is associated with an increased rate of intraoperative and postoperative complications and prolonged hospital length of stay after AH or LH. They indicated that LH is an excellent choice for enlarged uteri and it is strongly associated with decreased morbidity, shorter hospital stay, and reduced mean estimated blood loss and blood transfusion rate.

### Comparing to other approaches

The primary surgical approaches through which hysterectomies are performed are vaginal, abdominal, or laparoscopic (with or without robotic assistance)<sup>20</sup>. Aside from personal training and experience, factors to be considered by the surgeon in selecting the hysterectomy surgical approach include: the size and shape of the uterus, pelvis, and vagina; accessibility to the uterus; extent of extra-uterine disease; the need for concurrent procedures; available hospital resources; and patient preference<sup>20</sup>. Each surgical approach is associated with its own advantage regarding outcomes and complication rates<sup>21</sup>. When choosing the surgical approach, the surgeon should take into consideration how the procedure may be performed to optimize the patient's health and minimize the risk of complications<sup>20</sup>. While in general it is recommended to take the most MIS, the majority of the existing evidence specifically supports the principle that, when feasible, VH is the safest and most cost-effective route by which to remove the uterus<sup>20</sup>.

In the literature, the review of the major reports on hysterectomy for myomatous uteri demonstrates that the vaginal approach is used more frequently for small or medium sized uteri<sup>21</sup>. With the LAVH, the abdo-

minal-pelvic exploration and the ability to perform oophorectomy safely represent the major advantages compared with VH<sup>21</sup>. The specific indications for each of the hysterectomy techniques remain uncertain<sup>21</sup>. However, the purpose of LAVH and LH is not to replace VH, but rather to increase the abilities of the gynecological surgeon to perform MIS for more extended indications, avoiding the need of an AH also in the presence of ovarian tumors, tubo-ovarian adhesions, endometriosis, or previous pelvic surgery<sup>21</sup>. Hatta *et al*<sup>22</sup>, believe that LH is a better procedure for a large uterus because the average intraoperative blood loss in the LH group was significantly lower than that in the LAVH group. Given adequate training in laparoscopic surgery and use of proper technique, LH can be performed successfully in most patients with large myoma uteri, with no increase in the complication rates, and with a short-term recovery comparable to that achieved with LAVH<sup>20</sup>. Robotic hysterectomy was shown to be feasible and safe with a lower blood loss, albeit at the cost of a greater number of ports and longer operative time<sup>23</sup>. Last but not least, compared to AH, LH has a faster return to normal activity, shorter duration of hospital stay, fewer wound or abdominal wall infections and longer operating time. Considering the MIS, VH, LAVH, and LH and laparoscopic supracervical hysterectomy, the AH can be avoided in almost every case<sup>10</sup>.

### ENDOMETRIOSIS

Endometriosis is estimated to occur in 6% to 10% of women of reproductive age,<sup>24</sup> with a prevalence of 38% (range, 20%–50%) in infertile women,<sup>25</sup> and in 71% to 87% of women with chronic pelvic pain.<sup>25</sup> In the past, symptomatic moderate to severe endometriosis was most commonly treated by laparotomy with the removal of affected tissue, with or without hysterectomy and bilateral salpingo-oophorectomy<sup>26</sup>. More recently, many women with advanced endometriosis have been treated with a laparoscopic approach because it results in a shorter hospital stay and recovery period compared with laparotomy<sup>26</sup>. However, LH in women with deep endometriosis may be challenging even for expert surgeons: the pelvis is often obliterated and “frozen” because of the adhesive nature of the disease, obliteration of the surgical plans, the involvement of the ureters with distortion of their normal course and the bowel is often adherent to the uterus and the adnexa<sup>26-27</sup>.



## Surgical Technique

In cases with endometriosis the procedure may need to be modified according to the extent and anatomical location of the disease. Adhesiolysis must be meticulous and most of the time is the first step<sup>27</sup>. Whenever feasible, avoid lysing dense and fibrotic adhesions of bowel and bladder adhesions to the uterus until all of the uterine blood supply is secured.<sup>6</sup> A retroperitoneal approach it is used to try to work in healthy tissue, surrounding the disease<sup>27</sup>. As we said before, the identification of the ureter trajectory is very important to avoid complications. Particular attention should be paid during isolation of the ureter to avoid damage to its periaortic vessels, and to ortho and parasympathetic nerves running caudally and dorsally to it<sup>27</sup>.

As we see before, uterine artery ligation can be done in four ways.<sup>6</sup> The posterior is excellent in patients with extensive and dense uterine adhesions to the bladder and anterior abdominal wall<sup>6</sup>. The lateral approach is good for retroperitoneal fibrosis in the parametrium seen in severe endometriosis<sup>6</sup>. The dissection shouldn't be extended below the level of the deep uterine vein, to spare the hypogastric nerves, the pelvic splanchnic nerves and the inferior hypogastric plexus (also known as pelvic plexus), unless massive infiltration by the endometriotic process is present below this level<sup>27</sup>. In addition, the recto-vaginal septum may need to be opened and developed in the case of local infiltration by the endometriotic process<sup>27</sup>.

## Complications

In patients with endometriosis, even in the case of deep infiltrative lesions and "frozen pelvis", laparoscopic surgery allows not only eradication of the disease, an excellent safety profile, lower pain, and faster recovery, compared with open surgery, but it also guarantees a better visualization of the anatomical structure with the possibility (when indicated and feasible) of nerve-sparing procedures<sup>27-29</sup>.

However, performing LH in women with endometriosis (and in particular, moderate and severe endometriosis) is not only more difficult, but it is associated with a higher incidence of complications, urinary lesions and voiding dysfunction<sup>27</sup>. Nevertheless, the total risk of post-LH complications in this subset of high-risk patients appears acceptable<sup>27</sup>. Another interesting consideration is to observe how the risk of voiding dysfunction is approximately 4% among women with endometriosis, compared with 0% in those not affected by the disease<sup>27</sup>. This is likely due to den-

ervation at the level of the mixed orthosympathetic and parasympathetic inferior hypogastric plexus<sup>27</sup>. Despite a particular attention to preserve nervous fibers running through the pelvis, it appears sometimes impossible to preserve the hypogastric nerves and/or the pelvic splanchnic nerves that run caudally and dorsally to the ureter<sup>27</sup>. Nerve-sparing procedures have been proposed recently with encouraging results, as a demonstration that a thorough and comprehensive anatomical knowledge, along with a high laparoscopic skill may reduce the incidence of some subgroups of complications<sup>27</sup>.

Adding, comparatively with AH, the use of LH has fewer complications and should be the first choice of surgical treatment in patients with severe pelvic endometriosis who require a hysterectomy<sup>30</sup>.

## PELVIC ADHESIONS

Cesarean section (CS) and hysterectomy are major gynecologic surgeries frequently performed worldwide. With an increasing CS rate, a high proportion of women submitted to a hysterectomy will have a history of laparotomy<sup>31</sup>. Abdominal adhesions, related to the surgery or an inflammatory process, are associated with an increased risk of small bowel obstruction, pelvic pain, subfertility, and complications in a subsequent surgery<sup>31</sup>. Pelvic adhesions are estimated to develop in one- to two-thirds of women delivered by CS and contribute to bladder, bowel, and ureter injuries as well as prolonged operation times<sup>31</sup>. Accordingly, at the time of a hysterectomy, previous cesarean delivery has been associated with an increased risk of complications, such as bladder injury, hemorrhage, and a conversion to laparotomy, but studies are limited in number and participants<sup>31</sup>. Prior CS has also been reported as a strong predictor of re-admission after a benign hysterectomy<sup>31</sup>. Occurrence of adhesions in gynecologic surgery increases with numbers of CS, but it remains uncertain whether complications during a hysterectomy are related to adhesions following a CS or to any comorbidity in the woman with a personal history of cesarean delivery<sup>31</sup>.

## Surgical Technique

Anterior wall adherence should be anticipated in patients who have undergone CS if the uterine cervix is found to be located much superior to its normal location during pelvic examination<sup>32</sup>. In general, the umbilical

trocar is inserted first to create a pneumoperitoneum for surgery<sup>32</sup>. However, because midline adhesion is most common in women with anterior wall adherence, this may be difficult<sup>32</sup>. Therefore, for LH in such women, it is safer and more effective to make a pneumoperitoneum by inserting the first trocar in the upper lateral part instead of the umbilical trocar<sup>32</sup>. Ancillary trocars are then inserted in sites with less adhesion. Sufficient adhesiolysis is performed to secure adequate visual field for LH<sup>32</sup>. If both the surgeon's hands are freed as in previously described surgical method, LH can be performed successfully. The adhesion site between the uterus and anterior wall is examined closely and the lateral portion of the adhesion is dissected with a dissecting scissors with monopolar coagulation<sup>32</sup>. The use of lateral approach for adhesiolysis can reduce bleeding, allowing hysterectomy to be performed more easily<sup>32</sup>. Sometimes it can be an issue the distance from the anterior wall adherence to the trocar. If it is too close, it is easier to perform adhesiolysis of the anterior wall adherence using a 5-mm telescope in the right upper quadrant and laparoscopic instruments in the left upper quadrant and umbilical port without leading to major changes in the surgical view between the umbilical and right upper quadrant port sites<sup>32</sup>. Bladder wall adhesion is an unavoidable side effect in patients who have undergone CS<sup>32</sup>. If the boundary between the bladder and adhesion is unclear, it can be used the cystosufflation technique using carbon dioxide to distend the bladder through a Foley catheter during the laparoscopic procedure to check the border for a site to perform adhesiolysis<sup>32</sup>.

### Complications

Prior CS is associated with an increased risk of complications during a subsequent hysterectomy. CS predisposed for bladder injury<sup>31</sup>. In a prospective study of 574 laparoscopic hysterectomies, bladder injury occurred in 5 % of the women with a former CS compared with 1.2 % of the women with no CS, moreover, major complications increased with the numbers of CS<sup>33</sup>. This conclusion is not surprising given that previous pelvic surgery distorts normal anatomy with loss of surgical planes increasing the difficulty of surgery<sup>33</sup>. In the presence of previous CS, VH also has an increase in complications.<sup>33</sup> There is evidence in patients undergoing AH with previous CS of increased complication rates, but statistically less than with VH or LH<sup>33</sup>. An increase in urologic injury has been shown when comparing LH with AH or VH<sup>33</sup>. Overall LH in the set-

ting of previous CS can still be recommended, because long-term sequelae are rare<sup>33</sup>. Should bladder injury occur, recognition and immediate repair provides a very good prognosis<sup>33</sup>.

### Barrier Agents

Laparoscopic surgical procedures have been associated with fewer postoperative adhesions than open surgeries. Meticulous surgical technique is a means of preventing adhesions<sup>34</sup>. This includes minimizing tissue trauma, achieving optimal hemostasis, minimizing the risk of infection, and avoiding contaminants and the use of foreign materials when possible<sup>34</sup>. However, adhesions are not always preventable despite meticulous surgical technique. Some conditions may increase the likelihood of forming adhesions, such as endometriosis or chronic pelvic inflammatory disease. When patients are at particular risk of postoperative adhesions the use of adjuvant measures of adhesion prevention could be considered<sup>34</sup>. Polytetrafluoroethylene barrier is more effective than no barrier or oxidized regenerated cellulose in preventing adhesion formation<sup>34</sup>. Oxidized regenerated cellulose adhesion barrier is associated with a reduced incidence of pelvic adhesion formation at both laparoscopy and laparotomy when complete hemostasis is achieved. Chemically modified sodium hyaluronate/carboxymethylcellulose is effective in preventing adhesion formation, especially following myomectomies<sup>34</sup>. In the Cochrane Database<sup>35</sup>, there was no evidence on the effects of barrier agents used during pelvic surgery on either pain or fertility outcomes<sup>35</sup>. However, low quality evidence suggested that oxidised regenerated cellulose, expanded polytetrafluoroethylene and sodium hyaluronate with carboxymethylcellulose may all be more effective than no treatment in reducing the risk of adhesions following pelvic surgery<sup>35</sup>. No adverse events directly attributed to the adhesion agents were reported<sup>35</sup>.

### OBESITY

Obesity is an increasing prevalence disease that surgeons must consider its effects on perioperative complications and surgical decision-making<sup>36</sup>. It has been shown that patients who are obese experience some of the greatest differential benefit from minimally invasive techniques<sup>37-38</sup>. In patients who are not good candidates for vaginal surgery, the laparoscopic approach offers an alternative that may decrease blood loss and

length of hospital stay at the time of hysterectomy<sup>38</sup>. In a Cochrane review of studies on hysterectomy, the risk of wound complication and surgical site infections is less when the procedure is done through a vaginal or laparoscopic approach compared with an open route<sup>37</sup>. Laparoscopy can be more complicated in the obese patient, and the risk of conversion to laparotomy is higher, but the conversion rate tends to decrease over time with surgical experience<sup>37</sup>. Quality of life data for patients of all weights, 4 years after hysterectomy, also support the use of laparoscopy over laparotomy<sup>39</sup>. Gynecologic surgeons should have the knowledge to counsel obese women on the risks specific to this group<sup>38</sup>.

Counseling for the obese woman scheduled for gynecologic surgery should be individualized and take into consideration specific risk factors and indication for surgery<sup>38</sup>. The possibility of conversion to an open procedure should be discussed in preoperative counseling and individualized based on the surgeon's experience<sup>38</sup>.

Before undertaking gynecologic surgery, an evaluation of underlying comorbid conditions that could affect intra-operative and postoperative care should be performed. Preoperative consultation with an anesthesiologist should be considered for the obese patient<sup>38</sup>. Preoperatively, the office abdominal and bimanual pelvic examination to guide the route of surgery may be difficult in obese patients.<sup>38</sup> Preoperative imaging may help to determine the best route of surgery in these cases, and an examination under anesthesia may provide more guidance<sup>38</sup>.

Obese patients undergoing gynecologic surgery longer than 45 minutes, and not at risk of major bleeding should receive prophylaxis to venous thromboembolism<sup>38</sup>. The prophylactic antibiotics should be administered in dose of a 2g prophylactic cefazolin dose in those patients who weigh more than 80 kg, with an increase to 3 g for those who weigh more than 120 kg<sup>38</sup>. Surgical patient positioning is important to maximize exposure and reduce the risk of injury.<sup>38</sup> The set-up should allow the surgeon adequate maneuverability during the surgery, provide protection on patient pressure areas to avoid neural injuries and pressure sores, and ensure availability of secure belts and gel pads to prevent movement of the patient on the table<sup>38</sup>. Lithotomy position typically requires the use of knee-crutch, candy cane-shaped, or boot-type stirrups<sup>38</sup>. The candy cane-shaped stirrup allows more operating space, but they may lead to extreme knee and hip abduction in obese patients<sup>38</sup>. The boot-type stirrup allows better lower extremity alignment and safety, but

there is less maneuverability and decreased surgical site access<sup>38</sup>.

Laparoscopy in the obese patient is more technically challenging than in the normal-weight patient and should be undertaken by those who have adequate laparoscopic surgical experience<sup>38</sup>. Given the increase in size of the anterior abdominal wall, if the Veress needle is used, the 150 mm length may help achieve pneumoperitoneum and avoid preperitoneal insufflation; longer ancillary trocars (up to 150 mm) also may be useful<sup>38</sup>. Placement of ancillary trocars can be more challenging because of the suboptimal visualization of the inferior epigastric vessels<sup>38</sup>. Exposure can be difficult when operating in the pelvis of an obese patient<sup>38</sup>. Operating in the pelvis requires the Trendelenburg position, which may cause difficulty in ventilating the patient<sup>38</sup>. A higher pneumoperitoneal pressure may be required, but the higher pressure may hamper the ability to provide adequate ventilation<sup>38</sup>. The omental fat and limited manipulation of instruments also pose difficulty<sup>38</sup>. Closure of any port size at least 10 mm or greater often presents the greatest challenge; a port closure technique that affords laparoscopic visualization may be useful in this situation<sup>38</sup>.

Postoperative care of the obese patient is similar to post-operative care of the normal-weight patient and comorbid conditions should be taken into consideration<sup>38</sup>. Ancillary personnel should be aware of the importance of continued prophylactic measures to decrease the possibility of venous thromboembolism until the woman is fully ambulatory<sup>38</sup>.

LH seems to be a safe route for obese patients. It is important to note that obesity as evidenced by increasing BMI makes any hysterectomy procedure more challenging as demonstrated by our data<sup>36</sup>. Irrespective of the surgical approach, more time is required to complete the chosen surgery as the patient's BMI increases<sup>36</sup>. Given that laparoscopy is feasible in patients with a high BMI with fewer reported perioperative complications compared with open surgery, efforts should be made to streamline techniques that allow more obese patients to undergo a hysterectomy through a minimally invasive approach<sup>36</sup>.

## FUTURE PERSPECTIVES

Performing MIS is effective and efficient method with good surgical outcomes. Gynecologic surgeons should be trained and encouraged to perform MIS, such as



LH. After completing the learning curve and with the proper technique, LH can be performed successfully in most complex cases, such as patient with a large uterus, severe endometriosis, adhesions and obesity. In expert hands it is possible to have a low complications rate and a short-term recovery. Therefore, complex situations should not be considered contraindications for LH. With good training early on and a good understanding of laparoscopy, it is possible to achieve this goal. The future will be to practice more and more experienced surgeons to allow to offer the best treatment to the patient.

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