Implications of obesity on gynaecological surgery

Rohan Chodankar
Jonathan Chamberlain
Karen Rose*

Abstract

Obesity is a global health epidemic with a rising trend. There are well-established links between obesity and benign gynaecological pathology, premalignant gynaecological conditions and gynaecological malignancy. Obese women may need surgery just as non-obese women do, hence clinicians should be well versed with the impact of obesity on the woman's physiology, the surgical challenges and the effects of obesity on surgical outcomes. Clinicians should be able to counsel women regarding the risks of surgery as well optimizing their perioperative care whilst working within a multidisciplinary team. Current evidence highlights the efficacy and safety of minimally invasive surgery in obese women and it should be offered in preference to laparotomy when possible. All forms of surgery are more challenging in the obese population and routine techniques may need to be modified as described in this review.

Keywords gynaecological surgery; gynaecology; laparoscopy; minimally invasive surgery; obesity; robotic surgery

Introduction

It has been suggested that there is a global epidemic of obesity. The worldwide prevalence of obesity nearly tripled between 1975 and 2016, with approximately 13% of the world's adult population being recorded as obese. Recent data suggests that 26 per cent of adults in England were classified as obese in 2016, which is a 15% rise since 1993. Despite the rate of UK adult obesity plateauing in 2010, NHS hospitals had 617,000 obesity related admissions in 2016/17, which was an 18% rise from the previous year.

The World Health Organization (WHO) defines Overweight and Obesity as abnormal or excessive fat accumulation that may impair health and uses the Body Mass Index (BMI) to classify the degree of obesity. BMI is calculated by dividing a person's weight in kilograms by the square of their height in metres (kg/m^2).

Rohan Chodankar *MBBS MD MRCOG MRC Centre for Reproductive Health, The University of Edinburgh, The Queen's Medical Research Institute, Edinburgh, UK. Conflicts of interest: none declared.*

Jonathan Chamberlain *BDS MBBS MBA MRCOG Consultant Gynaecologist, Simpsons Centre for Reproductive Health, Royal Infirmary of Edinburgh, Edinburgh, UK. Conflicts of interest: none declared.*

Karen Rose *MBChB MRCOG MD Consultant Gynaecologist, Simpsons Centre for Reproductive Health, Royal Infirmary of Edinburgh, Edinburgh, UK. Conflicts of interest: none declared.*

Overweight and Obesity are defined as a BMI of ≥ 25 kg/m^2 and ≥ 30 kg/m^2 respectively, with the latter being further subclassified as Obesity I (BMI 30 to < 35 kg/m^2), Obesity II (BMI 35 to < 40 kg/m^2) and Obesity III (BMI ≥ 40 kg/m^2).

There are well-established associations between obesity and gynaecological pathology and women often seek a surgical solution. This review discusses ways of optimizing counselling, assessment and management of the preoperative, intraoperative and postoperative stages of obese women undergoing gynaecological surgery.

Preoperative considerations

Informed consent

One of the most important perioperative considerations is obtaining informed consent. Gynaecological surgery is often undertaken for benign pathology, and non-surgical treatment alternatives should be prioritized whenever appropriate. A period of weight reduction may have benefits on reducing anaesthetic and surgical risk, and may also improve the preoperative gynaecological symptoms and postoperative surgical outcomes. Patients may require dietetic referral to optimize nutrition and weight loss, and occasionally bariatric surgery prior to planned elective gynaecological surgery.

Obesity may be accompanied by multiple comorbidities, and women often benefit from multidisciplinary input to determine their individual risks in addition to optimizing their health. A preoperative anaesthetic review may aid counselling and optimization.

Obesity is strongly associated with an increased risk of postoperative infections, wound complications and venous thromboembolism. Higher rates of conversion to laparotomy due to poor access or difficulty with ventilation are seen in obese patients. Difficulty positioning the obese patient on the operating table increases the risk of peripheral nerve injury and the development of pressure sores, especially when using the lithotomy position. These risks can be optimized with antibiotics, thromboprophylaxis and careful positioning on appropriately sized operating tables. Obese women requiring surgery should be offered the least invasive option appropriate to their care, with the aim of reducing operating time as well the duration of inpatient hospital stay and postoperative recovery period.

Preoperative assessment

Obese patients should ideally be reviewed in a multidisciplinary preoperative assessment clinic, which can identify those at higher risk. Whilst initial assessment can be completed in a triage format, anaesthetic advice should be readily available due to potential difficulty with intravenous access, airway and ventilation maintenance as well as post-operative analgesic and antiemetic control.

It is important to have an up-to-date BMI calculation in the hospital records because delays can occur prior to the admission for surgery and the BMI may change.

Modifiable risks can be identified and addressed by obtaining a comprehensive history, examination and appropriate investigations. Whilst the extent of tests required needs to be individualized per patient, the assessments should focus on

identifying the comorbidities frequently associated with obesity such as cardiac, respiratory and metabolic disease.

Cardiac diseases such as hypertension, hyperlipidaemia, coronary artery disease and heart failure are commonly seen in obese patients. The increased metabolic demands in obese women increases oxygen consumption, raises cardiac output, reduces preload and peripheral vascular resistance and increases stroke volume. This combination predisposes to hypertension and cardiomegaly. Blood pressure screening (using an appropriately sized cuff) and a baseline ECG are required. Exercise tolerance should be assessed, and in some instances, an exercise stress test may be indicated.

Obesity is often associated with an increase in fatty tissue around the abdomen, chest, neck, mouth and pharynx. This can lead to a reduction in neck mobility as well as a narrowing of the pharyngeal space, which can cause difficulty in obtaining and maintaining a secure airway and can also reduce functional residual capacity, especially in the supine position. Screening for obstructive sleep apnoea is therefore advised, as it may be present in up to a quarter of obese women and the use of continuous positive airway pressure (CPAP) may be required.

A respiratory history and room air pulse oximetry are useful screening tools to identify patients requiring further investigations such as arterial blood gases or pulmonary function tests. Morbidly obese patients should have their airway reviewed by an anaesthetist to assess for intubation and, if available, previous anaesthetic charts should be reviewed for evidence of prior anaesthetic problems.

Obese women are more likely to have large gastric volumes, lower gastric pH and delayed gastric emptying. Intra-abdominal pressures can be 2–3 times greater in the morbidly obese, and the incidences of oesophageal reflux and hiatus hernias are increased. All these factors increase the risk of aspiration of gastric contents during and after surgery, and therefore antacid prophylaxis should be considered.

Obese patients are at higher risk of metabolic syndrome and diabetes as well as their secondary complications such as cardiac and renal disease. It is therefore recommended that a broader range of baseline blood tests are taken pre-operatively to identify any of the associated conditions (such as screening for diabetes) in addition to the routine blood tests required for the surgery. Pre-operatively optimizing glucose control can reduce the risk of infections and wound complications. Additionally, patients should be advised regarding smoking cessation at least 8–10 weeks preoperatively and may require treatment of any bacterial or fungal infections affecting the abdominal skin folds.

There is limited evidence to support the use of bowel preparation to improve surgical views during laparoscopic surgery in obese patients.

Perioperative considerations

Whilst hospitals will have their own policies regarding the admission and management of obese patients, extra considerations may be needed for bariatric patients. The department may need to acquire beds, mattresses, hoists, chairs, commodes, wheelchairs as well as gowns to accommodate the patient's weight and size. The patient's weight, mobility and ability to transfer will need to be assessed prior to admission.

The risk of venous thromboembolism is significantly increased in obese patients and they should, therefore, wear properly sized anti-thromboembolic stockings and intermittent pneumatic compression systems should be considered. Early mobilization should be encouraged, with early discharge home if possible. High dose low molecular weight heparin should be continued throughout the hospital admission and treatment may need to be extended for several weeks beyond discharge, especially in cases of surgery for malignancy.

Intraoperative considerations

Appropriate equipment for operating on the obese patient should be available including specific/longer surgical equipment and specially designed operating tables that can accommodate the size and weight of the patient. Width extenders should be used to avoid the patient's body overhanging the sides of the table. These may restrict access for the surgical and anaesthetic staff, which may cause them to adopt unhealthy postures during the procedure. Additional time should be allocated for patient positioning, anaesthesia and surgery. Additional staff may be required for transferring a patient and assigning an experienced anaesthetic and surgical team will help to reduce operating time and operative morbidity.

Patient positioning checklist

The major principles of patient positioning are listed below.

- Allocate adequate time for patient positioning
- Check the weight bearing capacity of the operating table
- Use adequate padding around pressure points
- Avoid hyperextension of the arms. If possible, place the arms in a military tucked position (at the patient's sides) using low profile arm extenders.
- Anti-slide devices may prevent slippage whilst in the Trendelenburg position (e.g. gel foam pads, surgical beanbags and egg crate mattresses)
- Careful positioning reduces the risk of pressure sores
- Careful positioning also helps minimize the risk of neural injury. The brachial plexus, the sciatic and ulnar nerves are some of the major nerve groups that are at risk, and permanent injury can occur when compression is applied for 6 h or more.

Gynaecological surgery

Gynaecological surgery is undertaken using three major routes of access: open abdominal, laparoscopic/robotic and vaginal. Obesity has effects on each of these routes, such that intraoperative adjustments need to be made. Whilst vaginal surgery has in the literature been included with laparoscopic and robotic surgery under the heading "minimally invasive surgery" (MIS), for the purpose of this chapter we have referred to vaginal surgery separately.

Obesity and Vaginal Surgery: the most common gynaecological procedures performed vaginally include vaginal hysterectomy, urogynecology procedures for prolapse and urinary incontinence, surgical uterine evacuation, hysteroscopy and colposcopy.

The benefits of vaginal hysterectomy over other routes of hysterectomy are well established (patient safety, economics,

cosmesis, and perioperative morbidity), and many publications suggest it to be the route of choice when feasible. The benefits of the vaginal route are also evident in obese women undergoing a hysterectomy when compared to the abdominal route. These include a lower incidence of postoperative pyrexia, ileus, urinary tract infection, shorter mean operative time and length of hospital stay.

There is limited evidence available regarding the outcomes of pelvic organ prolapse (POP) surgery in obese women. Obesity is considered an independent risk factor for POP surgery failure and a recent Swedish study of 18,554 women reported a BMI $\geq$ 30 to be a risk factor for the sensation of a vaginal bulge one year following primary POP surgery. Whilst the authors found no correlation between obesity and surgical outcomes of repeat POP surgery, nor an increase in surgical complications, they did identify an associated increase in urinary incontinence after primary surgery.

In contrast to this study, analysis of 16,639 women undergoing pelvic reconstructive surgery in the US revealed that obesity was associated with a 40% increased risk of perioperative complications after controlling for age, race, income, concomitant hysterectomy, and medical comorbidities. The association between obesity, prolapse and surgical outcomes is not clear due to the differing methodologies reported in the literature, and therefore the evidence to guide surgical treatment choices remains limited.

The relative risk of urinary incontinence (UI) for morbidly obese women (BMI $>$ 40 kg/m^2) is found to be five times greater than for a woman with a normal BMI, and a 10% reduction in weight can reduce the frequency of urinary leakage by up to 50%. Beyond a BMI of 35 kg/m^2, the success rate of sub-urethral slings decreases to 50% with a concomitant increased risk of *de novo* urgency. Within this population of morbidly obese women, bariatric surgery alone was shown to be as good as or better than incontinence surgery. A Canadian study evaluated the 5-year outcomes for mid-urethral sling surgery and found that obese women continued to experience lower rates of cure when compared with non-obese women.

Whilst obesity may present certain technical challenges when performing surgical uterine evacuation, the current evidence does not indicate obesity to be a risk factor for an increase in operative complications.

There is limited evidence to assess the impact of obesity on outpatient procedures undertaken through the vaginal route such as diagnostic and operative hysteroscopy and colposcopy treatments. Whilst anaesthetics should be avoided when possible, obese women may need to have their procedures performed in the theatre setting to gain access to appropriate equipment and staff. A vaginoscopic approach for hysteroscopy in the obese patient is advantageous as it removes the challenge of locating the cervix by speculum examination and reduces the restriction of movement caused by the presence of a vaginal speculum.

Minimally Invasive Surgery (MIS): obesity was previously considered a relative contraindication to performing MIS due to limited availability of appropriate instrumentation, difficulty in accessing the peritoneal cavity and potentially poor visualization relating to increased abdominal wall and intraperitoneal fat. However, with the increase in surgical expertize and development of ports and laparoscopic equipment, MIS has rapidly become the route of choice when undertaking abdominal gynaecological surgery in obese women.

Recent evidence supports the safety of MIS in obese women and its known benefits are extended to this population including shorter hospital stay, improved QoL outcomes, reduced postoperative pain, earlier return to normal activities and reduced morbidity relating to wound infection, pyrexia and ileus. However, laparoscopic surgery is more challenging in the obese population, and routine techniques may have to be modified as described below.

Laparoscopic entry techniques

In obese women, a large pannus can lead to caudal migration of the umbilicus making it an unreliable anatomical landmark for laparoscopic port placement. Notably, the umbilicus can be closer to the true pelvis in the obese patient and can mislead the surgeon when referring to it when "triangulating" the position of the laparoscopic ports for optimum access to the pelvis. Identification of bony landmarks may, therefore, be more reliable when siting laparoscopic ports in obese patients. No specific entry technique is proven to be superior in obese women in terms of ease and safety; however, the following should be considered.

- The surgeon should use the entry technique with which they are most proficient.
- The Veress needle entry is associated with a higher risk of failed entry due to pre-peritoneal insufflation.
- Direct trocar entry when compared with the Veress needle entry, is shown to have lower failed entry rates.
- Left upper quadrant (Palmer's point) entry allows for improved triangulation, especially in women with a large pannus with a displaced umbilicus.
- A nasogastric or orogastric tube should be considered to minimize inadvertent gastric injury if a Palmer's point entry is planned.

In the UK, guidance from the British Society of Gynaecological Endoscopy and Royal College of Obstetricians and Gynaecologists (Grade C recommendations) recommend the open (Hasson) technique or entry at Palmer's point for the primary entry in women with morbid obesity. If the Veress needle approach is used, particular care must be taken to ensure that the incision is made right at the base of the umbilicus and the needle inserted vertically into the peritoneum. Elevation of the umbilicus has been associated with a higher failure rate, and therefore upward traction of the abdominal wall during insertion of the Veress needle in an obese patient is not recommended.

Primary port placement

In non-obese women, a 30–45° angle relative to the abdominal wall is chosen for umbilical port placement or Veress needle entry. In contrast, for women who are obese without a significant pannus, the use of longer trocars or 150-mm Veress needle and a 90° umbilical entry approach is recommended to accommodate the increased abdominal wall thickness and the potential caudal migration of the umbilicus below the aortic bifurcation. Alternatively, a Palmer's point entry or supraumbilical entry can be considered if the surgeon has experience in these techniques.

Palmer's point entry

The standard indication for this entry technique in non-obese women is previous abdominal surgery that may have caused significant adhesions around the umbilical area. In obese women with a significant pannus, this point is used to ensure a successful safe entry and to achieve triangulation of port placement with respect to the pelvic organs. The point of entry is in the midclavicular line, 2–3 cm below the costal margin. The layers encountered include the skin, subcutaneous tissue, anterior rectus sheath, rectus muscle, posterior rectus sheath, preperitoneum (with fat) and the peritoneum. This approach is contraindicated in women with splenomegaly, previous splenectomy and gastric bypass.

Secondary port placement

Ancillary ports should be inserted under direct vision and placed more cephalad and lateral when compared to port placement in non-obese women. Epigastric vessels are often difficult to visualize due to the presence of abdominal fat, and this configuration allows for a safer entry and improved ergonomics, especially in the presence of a large pannus. Port dislodgement can be a problem in the obese patient, and therefore ports with inflatable intraabdominal balloons should be considered.

Other intraoperative considerations

Safe and effective laparoscopic surgery requires a dynamic collaboration between the gynaecologist and anaesthetist. Whilst the surgeon often seeks steeper Trendelenburg positions and increased insufflation of the peritoneal cavity to obtain an adequate view, these often challenge patient ventilation, especially in the obese individual. In addition to the mechanical impediments caused by excess weight around the jaw, neck, chest and abdomen, obese women have a higher metabolic rate resulting in hypercapnia. Therefore once pneumoperitoneum is established, the accessory ports should be introduced promptly and the bowel should be displaced above the pelvic brim. The intra-abdominal pressure should then be reduced to 12 mmHg and the Trendelenburg tilt reduced to allow for optimal ventilation whilst maintaining the bowel above the sacral promontory.

Occasionally, to improve visualization, the rectosigmoid may need to be temporarily hitched out of the pelvis to the anterior abdominal wall using a stitch through the tinea epiploicae. This can be achieved with routine laparoscopic suturing techniques or by using a proprietary device such as T-Lift or endoloop. Additionally, the bowel can be manipulated with an adjustable laparoscopic fan retractor.

Caudal displacement of a large pannus during the operation can improve both ventilation and surgical ergonomics, and a variety of techniques describe how this can be physically achieved on the operating table.

Obese patients have an increased risk of infection, and therefore the use of drains and haemostatic agents should be considered in an attempt to avoid the development of a postoperative pelvic collection.

Laparoscopic fascial defects can be difficult to close in patients with increased abdominal fat and devices such as the Endoclose or Szabo-Berci needle facilitate closure of the fascia under direct vision.

Robotic surgery: the evidence comparing robotic and conventional laparoscopic surgery is conflicting. A recent systematic review and meta-analysis found no difference in major outcomes (postoperative complications, the length of hospital stay, reoperation, conversion and mortality) using either approach when performing bariatric surgery in obese patients. Similarly, in women undergoing surgery for endometrial cancer, both routes were comparable with each other, yet both were superior in comparison to the open abdominal approach.

The proposed benefits of robotic surgery are thought to relate to the following:

- Improved surgeon comfort and reduced surgeon fatigue
- Articulated robotic instruments providing a better range of movement
- Advantages overcoming the force/torque encountered between the ports and the thicker abdominal wall when compared to conventional laparoscopic surgery. These benefits may be offset by longer docking times and increased costs associated with the robot.

Most of the evidence relating to the use of robotic surgery in gynaecology concerns the surgical management of gynaecological cancer. The link between obesity and endometrial cancer is well established, and robotic surgery is often used in this subgroup of women. A recent comparative study of women undergoing surgery for endometrial cancer suggested the outcomes of both laparoscopic and robotic techniques to be comparable with each other, and both were found to be superior to the open abdominal approach.

A systematic review of robotic-assisted hysterectomy suggested that the robotic technique could optimize the surgical approach and recovery of obese women with equal if not better outcomes when compared to laparoscopic and or open techniques.

The benefits of the robotic technique over the open abdominal approach were similarly identified in a Swedish study of women undergoing a hysterectomy for benign conditions. In trained hands, the robot-assisted laparoscopic hysterectomy was found to be associated with shorter hospital stay, less bleeding and fewer complications when compared to laparotomy.

Obesity and Abdominal Surgery: although minimally invasive surgery is considered the preferred route for abdominal gynaecological surgery, open abdominal surgery remains the option of choice for some patients. Obesity provides additional surgical challenges such as operating in a confined space with a smaller field of vision due to an increase in the thickness of subcutaneous tissues. The strain of retracting tissues, the longer operating times and suboptimal surgeon's posture, result in additional ergonomic stressors contributing to surgeon's work-related musculoskeletal disorders. Ensuring the availability of adequate assistance, appropriate equipment and good lighting is essential.

Open abdominal hysterectomies are known to be associated with an increased risk of wound infections, prolonged hospital stay and extended recovery periods compared to patients undergoing a laparoscopic hysterectomy (2015 Cochrane report). A US study comparing the outcomes of women (n = 9917) undergoing an abdominal hysterectomy of an ideal BMI versus those who were overweight and obese, identified a further

increase in the risk of deep vein thrombosis, surgical complications, wound infections, wound disruptions and overall morbidity in the higher BMI group. Several studies including one comparing open abdominal myomectomies in high BMI versus normal weight women support these higher rates of morbidity, and therefore these additional risks need to be addressed when counselling an obese patient before open abdominal surgery.

Incision placement can be challenging in the obese patient. Traditional transverse incisions below the pannus are at risk of infection and wound breakdown due to the moist anaerobic environment beneath the fold. Higher transverse incisions are often complicated by the increased thickness of adipose tissue, the need to divide the rectus muscles and the increased vascularity. Midline incisions allow for easier access and can be performed supra-umbilically in cases of severe obesity where a large pannus may have caused displacement of the umbilicus. Once again, bony landmarks such as the pubis may be more reliable when planning a laparotomy incision in the morbidly obese patient. Proper aseptic techniques, mass closure of the rectus sheath and meticulous closure of the superficial layers reduce the risk of wound complications.

Some surgeons chose to combine their laparotomies with a non-cosmetic panniculectomy for their abdominal gynaecological procedures in obese women. The panniculectomy involves the removal of the excess skin and fat to facilitate access to the peritoneal cavity. Evidence supports the use of this technique, and it has an acceptable rate of wound infection. However, a history of diabetes, hypertension, and smoking increases the risk of postoperative wound complications, and this needs to be taken into account when choosing this procedure.

Obesity and cancer

Obesity is a well-established risk factor for endometrial cancer and endometrial hyperplasia. Endometrial cancer is the most common gynaecological malignancy in Europe and in developed countries represents the fourth most common cancer in women. The link between obesity and other forms of gynaecological cancer remains unclear, but recent evidence does support an association between obesity and an increased risk of the less common histological subtypes of ovarian cancer.

There is good quality evidence to support the use of MIS over open abdominal surgery for treating endometrial cancer, such as the LAP 2 study. This study randomized women with early stage endometrial cancer (up to stage 2A) to laparoscopy and laparotomy for the purposes of staging, including hysterectomy, salpingo-oophorectomy, cytology and lymphadenectomy. This study indicated that comprehensive surgical staging of endometrial cancer could be performed using laparoscopy without increased intraoperative injuries, with fewer postoperative complications, and with a shorter hospital stay.

A further sub-analysis of the LAP 2 study concluded that although disease-specific mortality isn't higher in women with obesity, as compared to normal weight women, all-cause mortality is significantly higher, possibly secondary to increased cardiac morbidity.

A US study of 1112 women over a 6-year period, analysed women undergoing surgery for endometrial hyperplasia and cancer and stratified these women according to the mode of surgery and extent of obesity. The study found that MIS may increase the value of care in this cohort of women by minimizing complications and decreasing costs, especially in morbidly obese patients. In essence, MIS is the current standard of care for women with endometrial cancer and its precursors.

Several meta-analyses have compared robotic surgery to both standard laparoscopy and laparotomy for managing women with endometrial cancer. The reported benefits of robot-assisted MIS include reduced hospital stay, reduced blood loss/transfusion rates, reduced rates of conversion to laparotomy and reduced intraoperative complications. However, robotic surgery is associated with longer operating times and not all studies confirmed these reported benefits of robotic surgery over standard laparoscopy.

The issue of robotic versus laparoscopic surgery for endometrial cancer specifically in obese women has been addressed by Corrado et al. The study identified that robot-assisted MIS is associated with reduced conversion rates to laparotomy, higher lymph node dissection rates and reduced hospital stay, but at the cost of longer operating times. In keeping with other studies, the oncological outcomes did not vary based on the route of surgery.

Postoperative considerations

Whilst it is now common practice to accept obese patients with no identifiable increased risk to day surgery units, morbidly obese patients may still require high dependency care and specialist management postoperatively. Delivering adequate analgesia and antiemetic control can be challenging in the obese patient due to altered pharmacokinetics and pharmacodynamics but is essential for ensuring early postoperative feeding and ambulation. Prompt physiotherapy input is a useful adjunct to help reduce the risk of respiratory complications and encourage mobilization.

Venous thromboembolism (VTE) prophylaxis

In the UK, risk assessment tools are available to determine the risk of VTE events and offer appropriate postoperative prophylaxis for women undergoing surgery, both in the correct dose and duration. The recently updated NICE guidance (March 2018), provides a good starting point for clinicians, which can then be modified to fit local needs. With appropriate prophylaxis the incidence of VTE events estimated at just 0—0.2% for women undergoing minimal access surgery.

Antibiotic prophylaxis

Obese women are known to have an increased risk of developing postoperative infections in the skin, soft tissues and urinary tract infections are reported to be up to five times more common than in women with a normal BMI. The mechanisms for the increased risk of developing infections are not clear. Chronic tissue hypoxia promotes a chronic inflammatory state, and some studies suggest impaired chemotaxis as a pathogenetic mechanism. Impaired glucose tolerance leading to leukocyte dysfunction, hypercortisol-induced immunosuppression, and elevated levels of tumour necrosis factor-alpha have also been proposed

mechanisms. The use of broad-spectrum antibiotic prophylaxis should be considered.

Cardiorespiratory support

Obese women undergoing surgery are at a higher risk of postoperative cardiac and respiratory complications. Cardiac complications may arise due to pre-existing hypertension, coronary artery disease, cardiomegaly, which may result in heart failure due to the additional surgical and anaesthetic stress. Sudden deaths due to unexplained cardiac arrhythmias are also known in this population. Respiratory complications may also worsen cardiac compromise. A higher level of postoperative monitoring in an appropriate setting such as a high dependency care unit may need to be provided on an individualized basis.

Approximately 25% of obese women have undiagnosed obstructive sleep apnoea, and this is thought to be a contributory factor to their risk of developing respiratory complications postoperatively. Postoperative hypoxemia, which is experienced more frequently in the obese patient, can be addressed with the use of incentive spirometry or CPAP. The American Society of Anesthesiologists' practice guidelines for the perioperative care of patients with obstructive sleep apnoea recommend the development of specific local pathways. Respiratory volume monitoring devices are being evaluated to see if they can improve postoperative respiratory performance in these patients.

Conclusion

The increasing prevalence of obesity has been associated with an increased incidence of numerous gynaecological pathologies including malignancy. Obese women often need surgery, hence prior to embarking on surgery, the gynecologist should be aware of the impact of obesity on human physiology as well as the additional preoperative, intraoperative and postoperative considerations specific to this high-risk group of women. Multidisciplinary input is often required in the care of obese women as well as the need for specialized equipment on the wards and in the operating theatres.

With advancements in modern medicine, the 'disease-specific' mortality is often similar to normal weight women, but it must be emphasized that the 'all cause' mortality and morbidity is significantly higher in obese women. Whilst the benefits of the vaginal hysterectomy are well established, current evidence supports the use of MIS in obese women and should be considered as a route of surgery for benign and malignant conditions, especially over open abdominal surgery. ◆

Practice Points

- Obesity has a significant impact on women's physiology, and a thorough multidisciplinary pre-operative evaluation should be undertaken prior to surgery.
- Supplementary preparations should be made for obese patients, such as allotting additional time and acquiring specialized equipment on the wards and in the operating theatres.
- The benefits of vaginal hysterectomy over other routes of hysterectomy are well established, and many publications suggest it to be the route of choice when feasible.
- Current evidence highlights the efficacy and safety of minimally invasive surgery in obese women and should be offered in preference to laparotomy when possible.
- The role of robotic-assisted surgery remains unclear, and its routine use cannot be recommended without further evidence.
- Routine surgical techniques often need to be modified in the obese population

FURTHER READING

Committee opinion no. 619: Gynecologic surgery in the obese woman. *Obstet Gynecol* 2015; **125:** 274–8.

Afors K, Centini G, Murtada R, Castellano J, Meza C, Wattiez A. Obesity in laparoscopic surgery. *Best Pract Res Clin Obstet Gynaecol* 2015; **29:** 554–64.

Cooper K, Falcone T. Gynecologic surgery in the obese patient. *J Minim Invasive Gynecol* 2014; **21:** 155–6.

Louie M, Toubia T, Schiff LD. Considerations for minimally invasive gynecologic surgery in obese patients. *Curr Opin Obstet Gynecol* 2016; **28:** 283–9.

Papadia A, Ragni N, Salom EM. The impact of obesity on surgery in gynecological oncology: a review. *Int J Gynecol Cancer* 2006; **16:** 944–52.

Scheib SA, Tanner E, Green IC, Fader AN. Laparoscopy in the morbidly obese: physiologic considerations and surgical techniques to optimize success. *J Minim Invasive Gynecol* 2014; **21:** 182–95.