Chapter

Laparoscopic Hysterectomy in Morbidly Obese Patients

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Abstract

The following chapter will focus on laparoscopic hysterectomy in morbidly obese patients. The discussion reviews the physiological changes associated with morbid obesity and the potential implications on pneumoperitoneum during laparoscopic surgery. Important considerations such as perioperative care and operating room setup are discussed. Additionally, obtaining abdominal access, reviewing the surgical approach, and post-operative considerations are all highlighted within this chapter.

Keywords: minimally invasive surgery, morbid obesity, laparoscopic hysterectomy, robotic assisted laparoscopy hysterectomy

1. Introduction

Obesity worldwide has increased over time and is now considered an epidemic with significant health implications. Worldwide obesity has nearly tripled since 1975. In 2015–2016, the prevalence of obesity was 39.8% in adults and 18.5% in youth [1]. Body mass index (BMI) is a widely used method for estimating body fat mass. The World Health Organization defines class I obesity as BMI 30 to <35, class II obesity as BMI 35 to <40, and class III obesity as >40. The prevalence of clinically severe obesity (BMI > 40) is increasing at a much faster rate among adults in the United States than is the prevalence of moderate obesity [2]. In addition to the overall rising rates of severe obesity, the mean waist circumference (WC) has increased continuously among adults over the last 15 years. Abdominal fat deposition is a key component of obesity and some studies have shown that WC may be a better predictor for the risk of myocardial infarction, metabolic syndrome, and all-cause mortality than BMI [3].

From a surgical perspective, facilities need to consider the availability of specialized equipment for morbidly obese patients. Many facilities may lack the appropriate equipment for patient transfer, operating room tables that can accommodate the patient's weight, and specialized laparoscopic surgical equipment for minimally invasive surgery. Particular challenges of minimally invasive surgery for morbidly obese patients can be seen with central adiposity, which creates a thicker abdominal wall, larger visceral volume, and enlarged mesentaries, which can impact intraperitoneal visualization more difficult [4]. Central adiposity can also create technical challenges for entry into the abdominal cavity, difficulty with maneuvering laparoscopic instruments through a thick abdominal wall, and physiological stress of Trendelenburg position and pneumoperitoneum [5].

With respect to gynecologic minimally invasive surgery, obesity was previously considered a relative contra-indication. The first feasibility study of gynecologic laparoscopic surgery for obese patients was performed in 1976 [6]. With advances in minimally invasive technologies and increased operator experience, there has been growing evidence supporting minimally invasive surgery for obese patients. There is a large amount of data from gynecologic oncology indicating laparoscopic or robotic surgery resulted in shorter hospital stay, less postoperative pain, earlier return to normal activity, decreased postoperative complications, and fewer wound infections [7]. However, there are some studies indicating a higher conversion rate to laparotomy, which was dependent on BMI, noting that women who were morbidly obese had a 57% conversion rate to open laparotomy [8].

There is conflicting data regarding comparisons between robotic vs. conventional laparoscopic surgical outcomes. When looking at bariatric surgery studies, there is some evidence that robotic surgery results in shorter operative times with increased BMI [9]. However, other studies indicate that there are longer operative times [10]. One reason that surgeons may favor the use of robotic surgery is reduced surgeon fatigue, the utility of articulated wristed robotic instruments which allow for more fluid movements and less torque on the abdominal wall [11]. Further prospective studies are required to define the best and most cost-effective minimally invasive surgical method in obese women. Ultimately, every effort should be made to offer the least invasive procedure regardless of BMI, to maximize clinical benefits and quality of life [12].

2. Physiological changes

According to the National Institutes of Health, a BMI >40 increases the risk for diabetes mellitus, cardiovascular disease, and reduced life expectancy [13]. Understanding the differences in anatomy and physiology of morbidly obese patients is critical for surgical planning.

2.1 Cardiovascular

Myocardial infarction, cardiac failure, and sudden cardiac death risk increase in obese individuals. This may be due to increased body mass leading to hemodynamic and cardiovascular changes resulting in increased cardiac output, larger stroke volume, decreased vascular resistance, and increased cardiac workload [14]. In autopsy studies comparing obese and non-obese patients it has been found that obese patients can have 20–55% larger cardiac diameters, hypertrophied ventricles, and increased cardiac weight. These changes in cardiac physiology can result in hypertension and ultimately lead to cardiac failure [15]. Studies have found that ventricular hypertrophy and cardiac failure caused by obesity results in a higher risk of mortality [16]. The eccentric and concentric ventricular hypertrophy associated with obesity can lead to prolonged Q-T intervals or tachyarrhythmia. Additionally, unexplained cardiac arrhythmias are more common in obese patients [11]. The creation of pneumoperitoneum required to perform minimally invasive procedures can cause further cardiac depression. Abdominal insufflation causes an increase in afterload while the subsequent impeding of a venous return causes a decrease in preload. This contributes to an overall reduction in cardiac output [17]. Cardiac depression during laparoscopic procedures is often transient as the patient's body compensates for the change in physiology. In one study of morbidly obese patients undergoing laparoscopic gastric bypass, cardiac output levels returned to baseline at 2.5 hours after abdominal insufflation [17].

2.2 Pulmonary

Due to fat deposits in the mediastinum and abdominal cavities, the mechanical properties of the lungs and chest wall are altered in obese patients resulting in reduced compliance of the lungs, chest wall, and entire respiratory system. These changes likely contribute to increased symptoms of wheezing, dyspnea, and orthopnea [18]. Obesity causes reduced chest wall and pulmonary compliance and therefore reduction in gas exchange and increased bronchial resistance and ventilation-perfusion. Increased abdominal pressure and pleural pressures in obesity alter the breathing pattern resulting in a reduction of both expiratory reserve volume (ERV) and the functional residual capacity (FRC). Severely obese patients have a decreased FRC up to 33% [11, 18].

The expiratory reserve volume is also compromised by 35–60%, secondary to cephalad displacement of the diaphragm by the obese abdomen [19]. Sleep-disordered breathing, including obstructive sleep apnea (OSA) and obesity-related respiratory failure (ORRF) is common in obese patients. Studies demonstrated that half of all patients with a BMI >40 kg/m^2 demonstrate OSA [20]. Untreated OSA can result in hypoxemia during sleep as well as pulmonary hypertension, both of which increase risk of cardiac arrythmias. In addition, OSA has been associated with postoperative respiratory complications pneumonia, postoperative hypoxemia, and unplanned reintubation [11].

There are additional intrinsic qualities of an obese body habitus that can impair respiratory function. More soft tissue of the upper airway combined with increased tongue size can cause significant upper airway resistance [16]. An increase in breast mass and additional adiposity can cause difficulty with direct laryngoscopy [16]. Finally, a waist-to-hip ratio has been found to poorly impact gas exchange with larger waist-to-hip ratios correlating to worsening arterial blood gas values [11, 16, 21].

Performing a minimally invasive hysterectomy requires the patient to undergo general anesthesia, the creation of pneumoperitoneum, and supine positioning, all of which further impact respiratory physiology in obese patients. The administration of general anesthesia can reduce a patient's FRC by an additional 20%, while pneumoperitoneum increases inspiratory resistance requiring higher minute ventilation [11, 15]. In one study evaluating respiratory mechanics in laparoscopy, it was found that obese, anesthetized patients in the supine position required 15% higher minute ventilation to maintain normocarbia prior to abdominal insufflation. The authors also reported that these patients had 30% lower static compliance and 68% higher inspiratory resistance after insufflation of the abdomen with CO2 to a pressure of 20 mmHg [15, 22]. While the increase in inspiratory restitance caused by obesity requires higher minute ventilation, oxygenation does not seem to be affected by abdominal insufflation or Trendelenburg positioning. Therefore, patients who are able to tolerate general anesthesia in the supine position are likely also able to tolerate abdominal insufflation and changes in position including Trendelenburg [15, 22].

2.3 Gastrointestinal system

Gastric and esophageal function may also be impaired in obese patients, which can lead to intra-operative challenges. Gastroesophageal reflux disease (GERD) and hiatal hernias are found more commonly in obese patients and can often be asymptomatic [11]. This is caused by increased intra-abdominal pressure which can be two to three times higher in morbidly obese patients compared with non-obese patients [11]. Studies have found that obese patients tend to have higher gastric volumes, lower gastric pH, and delayed emptying which can increase their risk of intra-operative and post-operative gastric acid aspiration [11, 15]. For this reason, a prophylactic H2 blocker (ranitidine) and a pro-kinetic (metoclopramide) are often recommended prior to a surgical procedure [16].

2.4 Thromboembolism

Obesity is an independent risk factor for venous thromboembolism (VTE). Current data regarding the risk of VTE in gynecologic surgery shows the incidence of VTE in gyn surgery ranges from 0 to 2%. Evidence for these studies is from retrospective studies in non-obese patients who underwent simple laparoscopic procedures [11]. Gynecologic laparoscopic procedures with a duration of >30 min are considered moderate to high risk for VTE. Increasing laparscopic surgical complexity increases rates of VTE after completion of surgery according to the American College of Chest Physicians (ACCP) [23]. For these procedures, the standard treatment for VTE prophylaxis is mechanical prophylaxis with sequential compression devices. For obese patients it is critical these devices are appropriately fitted. Alternatively, pharmacologic prophylaxis with either subcutaneous low molecular weight heparin or unfractionated heparin can be administered. For bariatric surgery patients who have a BMI >55, immobility, history of active or recent VTE, hypercoagulable disorders, or severe OSA there are recommendations for placement of an inferior vena cava (IVC) filter for patients prior to bariatric surgery [24]. There are no current clear guidelines for patients undergoing gynecologic laparoscopic surgery and decisions should be made on an individual basis. The ACCP recommends dual prophylaxis with sequential compression devices and pharmacologic prophylaxis during admission and prolonged pharmacologic prophylaxis for 2–4 weeks after discharge for patients with gynecologic cancer with additional risk factors such as age >60 or history of VTE [23]. Recommendations for patients who are morbidly obese undergoing gynecologic laparoscopy may include combination mechanical and pharmacological prophylaxis during surgery and hospitalization. Taking into consideration patient comorbidities and mobility status, extended prophylaxis after discharge may also be considered [11].

3. Perioperative considerations

It is imperative that morbidly obese patients who are seen for surgical consultation should have a comprehensive history and physical exam in addition to laboratory and diagnostic testing as their obesity can increase their medical complexity. During a physical exam, there should be documentation of the patient's body habitus, assessment of the uterine size, uterine mobility, and vaginal caliber. Proper evaluation of the patient's panniculus and body type is crucial for determining intravenous access, trocar placement, and positioning during laparoscopy [4]. Special attention must be paid to the distribution of the patient's weight (i.e. increased waist circumference vs. increased hip circumference). Patients with large adipose tissue centered on their waist are likely to be more technically challenging than patients whose adipose is centered on the hips [15]. In patients with large panniculus, trocar placement may be hindered not only by increased thickness but also by a lack of mobility. If the panniculus is soft and mobile, it can be repositioned easily using traction with weights or tape.

In general, preoperative testing should be tailored to the patient's risk factors. Basic laboratory assessment can include a complete blood count, blood glucose concentration, basic metabolic panel, and blood type and screening. Given the high predisposition for cardiovascular, pulmonary, and endocrine abnormalities in morbidly obese patients, evaluation by subspecialists for additional diagnostic testing should be performed. Informed consent should take into account both the increased medical and surgical complexity of the case and inform the patient of increased risk of infection, increased risk of VTE, and potential increased risk for conversion to laparotomy [11]. As pulmonary and cardiovascular changes are prominent in morbidly obese patients, there are numerous risks associated with general anesthesia including airway complications and oxygenation issues with induction of anesthesia, intubation, and extubation [4]. Increased communication with anesthesia and pre-operative evaluation with anesthesia may be beneficial for these patients. When considering antibiotic prophylaxis, the current standard for routine prophylaxis prior to hysterectomy is 2 g of cefazolin for patients under 120 kg and 3 g for patients over 120 kg [25]. With regards to mechanical bowel prep (MBP), the theoretical advantage is to reduce intestinal volume and mass to improve intraoperative manipulation and visualization. A meta-analysis of elective colorectal surgery has revealed no statistical advantage of MBP [4].

4. Operating room setup

In order to complete laparoscopic surgery safely and efficiently for morbidly obese patients, proper preparation in the operating room is essential. Proper setup of the operating room will allow for mobility of the surgical team, quick access to instruments, increase patient safety, and the ability for the surgeon to successfully complete the procedure.

The first consideration needs to be placed on basic operating room equipment such as the operating room table and mechanisms for patient transfer. Patients are usually brought to the operating room in a stretcher. Lateral transfer devices that utilize hover technology (Hovermatt) can enable the team to move the patient to the operating room table and back to the transport stretcher in a secure and comfortable manner [26]. Operating room tables must have the capacity to support morbidly obese patients. Many standard tables have weight limits of 227 kg (500 lb). A bariatric bed is wider than traditional beds and can accommodate a weight of up to 1000 lb. If there is no availability of a bariatric bed, two standard operating room tables can be used together. Extra padding, blankets, sheets, or lifting devices may be needed to appropriately position an obese patient. Blood pressure cuffs and sequential compression devices will need to be of appropriate size to provide accurate readings.

An additional consideration should be placed on specialized laparoscopic instruments. Laparoscopes come in various sizes with a standard length of 32 cm and diameters ranging from 2 to 10 mm. There are various angled scopes available. In bariatric surgery, some surgeons endorse using a 45-degree angled scope or an extra-long laparoscope (45 cm) to aid with viewing flexibility in extremely obese patients [27]. Laparoscopic assist trays may include extra-long laparoscopic instruments (41–45 cm), which may aid with the ability to complete the procedure successfully. Instruments such as long trocars, trocars with a non-latex balloon at the distal end for retention of the trocar tip in the abdominal cavity, or a long Veress needle (150 mm) may be used. Uterine manipulators should be considered for safe completion of hysterectomy. Although redundant perineal tissue or a large uterus may limit the full mobility of the uterus, the integrated cervical cup will allow for cephalad traction and proper identification of surgical landmarks for colpotomy creation and increase the distance of the uterine arteries from the ureters [4].

5. Patient positioning

Obese patients are at greater risk for pressure sores and nerve injuries when compared to non-obese patients. Duration of compression and compressive force applied influence the risk of nerve injuries. Prolonged compression for 6–8 hours can cause permanent nerve injuries [11, 28, 29]. For laparoscopic surgical procedures in gynecology, patients are placed in a dorsal lithotomy position with their arms tucked at their sides in a "military" position. It is recommended to initially position the buttocks slightly lower than the edge of the bed as the body will shift cephalad with the weight of the panniculus once in Trendelenburg position.

Several considerations should be taken when tucking the arms. It is important to ensure that all intravenous access and cardiopulmonary monitors are functioning appropriately. Adequate padding should be placed at the hands and elbows to minimze ulnar or branchial plexus injuries [29]. If the arms are hanging too far off the side of the bed, bed extenders or arm sleds can be used. If the patient slides cephalad with shoulder blocks in place or if the arms are extended. Two potential scenarios that can increase the risk of brachial plexus injury are if the patient slides cephalad with shoulder blocks in place or if the surgeon leans on the patient's extended arms [30]. The legs should be positioned in stirrups in a low lithotomy position with generous padding applied around the hips and knees. The most common stirrups available in the United States are the YellowFin, the YelloFin Elite, and the Ultrafin. The Ultrafin is capable of accommodating calves that are 13 inches wide and have a weight capacity of 800 lb. Appropriate selection of stirrups can potentially aid in decreasing nerve injury. Obese patients have an increased risk for brachial plexus injury given downward shifting in Trendelenburg [11]. There are multiple options to help reduce this cephalad shifting including gel padding, egg-crate foam, surgical bag, and a padded straps. Once the patient has been positioned a "tilt-test" can be performed where the patient is placed into Trendelenburg position for approximately 2–5 minutes in order to assess the stability of the patient's positioning and assess the impact on the respiratory and cardiac status. Some adjustments that can be made to help insufflation pressures would be to decrease the degree of Trendelenburg or reduce the insuflation pressure.

6. Panniculus management

Management of the patient's panniculus in a caudad position during laparoscopic surgery can aid in improving the patient's ventilation and therefore potentially decreasing the conversation to laparotomy. One technique involves the use of a foley catheter that is passed through the patient's abdominal wall. The foley balloon is insuflated and the catheter is pulled up and clamped to a retractor attached to the foot of the bed [31]. A second technique involves using towel clips on the lower edge of the panniculus with 1-liter saline bags attached and hanging between the legs. Lastly, adhesive dressing can be used to secure the panniculus to the patient's thighs.

7. Abdominal access

Morbid obesity can increase the difficulty of initial abdominal access in laparoscopic surgery due to the increased thickness of the abdominal wall and lack of reliable landmarks. Traditionally, the umbilicus is a common landmark used for abdominal entry as it may represent the thinnest part of the abdominal wall.

However, in obese patients, the umbilicus is often located at or cephalad to the aortic bifurcation. In obese women, the mean umbilical location was found to be on average 2.9 cm caudal to the aortic bifurcation in comparison to nonobese women in which the umbilicus was 0.4 cm caudual to the bifurcation [32]. Given this migration of the umbilicus, if it is used for entry into the abdomen, it may compromise adequate triangulation with the surgical pathology [11]. There are multiple techniques for abdominal entry including the Veress needle, use of an optical trocar, or an open technique. In obese patients, there is a higher likelihood for the Veress technique to result in a higher rate of false entry and preperitoneal insufflation [11]. If there is no substantial panniculus and the umbilical approach is chosen, a 90-degree entry can be used and the use of a long Veress needle (150 mm) may help decrease pre-peritoneal insufflation. If an optical trocar is used, it may be beneficial to use a long trocar to aid in correct placement. Supraumbilical and left upper quadrant are two alternative abdominal entry sites. If the left upper quadrant is used, a nasogastric or orogastric drainage tube should be placed to decompress the stomach. This site is contraindicated in patients who have a history of gastric bypass, splenectomy, and splenomegaly.

8. Surgical approach

Obesity is an important factor to consider when determining an appropriate surgical approach to hysterectomy. A systematic review published in 2015 by Blikkendaal et al., found that laparoscopic hysterectomy and vaginal hysterectomy are associated with significantly fewer postoperative complications and shorter lengths of hospital stay [31]. While vaginal hysterectomy is generally the preferred surgical approach and is associated with improved outcomes, it seems to be less favorable in obese patients due to large uterine size, early-stage endometrial cancer, or lack of vaginal access and exposure secondary to the patient's body habitus [31]. In patients who are not good candidates for vaginal surgery, conventional laparoscopic hysterectomy and robotic hysterectomy are alternative approaches that are shown to be safe and feasible in this patient population [31, 32].

The benefits of minimally invasive surgery are well studied. Compared to laparotomy, laparoscopic hysterectomy results in fewer postoperative complications, decreased blood loss, less time in the hospital, and faster recovery [31, 33]. One study showed that obese patients who underwent laparoscopic hysterectomy compared with laparotomy had fewer incidences of postoperative ileus (0% vs. 13.3%), less postoperative fevers (5.5% vs. 31.1%), and a decrease in wound infections (9% vs. 22%) [15]. Additionally, obese women undergoing laparoscopic hysterectomies, bilateral salpingo-oophorectomy, and lymph node dissection for stage I endometrial carcinoma were found to have shorter hospital stays (2.5 vs. 5.6 days), less pain (32.2 vs. 124.1 mg of pain medication), and earlier return to normal activity [15].

Despite the clear benefits of minimally invasive techniques, research evaluating surgeons' surgical preference shows that the rate of abdominal hysterectomy increases as BMI increases [31]. In fact, in the past obesity was considered a relative contraindication to laparoscopic surgery. This is due to associated difficulties with Verees needle placement, accumulation of fat in the omentum obstructing the operative field and manipulation of laparoscopic instruments [15]. However, more recent studies have shown that minimally invasive approaches including robotics and conventional laparoscopic techniques can be successful in obese patients with proper planning and appropriate laparoscopic surgical experience.

Robotic surgery may help overcome some of the inherent challenges of minimally invasive surgery in obese patients. Robotic surgery offers greater flexibility, articulation, and control of the instruments with reduced hand tremors. Improved ergonomics and the 3D-HD view allow for surgeons to more easily operate within the confined space of an obese abdomen and reduce surgeon fatigue [33]. This is especially relevant in obese patients with endometrial cancer when lymphadenectomy is required [34]. The advantages of robotic surgery may help facilitate the completion of hysterectomy using a minimally invasive approach, however, the cost is significant. Each robotic console has a direct cost of $2.6 million USD and about $2000 per surgical case [34].

While most studies comparing robotic surgery to laparoscopic surgery have not been able to show an improvement in safety or efficacy compared with conventional laparoscopy, there is evidence that robotic surgery may provide clinical benefits in specific populations like the morbidly obese [34–36]. In fact, there is evidence of cost neutralization with robotic procedures when the rate of conversion to laparotomy is decreased [34]. A recent systematic review and meta-analysis comparing laparoscopic and robotic hysterectomy in endometrial cancer patients with obesity found similar perioperative complication rates but a decrease in conversion to laparotomy in robotic procedures performed on patients with BMI > 40 kg/m^2 (7.0% vs. 3.8%) [34]. Additionally, the qualitative reasons for conversion were different in robotic hysterectomy and conventional laparoscopic hysterectomy. Conversion to laparotomy from conventional laparoscopy was more often due to obesity-related anesthetic concerns (30% vs. 6%) while conversion from robotic assisted laparoscopy was attributed more frequently to increased uterine size [34].

9. Intraoperative considerations

9.1 Trocar placement

After properly positioning the patient and obtaining adequate pneumoperitoneum, the surgeon must determine adequate and safe port site placement. This step can be more challenging in obese patient as traditional landmarks may be altered. The surgeon should choose trocars that are adequate in length. Although extra-long trocars, up to 150 mm, are available and may be useful in patients with very thick anterior abdominal walls, they are often not necessary [29, 37]. In order to safely place accessory trocars, some authors recommend increasing the insufflation pressure to 25 mmHg to increase the distance for trocar placement in order to avoid vascular and visceral complications [37]. Once the initial trocar is placed and pneumoperitoneum is achieved, ancillary trocars can be placed under direct visualization after localization with a spinal needle [37]. In general, most authors recommend more cephalad and lateral placement of ancillary port in obese women. This is due to the difficult visualization of the inferior epigastric vessels and the extent of the panniculus [11, 29, 38]. When placing ancillary trocars, they should be angled toward the operative field to prevent slippage and torquing of the instruments [15]. Surgeons should have a low threshold for adding additional ports that may improve ergonomics, triangulation, or retraction [29, 38].

9.2 Exposure and uterine manipulation

Surgical exposure can be challenging in obese patients. This is due to increased visceral adiposity, a fatty rectosigmoid colon, or limited Trendelenburg positioning due to difficulty with ventilation [29, 32]. Mobilizing the cecum and sigmoid reflection from their lateral peritoneal attachments can help facilitate moving the large bowel out of the pelvis [29]. Additionally, the rectosigmoid colon can be retracted by using a puppet stitch to pull the epiploic appendices to the anterior abdominal wall [11]. Another option is using a pre-tied endoscopic loop that can be brought through the anterior abdominal wall using a fascial closure device or bringing the suture through a trocar to be tied off [29, 38].

Effective uterine manipulation is especially important to perform laparoscopic and robotic hysterectomies safely in obese patients. This is because the amount of Trendelenburg may be limited and exposure to the pelvis may be challenging [37]. There are many uterine manipulation devices available including the Zinnati Uterine Manipulator injector (ZUMI) (Cooper Surgical, Trumball, CT), the VCare (ConMed Endosurgery, Utica, NY), and the Reusable Uterine Manipulator Injector (RUMI) Arch (Cooper Surgical, Trumball, CT). It is recommended that surgeons choose a device that will be applicable to the majority of their cases so that the entire surgical team can become familiar with its use, allowing for reliable uterine manipulation [37].

9.3 Closure techniques

As with non-obese patients, closure of the fascia is recommended in incisions greater than 10 mm to prevent port site evisceration. Exposure to the fascia can be more challenging in obese patients. Facial closure devices like the reusable Carter-Thomason CloseSure System XL device (Cooper Surgical, Trumball, CT) allow for the closure to be performed under direct visualization. If the device is not long enough, the disposable Endoclose device (Covidien, Norwalk, CT) can be used [37].

Many studies have compared vaginal vs. laparoscopic vaginal cuff closure with more recent data showing a reduction in vaginal cuff dehiscence with laparoscopic closure (1% vs. 2.7%) [24]. A study by Uccella et al. further demonstrated a reduction in vaginal bleeding (2.7% vs. 4.9%), vaginal cuff hematoma (0.9% vs. 2.3%), need for vaginal re-suturing (0.9% vs. 2.3%) and postoperative infection (0.9% vs. 2.3%) [39]. In obese patients with limited vaginal access due to weight distribution or a large panniculus, laparoscopic closure may also be more accessible.

Some research suggests that obesity may be a protective factor against vaginal cuff dehiscence and evisceration. One study found that after laparoscopic hysterectomy, obese women were 86% less likely to experience vaginal cuff dehiscence than non-obese women [40, 41]. Although intercourse is a significant risk factor for cuff dehiscence, it is hypothesized that positioning during intercourse may be different for obese women, resulting in the application of less physical force at the apex of the vagina [40, 41]. The authors further also postulate that an increase in adipose tissue leads to less energy being delivered to the vaginal tissue during the creation of colpotomy, which can improve healing by causing less tissue desiccation.

10. Post-operative care

Studies have shown that the incidence of postoperative complications increases as BMI increases. However, when surgeries are performed in a minimally invasive fashion, complication rates for obese patients are similar to non-obese patients [29].

Patients with known or presumed cardiovascular disease, OSA, or high perioperative risk should be monitored closely in the postoperative period. Patients who have OSA should be observed overnight because of the increased risk of pulmonary complications [11, 29]. A multi-modal approach to analgesia is recommended to limit narcotic analgesic which can worsen atelectasis and hypoxia. This may include acetaminophen, nonsteroidal anti-inflammatory agents, cyclooxygenase-2 inhibitors, gabapentin, or pregabalin as well as local or regional anesthesia [29, 42]. Early ambulation and the use of incentive spirometry can help inflate dependent lung regions and decrease impairment of lung function induced by anesthesia. As discussed above in the thromboembolism section of this chapter, morbidly obese patients are at increased risk for VTE and may benefit from from extended VTE prophylaxis for 10–35 days following surgery [11, 23].

11. Conclusion

Minimally invasive laparoscopic hysterectomy is feasible for morbidly obese patients. Additional considerations regarding cardiopulmonary physiological changes seen in morbid obesity should be stressed as these have implications for preoperative surgical risk assessment and the patient's ability to tolerate surgical positioning and pneumoperitoneum.

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